

FOIA MARKER

**This is not a textual record. This is used as an
administrative marker by the William J. Clinton
Presidential Library Staff.**

Collection/Record Group: Clinton Presidential Records
Subgroup/Office of Origin: Council of Economic Advisers
Series/Staff Member: Subject Files
Subseries:

OA/ID Number: 24254
FolderID:

Folder Title:
Climate Change #2

Stack:	Row:	Section:	Shelf:	Position:
S	21	4	5	1



Will you please

PLEASE DELIVER TO NAME IN UPPER LEFT CORNER

To: Participants in CSIS Climate Change Roundtables
From: Karl Hausker, Senior Fellow
Re: **Postponement of September 30 Roundtable**
Date: September 10, 1997

Thank you for your interest in the CSIS climate change roundtables. The first roundtable on July 22 provided a forum for a frank, off-the-record exchange of views on a variety of challenging issues before the Third Conference of the Parties to the UN Framework Convention on Climate Change.

As you know, there has been a flurry of developments since the roundtables were scheduled early in the summer. With the elevation of discussions to the CEO level and the highest levels of the White House, and with the White House conference on climate change now scheduled for October 6, **I have decided to postpone the second roundtable originally scheduled for September 30 until November** (specific date to be determined). I will continue to talk with various participants to ensure that this second gathering has the highest possible value-added as the climate evolves.

I will contact you again in October. I can be reached at 202/775-3267 (ph), 202/467-0357 (fax), and hauskerk@csis.org.

THE WHITE HOUSE
WASHINGTON

September 30, 1997

cc: JY
JAF
AM
RL
File

MEMORANDUM FOR CLIMATE CHANGE CONTACTS

FROM: KRIS BALDERSTON *KB*SUBJECT: OCTOBER 6 CONFERENCE ON CLIMATE CHANGE

Attached is a **DRAFT** agenda for October 6. There will be a Climate Change conference call tomorrow at 11:30 am. The code is 9108. The following agencies should have a representative on the call: State, Treasury, DOD, Interior, USDA, Commerce, DOL, HHS, HUD, DOT, Energy, EPA, UN, USTR, FEMA, NASA and USIA.

DRAFT AGENDA

10:05-10:20

President Clinton: Opening Remarks: Importance of Global Warming and Climate Change for the American People

10:20-11:15

Panel I: The Science of Global Warming and Climate Change

Presentation: **John Holdren**, Teresa and John Heinz Professor of Environmental Policy, Harvard University

Panelists: **Robert Watson**, Director for Environment, World Bank
Tom Karl, Senior Scientist, NOAA, National Climatic Data Center
Diana Liverman, University of Arizona
Don Wilhite, Director, National Drought Mitigation Center, University of Nebraska

11:30-11:45

Vice President Gore: Where We've Come From; Where We're Going

11:45-12:45

Panel II: The Role of Technology in Reducing Greenhouse Gas Emissions

Presentation: **Federico Peña**, Secretary of Energy
Panelists: **Maxine Savitz**, General Manager, AlliedSignal Aerospace Company's Ceramic Components Unit
Tom Casten, President and CEO, Trigen Energy Corporation
Michael Bonsignore, President and CEO, Honeywell Corporation
Mason Willrich, CEO, EnergyWorks
Kurt Yaeger, President, Electric Power Research Institute a non-profit collaborative research enterprise of the electric power industries.

1:00-2:00

Lunch: Breakout Discussions with Cabinet Members

2:15-2:30

Remarks by First Lady Hillary Rodham Clinton

2:30-3:30

Panel III: Kyoto Conference and U.S. National Interests

Presentation: **Madeleine Albright**, Secretary of State
Panelists: **Jessica Tuchman Mathews**, President, Carnegie Endowment for International Peace
E. Linn Draper, Chairman, President, and CEO, American Electric Power
Richard Schmalensee, Massachusetts Institute of Technology, Director of MIT Center for Energy and Environmental Policy Research
Fred Krupp, Executive Director, Environmental Defense
Daniel Yergin, President, Cambridge Energy Research Associates
Mae Jemison, President, Jemison Group, Inc. and Jemison Institute of Advancing Technology in Developing Countries

3:30-4:30

Panel IV: Climate Change Policy and the U.S. Economy ;

Presentation: **Larry Summers**, Deputy Secretary of the Treasury
Panelists: **Robert Repetto**, Vice President, World Resources Institute
William Nordhaus, Whitney Griswold Professor of
Economics Yale University
Richard Sandor, Chairman and Chief Executive, Centurion
Financial Products Limited
Richard Trumka, AFL-CIO

White House Begins Push for New Global Warming Pact

By JOHN H. CUSHMAN Jr.

WASHINGTON, July 15 — After tinkering with computer models for more than a year, the Clinton Administration predicted today that measures to combat the growth of global warming by limiting the emissions of carbon dioxide and other gases that trap heat from the sun would have a far less dramatic effect on the economy than had been projected by industries opposed to restraints on energy use.

The Administration's analysis opens what is expected to be a long campaign between now and the end of the year, when international negotiations are scheduled to conclude in Kyoto, Japan, to build support for a proposed binding treaty to limit the emissions of those kinds of gases.

Any measures to reverse the steady growth in such emissions, mostly given off by burning fossil fuels to operate cars and generate electricity and heat, would probably involve the biggest Federal intervention in energy markets since oil-exporting countries raised oil prices substantially in the 1970's.

But the Administration's computer models suggested that the economic side effects would be only half as severe as those projected in a recent study by economists at Charles River Associates for the American Petroleum Institute, a lobbying group for fuel producers.

Critics who say the Administration is moving too fast on global warming have warned that mines and factories would close, inflation would rise and productivity would fall. But another school of thought holds that energy conservation can pay for itself and that new technologies can be found, offering major economic gains, not to mention the benefits of limiting global warming and its potentially serious effects.

As the Administration tries to decide how fast and how far to cut those gas emissions, the question of the treaty's economic effect is being asked with increasing urgency in Congress, which has ultimate authority over the country's energy policy. In addition, any treaty would have to be submitted to the Senate for ratification.

In a staff paper released today, the White House said tough action on such gas emissions might, over the next few decades, shave a fraction of a percent from the nation's economic growth, followed by a recovery — or might, if implemented cleverly, have a barely discernible effect or even a net economic benefit.

"It just boils down to this," Janet Yellen, chairwoman of the Council of Economic Advisers, said at a hearing of the House Commerce committee. "If we do it dumb, it could cost a lot, but if we do it smart, it will cost much less, and indeed could produce net benefits in the long run."

Ms. Yellen's comments were met with skepticism from both the ranking Republican and Democrat on the committee, and by many junior members of the panel as well.

"Unfortunately, in the area of global climate change, the Administration has not yet presented a persuasive case," said Representative Thomas J. Bliley Jr., the Virginia Republican who heads the chairman.

Representative John D. Dingell, Democrat of Michigan, treated Ms. Yellen and Timothy Wirth, the Undersecretary of State for Global Affairs, to a sometimes blistering questioning.

Mr. Dingell, whose district is a prime manufacturer of automobiles, said the analysis suggested "huge economic constraints" on American businesses.

According to the Administration's projections, Mr. Dingell said, stabilizing emissions at their 1990 levels by 2010 would require steps equivalent to charging about \$100 for every ton of carbon emitted when a fossil fuel is burned. That would be like raising the tax on gasoline of about 26 cents a gallon, a tax on electricity of 2 cents per kilowatt hour, a tax on coal of \$52.52 per ton, and a tax on natural gas of \$1.49 per thousand cubic feet.

But, Administration officials said, the projections are put in terms of taxes merely because that is the easiest way for economists to model things that are even more complex than the tax code.

Nobody seriously expects the White House to propose a big increase in the gasoline tax.

The White House supports a treaty that would bind the United States and other developed countries to significant reductions in emissions of carbon dioxide and other heat-trapping gases, leaving each country to decide how it wanted to do so.

Effort to Curb Global Warming Is Tied to Higher Energy Prices in Two Studies

By JOHN J. FIALKA

Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON — Two new Clinton administration studies show that an international effort to curb global warming could result in a substantial increase in energy prices. But the administration played down the reports, saying they underestimated its "flexible" approach toward applying new controls.

Summing up the results of one inter-agency study led by the Commerce Department, Janet Yellen, head of the White House Council of Economic Advisers, said computer models of the economy can only provide a range of possible impacts, "not definitive answers."

The costs of reducing man-made "greenhouse gases," such as carbon dioxide, that are believed to be heating the atmosphere are "very difficult to predict with any certainty at all," she told members of a House Commerce subcommittee.

Ms. Yellen was asked about one mid-range estimate in the study, which predicted increases of 26 cents per gallon of gasoline, \$1.49 per thousand cubic feet of natural gas, \$52.52 per ton of coal and two cents per kilowatt hour of electricity by the year 2010. She noted that the study didn't take into consideration an international emissions-permit-trading plan being promoted by the Clinton administration that could, she said, "substantially" reduce the cost of pollution-control efforts.

The studies didn't account for the administration's emissions-permit-trading proposal because the computer models couldn't predict what trades would occur, administration officials said.

A second study, prepared by the Energy Department's Argonne National Laboratory, said energy-price increases would result in "significant reductions in output and employment" in six industries: chemicals, aluminum, steel, paper and pulp, petroleum refining and cement.

One of the worst-hit industries would be chemicals, the study said. It predicted that 20% to 30% of the nation's chemical-manufacturing capacity would move to developing nations that initially wouldn't be covered by a global-warming treaty. The move would mean U.S. job losses "as high as 200,000," the study said. The steel industry, it said, risked losing as many as 100,000 jobs.

In a statement accompanying the study, Marc W. Chupka, acting assistant energy secretary, said the report was based on "outdated" price-increase scenarios that would be "significantly lower" if the administration's international trading approach were taken into account. The plan has been used in the U.S. to cut the costs of complying with 1990 restrictions on sulfur dioxide, which causes acid rain.

As Washington roasted in a near-record heat wave, Ms. Yellen and Timothy E. Wirth, undersecretary of state for global

affairs, told members of the House panel that the administration won't pick specific target levels for cuts in emissions until after a White House conference on global warming scheduled in October. The U.S. will then take its position to Kyoto, Japan, where final negotiations for a global-warming treaty will be held in December.

White House Begins Push for New Global Warming Pact

By JOHN H. CUSHMAN Jr.

WASHINGTON, July 15 — After tinkering with computer models for more than a year, the Clinton Administration predicted today that measures to combat the growth of global warming by limiting the emissions of carbon dioxide and other gases that trap heat from the sun would have a far less dramatic effect on the economy than had been projected by industries opposed to restraints on energy use.

The Administration's analysis opens what is expected to be a long campaign between now and the end of the year, when international negotiations are scheduled to conclude in Kyoto, Japan, to build support for a proposed binding treaty to limit the emissions of those kinds of gases.

Any measures to reverse the steady growth in such emissions, mostly given off by burning fossil fuels to operate cars and generate electricity and heat, would probably involve the biggest Federal intervention in energy markets since oil-exporting countries raised oil prices substantially in the 1970's.

But the Administration's computer models suggested that the economic side effects would be only half as severe as those projected in a recent study by economists at Charles River Associates for the American Petroleum Institute, a lobbying group for fuel producers.

Critics who say the Administration is moving too fast on global warming have warned that mines and factories would close, inflation would rise and productivity would fall. But another school of thought holds that energy conservation can pay for itself and that new technologies can be found, offering major economic gains, not to mention the benefits of limiting global warming and its potentially serious effects.

As the Administration tries to decide how fast and how far to cut those gas emissions, the question of the treaty's economic effect is being asked with increasing urgency in Congress, which has ultimate authority over the country's energy policy. In addition, any treaty would have to be submitted to the Senate for ratification.

In a staff paper released today, the White House said tough action on such gas emissions might, over the next few decades, shave a fraction of a percent from the nation's economic growth, followed by a recovery — or might, if implemented cleverly, have a barely discernible effect or even a net economic benefit.

"It just boils down to this," Janet Yellen, chairwoman of the Council of Economic Advisers, said at a hearing of the House Commerce committee. "If we do it dumb, it could cost a lot, but if we do it smart, it will cost much less, and indeed could produce net benefits in the long run."

Ms. Yellen's comments were met with skepticism from both the ranking Republican and Democrat on the committee, and by many junior members of the panel as well.

"Unfortunately, in the area of global climate change, the Administration has not yet presented a persuasive case," said Representative Thomas J. Bliley Jr., the Virginia Republican who heads the chairman.

Representative John D. Dingell, Democrat of Michigan, treated Ms. Yellen and Timothy Wirth, the Undersecretary of State for Global Affairs, to a sometimes blistering questioning.

Mr. Dingell, whose district is a prime manufacturer of automobiles, said the analysis suggested "huge economic constraints" on American businesses.

According to the Administration's projections, Mr. Dingell said, stabilizing emissions at their 1990 levels by 2010 would require steps equivalent to charging about \$100 for every ton of carbon emitted when a fossil fuel is burned. That would be like raising the tax on gasoline of about 26 cents a gallon, a tax on electricity of 2 cents per kilowatt hour, a tax on coal of \$52.52 per ton, and a tax on natural gas of \$1.49 per thousand cubic feet.

But, Administration officials said, the projections are put in terms of taxes merely because that is the easiest way for economists to model things that are even more complex than the tax code.

Nobody seriously expects the White House to propose a big increase in the gasoline tax.

The White House supports a treaty that would bind the United States and other developed countries to significant reductions in emissions of carbon dioxide and other heat-trapping gases, leaving each country to decide how it wanted to do so.

Effort to Curb Global Warming Is Tied To Higher Energy Prices in Two Studies

By JOHN J. FIALKA

Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON — Two new Clinton administration studies show that an international effort to curb global warming could result in a substantial increase in energy prices. But the administration played down the reports, saying they underestimated its "flexible" approach toward applying new controls.

Summing up the results of one inter-agency study led by the Commerce Department, Janet Yellen, head of the White House Council of Economic Advisers, said computer models of the economy can only provide a range of possible impacts, "not definitive answers."

The costs of reducing man-made "greenhouse gases," such as carbon dioxide, that are believed to be heating the atmosphere are "very difficult to predict with any certainty at all," she told members of a House Commerce subcommittee.

Ms. Yellen was asked about one mid-range estimate in the study, which predicted increases of 26 cents per gallon of gasoline, \$1.49 per thousand cubic feet of natural gas, \$52.52 per ton of coal and two cents per kilowatt hour of electricity by the year 2010. She noted that the study didn't take into consideration an international emissions-permit-trading plan being promoted by the Clinton administration that could, she said, "substantially" reduce the cost of pollution-control efforts.

The studies didn't account for the administration's emissions-permit-trading proposal because the computer models couldn't predict what trades would occur, administration officials said.

A second study, prepared by the Energy Department's Argonne National Laboratory, said energy-price increases would result in "significant reductions in output and employment" in six industries: chemicals, aluminum, steel, paper and pulp, petroleum refining and cement.

One of the worst-hit industries would be chemicals, the study said. It predicted that 20% to 30% of the nation's chemical-manufacturing capacity would move to developing nations that initially wouldn't be covered by a global-warming treaty. The move would mean U.S. job losses "as high as 200,000," the study said. The steel industry, it said, risked losing as many as 100,000 jobs.

In a statement accompanying the study, Marc W. Chupka, acting assistant energy secretary, said the report was based on "outdated" price-increase scenarios that would be "significantly lower" if the administration's international trading approach were taken into account. The plan has been used in the U.S. to cut the costs of complying with 1990 restrictions on sulfur dioxide, which causes acid rain.

As Washington roared in a near-record heat wave, Ms. Yellen and Timothy E. Wirth, undersecretary of state for global

affairs, told members of the House panel that the administration won't pick specific target levels for cuts in emissions until after a White House conference on global warming scheduled in October. The U.S. will then take its position to Kyoto, Japan, where final negotiations for a global-warming treaty will be held in December.

White House Begins Push for New Global Warming Pact

By JOHN H. CUSHMAN Jr.

WASHINGTON, July 15 — After tinkering with computer models for more than a year, the Clinton Administration predicted today that measures to combat the growth of global warming by limiting the emissions of carbon dioxide and other gases that trap heat from the sun would have a far less dramatic effect on the economy than had been projected by industries opposed to restraints on energy use.

The Administration's analysis opens what is expected to be a long campaign between now and the end of the year, when international negotiations are scheduled to conclude in Kyoto, Japan, to build support for a proposed binding treaty to limit the emissions of those kinds of gases.

Any measures to reverse the steady growth in such emissions, mostly given off by burning fossil fuels to operate cars and generate electricity and heat, would probably involve the biggest Federal intervention in energy markets since oil-exporting countries raised oil prices substantially in the 1970's.

But the Administration's computer models suggested that the economic side effects would be only half as severe as those projected in a recent study by economists at Charles River Associates for the American Petroleum Institute, a lobbying group for fuel producers.

Critics who say the Administration is moving too fast on global warming have warned that mines and factories would close, inflation would rise and productivity would fall. But another school of thought holds that energy conservation can pay for itself and that new technologies can be found, offering major economic gains, not to mention the benefits of limiting global warming and its potentially serious effects.

As the Administration tries to decide how fast and how far to cut those gas emissions, the question of the treaty's economic effect is being asked with increasing urgency in Congress, which has ultimate authority over the country's energy policy. In addition, any treaty would have to be submitted to the Senate for ratification.

In a staff paper released today, the White House said tough action on such gas emissions might, over the next few decades, shave a fraction of a percent from the nation's economic growth, followed by a recovery — or might, if implemented cleverly, have a barely discernible effect or even a net economic benefit.

"It just boils down to this," Janet Yellen, chairwoman of the Council of Economic Advisers, said at a hearing of the House Commerce committee. "If we do it dumb, it could cost a lot, but if we do it smart, it will cost much less, and indeed could produce net benefits in the long run."

Ms. Yellen's comments were met with skepticism from both the ranking Republican and Democrat on the committee, and by many junior members of the panel as well.

"Unfortunately, in the area of global climate change, the Administration has not yet presented a persuasive case," said Representative Thomas J. Bliley Jr., the Virginia Republican who heads the chairman.

Representative John D. Dingell, Democrat of Michigan, treated Ms. Yellen and Timothy Wirth, the Undersecretary of State for Global Affairs, to a sometimes blistering questioning.

Mr. Dingell, whose district is a prime manufacturer of automobiles, said the analysis suggested "huge economic constraints" on American businesses.

According to the Administration's projections, Mr. Dingell said, stabilizing emissions at their 1990 levels by 2010 would require steps equivalent to charging about \$100 for every ton of carbon emitted when a fossil fuel is burned. That would be like raising the tax on gasoline of about 26 cents a gallon, a tax on electricity of 2 cents per kilowatt hour, a tax on coal of \$52.52 per ton, and a tax on natural gas of \$1.49 per thousand cubic feet.

But, Administration officials said, the projections are put in terms of taxes merely because that is the easiest way for economists to model things that are even more complex than the tax code.

Nobody seriously expects the White House to propose a big increase in the gasoline tax.

The White House supports a treaty that would bind the United States and other developed countries to significant reductions in emissions of carbon dioxide and other heat-trapping gases, leaving each country to decide how it wanted to do so.

Effort to Curb Global Warming Is Tied to Higher Energy Prices in Two Studies

By JOHN J. FIALKA

Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON — Two new Clinton administration studies show that an international effort to curb global warming could result in a substantial increase in energy prices. But the administration played down the reports, saying they underestimated its "flexible" approach toward applying new controls.

Summing up the results of one inter-agency study led by the Commerce Department, Janet Yellen, head of the White House Council of Economic Advisers, said computer models of the economy can only provide a range of possible impacts, "not definitive answers."

The costs of reducing man-made "greenhouse gases," such as carbon dioxide, that are believed to be heating the atmosphere are "very difficult to predict with any certainty at all," she told members of a House Commerce subcommittee.

Ms. Yellen was asked about one mid-range estimate in the study, which predicted increases of 26 cents per gallon of gasoline, \$1.49 per thousand cubic feet of natural gas, \$52.52 per ton of coal and two cents per kilowatt hour of electricity by the year 2010. She noted that the study didn't take into consideration an international emissions-permit-trading plan being promoted by the Clinton administration that could, she said, "substantially" reduce the cost of pollution-control efforts.

The studies didn't account for the administration's emissions-permit-trading proposal because the computer models couldn't predict what trades would occur, administration officials said.

A second study, prepared by the Energy Department's Argonne National Laboratory, said energy-price increases would result in "significant reductions in output and employment" in six industries: chemicals, aluminum, steel, paper and pulp, petroleum refining and cement.

One of the worst-hit industries would be chemicals, the study said. It predicted that 20% to 30% of the nation's chemical-manufacturing capacity would move to developing nations that initially wouldn't be covered by a global-warming treaty. The move would mean U.S. job losses "as high as 200,000," the study said. The steel industry, it said, risked losing as many as 100,000 jobs.

In a statement accompanying the study, Marc W. Chupka, acting assistant energy secretary, said the report was based on "outdated" price-increase scenarios that would be "significantly lower" if the administration's international trading approach were taken into account. The plan has been used in the U.S. to cut the costs of complying with 1990 restrictions on sulfur dioxide, which causes acid rain.

As Washington roasted in a near-record heat wave, Ms. Yellen and Timothy E. Wirth, undersecretary of state for global

affairs, told members of the House panel that the administration won't pick specific target levels for cuts in emissions until after a White House conference on global warming scheduled in October. The U.S. will then take its position to Kyoto, Japan, where final negotiations for a global-warming treaty will be held in December.

Climate Change File

JLY
JAF
AHM
JS
JR
MS



UNDER SECRETARY OF STATE
FOR GLOBAL AFFAIRS
WASHINGTON, D.C. 20520-7250

To: Climate Lunch Group

From: Timothy Wirth

Attached is an excellent summary of
Climate to date, done by Eileen Claussen
in a farewell memo.

I urge you to read this - call me
if questions or suggestions.

Viv

July 19



COPY FOR YOUR
INFORMATION

9712191 (rev.)

United States Department of State

Washington, D. C. 20520

Desk

INFORMATION MEMORANDUM

S/S

July 15, 1997

UNCLASSIFIED

TO: G - Mr. Wirth

FROM: OES - Eileen Claussen 

SUBJECT: My Thoughts on Climate Change

I thought it might be useful to lay out my thoughts on where things stand on the climate change issue internationally and domestically before I leave the Department. I will also make some suggestions on strategies to pursue in the months ahead.

INTERNATIONAL STATUS

We are at a virtual standstill in the international negotiations. There are nine large issues on the table, and an enormous amount of posturing on all sides. The United States lost a great deal of credibility in recent months as a result of our failure to propose specific targets or even to give an indication of what we might be able to accept.

1. Targets and Timetables

You know of the EU's proposal for a 15% reduction below 1990 levels in 2010. The EU also has a 2005 target (of 7.5% below 1990 levels) on the table. At the present time, there is no movement by others on a target. The U.S. has no target (although we have said that the EU targets are not possible for us), and neither does Japan, Canada, or others in Annex I. We have also been explicit about not accepting a target date of 2005, since it would be unlikely that we could ratify a treaty, obtain implementing legislation and promulgate the rules and regulations that would be required in time for a 2005 date. This issue is complicated by the EU position that it will not discuss other parts of the U.S. proposal until we put a target on the table.

UNCLASSIFIED

2. The EU Bubble

The EU target is based on the presumption that the EU is allowed to "bubble" its emissions; in other words, the EU, taken as a whole, will meet its overall target but individual countries may have different targets (i.e. Portugal may increase 40%, Germany may decrease 15% etc.). This is viewed as blatantly unfair by Japan, Australia, the U.S. and others. It is, in essence, a system of differentiated targets with internal trading within the EU. We have said that there are really three choices for how to deal with the EU. First, the EU could have one target, and be one party to the Convention, just like any other single country. Alternatively, it could have each EU member agree to the same target (the one we all agree to), and then the EU could trade emissions within itself so that each country was satisfied. This would be acceptable as long as every other country could also engage in trading. Finally, there is the EU proposal itself, where each country would agree to a different target, but that only the EU as a whole would have to meet the internationally agreed target. This last option, particularly if emissions trading is not allowed for all countries, is completely unacceptable. It is likely that the EU will suggest that they maintain their position on the bubble, but agree to emissions trading for everyone in Annex I in exchange.

3. Emissions Trading

We have put forward a proposal for emissions trading within Annex I, that is, among all countries that have binding targets. This proposal has received some support from Australia, Canada and New Zealand. It is viewed with suspicion by Japan, although they are unlikely to oppose it. The Russians are very supportive of this idea, since they would be the country most likely to have emissions to spare. This is the case because their emissions dropped substantially below 1990 levels during the early 1990s, and their economy remains in disarray. The EU claims it is too complicated to be agreed in Kyoto, and will not discuss it further until other targets are on the table. I suspect that the EU will eventually agree to this proposal although other issues will be raised. We have already heard comments to the effect that the purchase of Russian emission credits will not benefit the environment, allowing us, in effect, to purchase existing reductions rather than do our own. This is true, but is also an argument that could be used with the Germans, since their target is only possible because of the parallel situation in eastern Germany. It is possible that

emissions trading may end up by being limited in scope, allowing a country only to trade a portion of its emissions.

4. Joint Implementation

The U.S. has traditionally been a strong supporter of joint implementation, but has been unable to gain many supporters for its proposal internationally. At the present time, we are supported by the Central American governments, Canada, Australia, New Zealand, Norway and possibly Peru. The EU has raised objections, at least for this round of the negotiations, and the Japanese appear ambivalent. The developing countries, with the exception of those listed above, remain opposed. Developing countries are now engaged with us in an experimental joint implementation stage (called activities implemented jointly) where no credits are assigned. They claim first, that they want the experimental phase to finish and be evaluated before reaching further agreement; second, that technology transfer is required by the Convention, and therefore should not involve the transfer of emissions credits; and finally, that if they are eventually going to be subject to targets, they would like cheap reduction options available to them, not to those who participate in joint implementation rather than taking reductions in their own countries. Other complicating factors have also been raised, including the difficulties of establishing a suitable baseline for a given project, how to determine what is truly "additional" about the project's emissions reductions, and how to divide those reduction credits among different countries.

5. Policies and Measures

The Berlin Mandate discusses both targets and "policies and measures." The EU has been a strong supporter of harmonized and mandatory policies and measures, which could include everything from energy taxes to harmonized refrigerator efficiency standards. The Japanese seem perfectly willing to support the EU here, and the Canadians are ready to follow suit. Only the U.S. remains so strongly opposed to such measures, arguing that each country is fundamentally different, and that each country should have the freedom to decide on which policies and measures to use to implement its target. The compromise here may be a list of measures that individual countries could consider, although this will not be a compromise that will be reached easily.

6. Differentiation

Japan, Australia and Norway have argued that their circumstances are sufficiently different (Japan because it is so energy efficient, Australia and Norway because they are enormous fuel exporters), that there should not be a uniform target, but rather differentiated targets based on a set of criteria. This view is made more persuasive given the way in which the EU proposes to operate (i.e. differentiating within the EU). Strong opposition comes from the EU (which refuses to acknowledge its hypocrisy) and the U.S. We have argued against differentiation on the grounds that there is no consensus among any countries on a scheme that might be used, and also that, in light of the lack of support, it would not be possible to reach a conclusion in December in Kyoto. As a practical matter, we would fare poorly in any scheme - we are the largest emitter, we are among the most energy intensive (i.e. energy used per unit of GDP), and we are the largest per capita emitter, too. But it is not clear whether the countries who support this approach will simply "give it up" in Kyoto.

7. Compensation

The OPEC countries, who are not supportive of any agreement, have raised the issue of compensation. They believe that if a climate change treaty reduces oil imports from their countries, they should be compensated. While it would seem that this is a complete non-starter, other developing countries seem to be rallying to their side, and the EU has been acting like they think some compromise is possible here, at least in terms of an analysis on what our actions might do to their economies. While this proposal as drafted is unlikely to be successful, we are the most vociferous opposition.

8. Developing Country Actions

We have put forward a set of proposals that would apply to all developing countries, essentially "advancing" their existing commitments. In our text, we require that they take a series of actions, measure the effects of those actions, and report on what they have accomplished. While there are likely to be some changes to our language, the EU is generally supportive of our suggestions. I suspect that what the developing countries accept will be dependent on the target that developed countries negotiate.

9. Evolution

This is the most difficult and the most important of the U.S. proposals. We have argued that developing countries must agree in Kyoto to a subsequent negotiation in which they will assume binding targets and in which we will agree on a mechanism that allows for the "graduation" of countries from developing country status (and targets) to developed country status (and targets). We have no support for this concept, except for Canada, Australia and New Zealand. The EU believes it is too strong (and maybe, if weakened, could be part of a Kyoto mandate), the Japanese believe it could derail a successful conclusion in Kyoto, and the developing countries seem unready to accept it, even in cases where they understand its importance in solving the problem. We will have no chance of treaty ratification without such an agreement. In fact, Senate views on a treaty (represented by the Byrd amendment) would require more than the Administration has proposed -- including the acceptance of new commitments by the developing world. Such new commitments are clearly impossible under the Berlin mandate.

DOMESTIC STATUS

The domestic situation we face is extremely difficult. Whatever momentum we may have had coming from the July 1996 meeting in Geneva has dissipated, and if we are to succeed, we must work hard to rebuild domestic support for our approach and probable proposed target.

1. Industry

The industries that are most likely to be negatively affected by any climate change regime are very well organized and well funded. They have argued that significant cuts will cripple them, that developed country targets in the absence of developing country targets will disadvantage the U.S., and that the Administration is going to agree to a protocol without sufficient dialogue and support in the United States. Our failure to release the economic analysis we have done bolsters the first and last of these points, although if the data were released, the arguments would persist. On developing countries, their stance is designed to derail the negotiations, since the

Berlin Mandate explicitly precludes new commitments for developing countries. These industries also claim that there is no consensus on the science. They are, for the most part, members of the Global Climate Coalition, and include the coal industry, most of the oil industry, the railroads, and most of the electric utility industry.

There are two other industry constituencies that are important. The first of these is the group that would stand to gain from any climate change protocol, namely the renewable and solar energy industries, as well as those that promote the use of gas. They are not well organized, and have been a very weak voice supporting the Administration. Their group is the Business Council for a Sustainable Energy Future. Enron is the most influential member.

The third group is the International Climate Change Partnership. Most members are multinationals, and range from Carrier Corporation to British Petroleum to Dupont. These companies agree that the science is compelling, and that the framework we presented internationally (binding targets, flexibility, and developing country commitments) is a good one. However, they are disenchanted by our failure to share the economic analysis, and to further engage on the level of a target. The support of these companies is vital. But in order to it, their confidence needs to be rebuilt.

2. The Environmental Community

This community is also split on this issue. All environmental NGOs are concerned about the kind of target that the U.S. will propose. They have all supported targets beginning in 2005 (which the Administration has said is too early), and levels of reduction close to or resembling the EU. Some groups support trading and joint implementation (EDF in particular), while other have insisted on increased auto efficiency standards (the Sierra Club). If our target is too modest and does not go beyond stabilization, we will be heavily criticized by all.

3. The Congress

The most telling example of where we are in the Congress is the Byrd Resolution. This resolution, drafted by the coal industry, was a personal project of Senator Byrd, and now has more than 60 signatures. It stipulates that if developed countries have binding targets agreed in Kyoto, so must the developing world. Although this idea has

not been tested in the House, it is likely that we would see a similar line up. The reality is that there are too few Hill supporters of action on climate change to deal with this issue. The Administration has not engaged the Congress over the past six months, and we see little support emerging based on NGO lobbying. This has left the field completely open to the naysayers, and the result is pretty clear.

4. Domestic Implementation of a Treaty

of the Senate. It will also require Congressional passage of implementing legislation and the promulgation of rules and regulations by the Executive Branch. Even if the ratification hurdle is passed, developing and passing implementing legislation will be extremely difficult. Like The Clean Air Act, there will be different regional and sectoral impacts from efforts to reduce greenhouse gases. Decisions on how to distribute the burden between the transportation sector, the utility sector, and the household and commercial sector will have to be made. Legislators will have to focus on what to do with the coal industry and coal miners, the industry and labor group that will be most affected. Finally, we will have to look at different implementing mechanisms. The notion that a domestic "cap and trade" program will be all that we need is short-sighted. While such a system will work well for utilities (1/3 of our carbon dioxide emissions), it is not clear how the system can be made to work for transportation, or for the other greenhouse gases (methane, nitrous oxide, etc.) that we will have to regulate.

THOUGHTS FOR A STRATEGY

The task facing the Administration and the international community is enormous, given the timetable for decision, the difficulty of the issues to be decided, and the politics associated with those issues. But certain items must be faced immediately:

1. Building a Domestic Base

Nothing will substitute for an earnest dialogue, including a discussion of possible and realistic targets, timetables and impacts of those targets and timetables. This must be conducted at all levels, and with all

constituencies. It will only work if we are open, and share the results of our analyses, whether it is our economic analysis, or our analysis of long-term pathways leading to different atmospheric concentrations of greenhouse gases. The President must hold some meetings with selected CEOs (perhaps through the Business Roundtable) who are engaged in this issue, as well as with some Members of Congress. Others will also have to be heavily engaged. We will need to listen, as well as to share information and ideas. The only time frame that works is for this to occur over the summer.

Some groups will never be satisfied with a solution, since they wish only for there to be no solution. But there should be some members of all communities who could unite behind a realistic proposal. In particular, we need to build a core group from the Business Council, the ICCP, and those parts of EEI that are most forward looking. It may be possible to move the auto companies if they are assured that domestic implementation will not fall on them in the form of CAFE standards. Some oil companies, particularly those with heavy investment in alternative energy sources may also be willing to engage.

We will also have to try to see if there can be common ground between the Administration and organized labor. This will not be an easy task. The Mineworkers have been strong and vocal on this issue, and it is not clear that their views can be reconciled with ours. However, there are others within the AFL-CIO who are more positive (including the Steelworkers and the Oil, Chemical and Atomic Workers), and we should attempt to work with all of them together.

Similarly, we will have to work closely with those members of the environmental community who are prepared to accept a reasonable solution. EDF, NRDC and WWF are obvious candidates. But even with those who are unlikely to be sympathetic, a good dialogue that covers what is possible and what is not might blunt some of the expected criticism.

If the outreach effort culminates in a White House Conference, it is critical that everything be programmed well enough in advance to assure a positive result. A White House Conference that does not result in a shared consensus on the need for action, combined with an acceptance of the principles that will form the basis of our negotiating position would not be helpful.

2. Making our Way Through the International Maze

The end game, of course, is the international negotiation. Even if we are successful in building some support domestically, the critical question is whether a deal can be struck in Kyoto. Key players include the EU, Japan, China, Brazil, India and the OPEC countries. We will need to engage all of these countries (or groups of countries) separately from the negotiating fora. A meeting at a high level with the EU and Japan could be useful after the October negotiating session. It must be kept small, and should, in essence, be an attempt to see if a deal is possible. High level visits to Saudi Arabia, India, Brazil and China are also important, and should be conducted before November. Again, these should be designed to assess whether a deal could be reached in December.

No matter how good the preparation, reaching a satisfactory conclusion in Kyoto will be extremely difficult. It is worth some time and effort to determine what follow-on process would be desirable if a deal is not achieved. The key will be keeping the issue alive. Those who oppose any agreement should not come away from Kyoto thinking that they were victorious. Tough questions that we will need to face if no agreement is possible include: if the stumbling block is developing country actions, do we need a change of mandate? If the stumbling block is the strength of the reduction commitment, can we put forward a package that cuts more deeply, but over the long term? And if that is the solution, what interim steps can be agreed? If the issue is the flexibility provisions, particularly joint implementation, are there different options for working with developing countries that could be introduced? Finally, we will need to decide what the best timetable is for an agreement. Certainly, it would be best to reach an agreement in Kyoto. It is early in the Administration's second term, and bold steps are easier the farther they are from an election year. But if the projected schedule is closer to the year 2000, is that something we can live with?

cc:

CEQ - KMcGinty
White House - TStern
NEC - DTarullo

JL4, JS, MJ

**NOBEL LAUREATE SIGNATORIES
TO
ECONOMISTS' STATEMENT ON
CLIMATE CHANGE**

Kenneth Arrow (1972)
Stanford University

Gerard Debreu (1983)
University of California at Berkeley

John Harsanyi (1994)
University of California at Berkeley

Lawrence Klein (1980)
University of Pennsylvania

Wassily Leontief (1973)
New York University

Franco Modigliani (1985)
Massachusetts Institute of Technology (Emeritus)

Robert Solow (1987)
Massachusetts Institute of Technology

James Tobin (1981)
Yale University

January 3rd, 1997

Dear Colleague,

As you may know, representatives of the world's nations will convene in Kyoto in December, 1997 to negotiate an international agreement addressing the threat of global climate change due to greenhouse gas emissions. This presents a significant opportunity for the United States to exercise a leadership role in ensuring our long-term well-being. Conversely, a failure on the part of the U.S. government to put forward a well-reasoned position would be a major environmental, economic, and diplomatic setback.

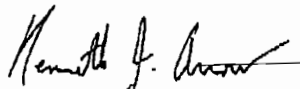
As the climate debate unfolds, it is imperative that public policy be guided by sound economics rather than misleading claims put forward by special interest groups. For this reason, we invite you to join us in endorsing the attached non-partisan consensus statement on the economics of climate change.

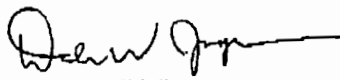
Once this statement has been signed by a large number of economists, it will be widely disseminated to leaders in the public and private sectors, and to the general media. This effort is being coordinated by Redefining Progress, a non-partisan, non-profit public policy organization.

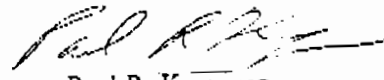
Attached please find an endorsement form for your consideration. This letter and endorsement form are being sent to the membership of the American Economic Association. Please feel free to circulate it to your colleagues in case they are not on the AEA mailing list.

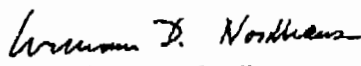
We thank you for your prompt attention to this critical issue.

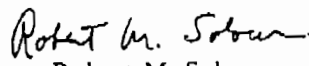
Sincerely,


Kenneth F. Arrow


Dale W. Jorgenson


Paul R. Krugman


William D. Nordhaus


Robert M. Solow

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

*Endorsed by Over 2500 Economists
including eight Nobel Laureates*

I. The review conducted by a distinguished international panel of scientists under the auspices of the Intergovernmental Panel on Climate Change has determined that "the balance of evidence suggests a discernible human influence on global climate." As economists, we believe that global climate change carries with it significant environmental, economic, social, and geopolitical risks, and that preventive steps are justified.

II. Economic studies have found that there are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs. For the United States in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measures may in fact improve U.S. productivity in the longer run.

III. The most efficient approach to slowing climate change is through market-based policies. In order for the world to achieve its climatic objectives at minimum cost, a cooperative approach among nations is required—such as an international emissions trading agreement. The United States and other nations can most efficiently implement their climate policies through market mechanisms, such as carbon taxes or the auction of emissions permits. The revenues generated from such policies can effectively be used to reduce the deficit or to lower existing taxes.

Sponsored By

REDEFINING PROGRESS

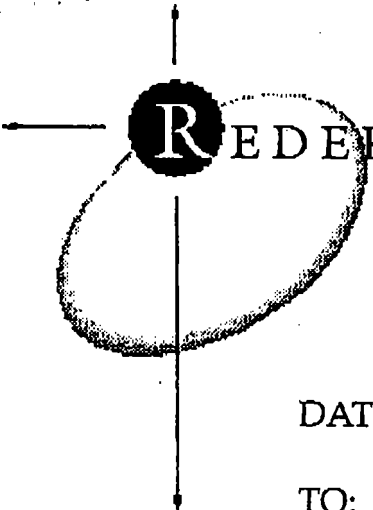
One Kearny Street • 4th Floor

San Francisco, CA 94108

Phone: (415) 781-1191

Fax: (415) 781-1198

EMail: info@RProgress.org

R

REDEFINING PROGRESS

ONE KEARNY STREET • 4TH FLOOR • SAN FRANCISCO • CALIFORNIA 94108

Telephone 415.781.1191 • Facsimile 415.781.1198

FAX TRANSMISSION

DATE:

7/22/97

TO:

SANDY DAIGLE

FAX #:

202 - 395-6958

FROM:

BRYNN TAYLOR

SUBJECT:

NOBEL LAUREATE SIGNATORIESNumber of pages: 4 (including this one)MESSAGE (if any):

Please let us know if there is
anything else you need.

Our fax number is 415.781.1198. If there are any problems with this transmission, please call 415.781.1191.

JLY, JS, MJ

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
A. W. Coats		Daniel G. Swanson	
Abbass Bozory		Danny A. Bring	
Abdul Qayum		David Ashmore	
Ahmad Afraslabi		David Buland	
Ajal Chopra		David Burress	
Alan R. Winger		David C. Campbell	
Almudena Arcelus		David C. Roberts	
Amos Khasigian		David Calvin Gogerty	
Andrea Dean		David D. Hanig	
Andrew Chritton		David I. Siskind	
Andrew Horowitz		David M. Eaves	
Andrew W. Weiler		David R. Burnett	
Angela E. Chang		David Reiffen	
Ann A. Dean		David Sandler	
Ann M. Watkins		David Schenker	
Anonymous		Debojyoti Sarkar	
Anthony Apostolides		Deborah A. Senior	
Anthony Barkume		Deenle Neff	
Arthur G. Ashbrook, Jr.		Delle Nadler	
Arturo R. Torres Jr.		Desiderius Viktor	
Arun Kumar Ghosh		Dhez Woodworth	
Austin Curwood Hoggatt		David W. Riggs	
Barbara Weinstein		Donald E. Agthe	
Barbara Y. Peters		Donald J. O'Hara	
Benjamin Bridges		Donald W. O'Connell	
Bernard Gordon		Donald Wooten	
Bernard Kemp		Douglass B. Lee	
Brian C. Jack		Dr. Raynal Hammelton	
Bruce Fallick		Drue Barker	
Caren Grown		Dubravko Mihaljek	
Carlos Padilla		Edgar J. Gordon	
Carlos Uliberri		Edward K. Smith	
Carmine Gorga		Elias R. Ason	
Charles D. Coleman		Elliot A. Ponchick	
Charles Ronald Ross		Elmer P. Lotshaw	
Charles S. Maurice		Eloy Mestre	
Chetan Sanghavi		Eric Nauenborg	
Chris Beacham		Ernest C. Olson	
Christian Ergen-Zucchi		Eugene D. Straub	
Chyongchiou Lin		Evamaria Uribe	
Clara Chu		Evert Van Der Heide	
Clyde Tappwig		F. Brian Simmons, III	
Cornelia Strawser		Fereldoon P. Sioshansi	
Craig Gallet		Francois Melese	
D. Ward Mardfin		Frank Canter	
Damon Whelchel		Frank Leiber	

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Thesia I. Garner		Donald Rosenthal	American Management Systems
Thomas Foster		Tom Everding	American Medical Association
Thomas M. Stanback, Jr.		Alan G. Isaa	American University
Thomson Whittin		Bruce H. Lubich	American University
Tim Lefever		Donald Bowles	American University
Timothy D. Baker		Howard M. Wachtel	American University
Timothy E. Mc Clive		James H. Weaver	American University
Timothy E. Sullivan		Robin Hahnel	American University
Va Nee V. Van Vleck		Sue Headlee	American University
Valeo Schultz		Karen Hallows	American University, Averett College
Van Lam		Ralph E. Beals	Amherst College
Volher Wieland		Richard C. Hoyt	Analytics
W. C. Brainard		Samuel Gubins	Annual Reviews Inc.
W. N. Turpin		Elbert V. Bowden	Appalachian State University
Willem J. Jansen		James Cavallo	Argonne National Laboratory
William A. Masters		Lutz Hendricks	Arizona State University
William Crowell		Michael Lemmon	Arizona State University
William Dellal		Gary A. Latanich	Arkansas State University
William J. Weiskopf		Brian J. Cody	Arthur Andersen
William Kahley		Kevin J. O'Connor	Assistant Attorney General
William R. Belmont		Thomas White	Assumption College
William S. Stine		Christopher J. Monroe	AT&T
Yves Maroni		Douglas G. Hobbs	AT&T
Clark C. Abt	ABT Associates, Inc.	Jian Cao	AT&T
Gregory B Mills	ABT Associates, Inc.	Kumiko Powell	AT&T
Gunars Hauff Platals	ABT Associates, Inc.	Gregory Napiorkowski	AT&T Laboratories
Jacob Benus	ABT Associates, Inc.	Louis T. Brewer	AT&T, Rtd.
Larry L. Orr	ABT Associates, Inc.	Henry Thompson	Auburn University
Leland Deck	ABT Associates, Inc.	John P. Sophocleus	Auburn University
Marty Makinen	ABT Associates, Inc.	Robert F. Hebert	Auburn University
Robert Kornfeld	ABT Associates, Inc.	Jurgen Brauer	Augusta State University, School of Business
Ulrich F.W. Ernst	ABT Associates, Inc.	Hiro Fukao	Aurthur D. Little
Allen B. Ferguson	AFE, Inc.	Patrick J. Kennon	Aviation Economics
Amy K. Taylor	Agency for Health Care Policy and Research	Mark Tomass	Babson College
Chiou-nan Yeh	Alabama State University	Stephen Silver	BADM, The Citadel
Earl W. Adams	Allegheny College	Judith A. Smrha	Baker University
Kenneth G. Alusworth	Allegheny College	Barbara Sherman Rolleston	Baldwin-Wallace College
Stephen D. Casler	Allegheny College	Terence E. Byrne	Baltimore-Washington Financial Advisors
Pamela Mobilia	Alpine PCS	Leland S. Prussia	Bank of America Corporation
Michael Stavy	Alternative Energy and EV's	R. McFall Lamm, Jr.	Bankers Trust Co.
Paul Thompson	AMBAC Indemnity	Maxwell Rhee	Banque Nationale de Paris
Riad Tabbarah	Ambassador of Lebanon to the U.S.	Mary Lashley Barcella	Barcella Associates
Daniel Bell	American Academy of Arts & Science	Dimitri Papadimitriou	Bard College
M. Abdul Shibli	American Economic Association	Shannon Mudd	Barente Group
Paul Kahane	American Economic Association	Gopal Iyer	Baruch College
Jay G. Chambers	American Institutes for Research	Theodore Joyce	Baruch College

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781 1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Ted Walther	Bates College	David Weil	Boston University
Steve Shantle	Battelle	Debraj Ray	Boston University
Kathrine F. Wellman	Battelle Memorial Institute	Eli Berman	Boston University
Dave Anderson	Battelle-Northwest	Ingo Vogelsang	Boston University
David B. Belzer	Battelle-Northwest	Jonathan Eaton	Boston University
Joseph A. McKinney	Baylor University	Laurence J. Kotlikoff	Boston University
John Katharopoulos	BCBS of Michigan	Shane J. Hunt	Boston University
Ernie Nadel	BCI	Thomas McGuire	Boston University
Wayne A. Morra	Beaver College	Wei Yu	Boston University
James Lacey	Bell Labs	William M. Capron	Boston University
Steven G. Lanning	Bell Labs - Lucent Technologies	Zvi Bodie	Boston University
Roger Story	Bellcore	Zvika Neeman	Boston University
Kristina Weir	Bellevue Community College	William F. Samuelson	Boston University, School of Management
Gary L. Hodglin	Belmont University	John Fitzgerald	Bowdoin College
Mary M. Thompson	Belmont University	Alan Day Haight	Bowling Green State University
Warren Palmer	Beloit College	Charles R. Chittle	Bowling Green State University
Marc Bendick, Jr.	Bendick & Egan Economic Consultants, Inc.	Harold L. Lunde	Bowling Green State University
Bertrand LaNoue, O.S.B.	Benedictine College	Kyoo Kim	Bowling Green State University
Janet M. Thomas	Bentley College	Mark Kasoff	Bowling Green State University
Lucy Ackert	Berry College	Paul F. Haas	Bowling Green State University
Bassem Abou-Zeid	Bethel College	Stephen Ziliak	Bowling Green State University
Phyllis Campbell	Bethel College	Felicia Yesari	BPBA-New York
Miles O. Bidwell	Bidwell Associates Inc.	Kalman Goldberg	Bradley University
Edward A. Manfield	Binary Traders	Kevin M. O'Brien	Bradley University
Charles W. Bischoff	Binghamton University	Anne P. Carter	Brandeis University
Clifford D. Clark	Binghamton University	Arthur Lewbel	Brandeis University
Dr. N.J. Wulwick	Binghamton University	Gary H. Jefferson	Brandeis University
Stanley H. Masters	Binghamton University	Rachel McCulloch	Brandeis University
L. Aubrey Drewry, Jr.	Birmingham-Southern College	Brian Kelly	Brian Kelly Inc.
M. Iqbal Akhtar	Blackburn College	Edward R. Fried	Brookings Institution
Bennett W. Golub	Blackrouk Financial Management	Margaret M. Blair	Brookings Institution
Edward Bloom	Bloom Research	Nora Lustig	Brookings Institution
Woo-Bong Lee	Bloomsburg University	Robert Axtell	Brookings Institution
Ronald L. Friesen	Bluffton College	Robert E. Litan	Brookings Institution
Chong-en Bai	Boston College	Robert Solomon	Brookings Institution
Christopher Baum	Boston College	William Dickens	Brookings Institution
Donald J. White	Boston College	Leo J. Raskind	Brooklyn Law School
Frank M. Gollop	Boston College	Akio Yasuhara	Brown University
Harold Petersen	Boston College	Louis Putterman	Brown University
Joseph F. Quinn	Boston College	Mark B. Schupack	Brown University
Kathleen Lang	Boston College	Michael Spagat	Brown University
Marvin Kraus	Boston College	David R. Ross	Bryn Maur College
Paul Streeten	Boston College	Thomas Loo	Budget Comp.
Robert G. Murphy	Boston College	Joel D. Fischer	Burnham Securities Inc.
Andrew Weiss	Boston University	Hasan MacNeil	Butte College
Carla Y. Willis	Boston University	Bruce W. Kinzey	BYU-Hawaii, School of Business

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNEY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Daniel M. Bernhofen	Clark University	Chaltram J. Talele	Columbia State College
John C. Brown	Clark University	Elliot Zupnik	Columbia University
Joseph Golec	Clark University	Giulio Pontecorvo	Columbia University
Rudy Yaksick	Clark University	Harold W. Watts	Columbia University
Wayne B. Gray	Clark University	Hugh Patrick	Columbia University
Fredric Menz	Clarkson University	James W. Kuhn	Columbia University
J.K. Mullen	Clarkson University	Jay Pil Choi	Columbia University
Holley Ulbrich	Clemson University	Maurice Wilkinson	Columbia University
Donald G. Freeman	Cleveland State University	Richard R. Nelson	Columbia University
John F. Burke Jr.	Cleveland State University	Roberto Perotti	Columbia University
Jon D. Harford	Cleveland State University	Roger F. Murray	Columbia University
Michael Bond	Cleveland State University	Ronald M. Schramm	Columbia University
Myong-Hun Chang	Cleveland State University	Stefan H. Robock	Columbia University
Vijay K. Mathur	Cleveland State University	Susan S. Wieler	Columbia University
Nancy C. Wilson	Climate Institute	Duncan K. Foley	Columbia University, Barnard College
Peter J. Francis	CNA Corporation	Perry Mehrling	Columbia University, Barnard College
H. A. Gemery	Colby College	Rajiv Sethi	Columbia University, Barnard College
Randy Nelson	Colby College	Andrew Haggard	Committee for Economic Development
Tom Tietenberg	Colby College	Ronald S. Boster	Committee for Economic Development
David M. Sturges	Colgate University	Van Doorn Ooms	Committee for Economic Development
Michael R. Haines	Colgate University	William J. Beeman	Committee for Economic Development
Oz Honkalehto	Colgate University	Robert Atallo	Comp. Resource Solutions
Robert W. Turner	Colgate University	Jeffrey G. Woods	Concord College
Wayne A. Grove	Colgate University	Dick Nanto	Congressional Research Service
Lawrence J. Frateschi	College of Du Page	William A. Cox	Congressional Research Service
Mary Goldschmid	College of Mount Saint Vincent	Spencer J. Pack	Connecticut College
Lee H. Endress	College of Security Studies, Asia-Pacific Center	Daniel W. Kennedy	Connecticut Labor Dept.
Marcia J. Frost	College of St. Benedict	Stuart Harshbarger	Coopers and Lybrand
James R. Ashley	College of St. Catherine	Ziad Ayash	Coopers & Lybrand
Miles B. Cahill	College of the Holy Cross	Habtu Braha	Coppin State College
David H. Feldman	College of William and Mary	Donald C. Cell	Cornell College
Eric R. Jensen	College of William and Mary	Gordon Urquhart	Cornell College
John S. Strong	College of William and Mary	Imran Farooqi	Cornell College
Robert B. Archibald	College of William and Mary	Bill Rosen	Cornell University
Carol A. Dahl	Colorado School of Mines	Duane Chapman	Cornell University
Graham Davis	Colorado School of Mines	Erik Thorbecke	Cornell University
Wade E. Martin	Colorado School of Mines	Gary S. Fields	Cornell University
Charles Revier	Colorado State University	John H. Bishop	Cornell University
John B. Loomis	Colorado State University	M. Gardner Clark	Cornell University
John R. McKean	Colorado State University	Robert C. Lind	Cornell University
Kenneth C. Nobe	Colorado State University	Robert Gibbons	Cornell University
Robert R. Keller	Colorado State University	Robert H. Frank	Cornell University
Stephen Weller	Colorado State University	Shankar Subramanian	Cornell University
Chris Mayer	Columbia Business School	Seymour Smidt	Cornell University, Johnson Graduate School
Kenneth N. Kuttner	Columbia Business School	Hirsch S. Ruchlin	Cornell University Medical College
Orba Traylor	Columbia College	Michael D. Topper	Cornerstone Research

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO, CALIFORNIA 94102-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
C. K. Woo	Energy and Environmental Economics, Inc.	Daniel A. Mizak	Frostburg State University
Bruce Stram	Enron Corporation	William J. Serow	FSU, Center for the Study of Population
Kenneth Acks	Env. Damage Valuation & Cost-Benefit News	Young J. Park	Fu Associates, Ltd.
Paul Holden	ERI	Raul Moreno	Fundacion Nacional Para El Desarrollo
Robert Neal Peterson	ERS	Kim M. Gardey	Gardey Investment Management
Dennis Erickson	Erskine College	Anthony Negbenebor	Gardner Webb University
Kenneth P. Selden	Essential Economics, Inc.	Frances Hammond	General Motors Corporation
Richard Castellana	Fairleigh Dickinson University	Carrie A. Meyer	George Mason University
Steven A. Seelig	FDIC	Chris G. Rodrigo	George Mason University
Kevin Lansing	Federal Reserve Bank of Cleveland	Steven C. Michael	George Mason University
Joseph Haimowitz	Federal Reserve Bank of Kansas City	Anita M. Benvignati	George Washington University
Edward Lotterman	Federal Reserve Bank of Minneapolis	David C. Riber	George Washington University
Richard M. Todd	Federal Reserve Bank of Minneapolis	Elinor H. Solomon	George Washington University
Patricia Pollard	Federal Reserve Bank of St. Louis	Eric Kodjo Ralph	George Washington University
Alexander David	Federal Reserve Board	Julian Silk	George Washington University
Charles Siegman	Federal Reserve Board	Mary Ann Bailly	George Washington University
Chunsheng Zhou	Federal Reserve Board	Stephen C. Smith	George Washington University
Dale W. Henderson	Federal Reserve Board	Vincy Fon	George Washington University
Dean F. Amiel	Federal Reserve Board	Warren Greenberg	Georgetown University
Guy V.G. Stevens	Federal Reserve Board	Charles K. Ebinger	Georgetown University
Laura S. Rubin	Federal Reserve Board	Dale Murphey	Georgetown University
Murat F. Iyigun	Federal Reserve Board	Daniel Kahn	Georgetown University
Randall Mariger	Federal Reserve Board	George J. Veksins	Georgetown University
Steve Rhoades	Federal Reserve Board	Ibrahim M. Oweis	Georgetown University
Gerald D. Lomen	Federal Reserve Board of New York	James Tybout	Georgetown University
George Budzelka	Federal Reserve Board of New York, Rtd.	Jens Ludwig	Georgetown University
Richard E. Ludwick, Jr.	Federal Trade Commission	John Cuddington	Georgetown University
Ohannes Hagopian	Felician College	Mitch Kaneda	Georgetown University
Abdollah Ferdowsi	Ferris State University	Robert E. Moore	Georgia College & State University
Daniel Teferra	Ferris State University	Usha Nair	Georgia Institute of Technology
Herbert E. Neill	Financial and Economic Strategies	David L. Sjoquist	Georgia State University
Gabriel Torres	Fitch Investor Services	Jorge Martinez-Vazquez	Georgia State University
Benjamin Chinitz	Florida Atlantic University	Julie Hotchkiss	Georgia State University
Alison Butler	Florida International University	Ronald G. Cummings	Georgia State University
Maria Willumsen	Florida International University	Rubin Saposnik	Georgia State University
Charles E. Rockwood	Florida State University	Peter G. Sassone	Georgia Tech
James Cobbe	Florida State University.	Richard J. Cebula	Georgia Tech
Michael Slotkin	Florida Tech	Brendan Cushing-Daniels	Gettysburg College
Peter M. Ewen	Forecasts Department, APS	Katsuyuki Niino	Gettysburg College
Dominick Salvatore	Fordham University	Ralph Chances	Gettysburg College
Jacqueline G. Coolidge	Foreign Investment Advisory Service	Janamitra Devan	Global Strategies Group
Betty F. Slade	Formerly Harvard Inst. for Intl. Development	Randal G. Gunden	Goshen College
Glenn G. Stevenson	Formerly Oak Ridge National Laboratory	Katherine Henneberger	Goucher College
Ronald G. Ridker	Formerly of The World Bank	Mark Montgomery	Grinnell College
Richard W. Stewart	Frontier Cooperative Herbs	Claude Gruen	Gruen Gruen & Associates
Yury F. Ruban	Frontier Vision Technologies, Inc.	Robert T. Tanimura	GTE Telephone Operations

SPONSORED BY:

ONE KALAM STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-381-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Lawrence Y. Fu	Illinois College	Stephen A. Vosti	International Food Policy Research Institute
J. Lon Carlson	Illinois State University	Nazrul Islam	International Inst. for Advanced Studies
L. Dean Hiebert	Illinois State University	Adolfo Barajas	International Monetary Fund
Michael A. Nelson	Illinois State University	Adrienne Chcasty	International Monetary Fund
Michael C. Seeborg	Illinois Wesleyan University	Alphecca Muttardy	International Monetary Fund
Thomas E. McGinnis	Indiana State Government	Caroline Van Ryckeghem	International Monetary Fund
Craig W. Holden	Indiana University	David T. Coe	International Monetary Fund
David Waterman	Indiana University	Dev Kumar Kar	International Monetary Fund
Eckhard Janeba	Indiana University	Elaine Buckberg	International Monetary Fund
Fwu-Rang Chiang	Indiana University	Ramiro Hernandez-Caja	International Monetary Fund
Herbert Kiesling	Indiana University	Geert J. Almekinders	International Monetary Fund
Janardhanan A. Alse	Indiana University	George Iden	International Monetary Fund
Joyce Man	Indiana University	Gian Maria Milesi-Ferretti	International Monetary Fund
Lloyd Orr	Indiana University	Gregory C. Dahl	International Monetary Fund
Mariannne V. Felton	Indiana University	Gustavo Canonero	International Monetary Fund
Martin C. Speechler	Indiana University	James E. Blalock	International Monetary Fund
Philip T. Powell	Indiana University	Jeromijn Zettelmeyer	International Monetary Fund
Phillip Saunders	Indiana University	John E. Leimone	International Monetary Fund
Roy Gardner	Indiana University	Kevin L. Ross	International Monetary Fund
Scott Smart	Indiana University	Lorenzo L. Perez	International Monetary Fund
Clarence C. Morrison	Indiana University, Bloomington	Malcom D. Knight	International Monetary Fund
Ashton I. Veramallay	Indiana University East	Mark R. Stone	International Monetary Fund
Shyam I. Bhatia	Indiana University Northwest	Michael G. Papaloannou	International Monetary Fund
Arthur Martel	Indiana University of Pennsylvania	Michael P. Leidy	International Monetary Fund
Robert J. Stonebrakon	Indiana University of Pennsylvania	Nicholas Tsaveas	International Monetary Fund
Roger W. Schmenner	Indiana University School of Business	Patricia A. Reynolds	International Monetary Fund
Lawrence J. Haber	Indiana-Purdue at Fort Wayne	Peter B. Clark	International Monetary Fund
Thomas L. Guthrie	Indiana-Purdue at Fort Wayne	Rakia Moalla-Fetini	International Monetary Fund
Robert Weiss	Industrial Electrotechnology Laboratory	Richard Stillson	International Monetary Fund
Roy B. Helfgott	Industrial Relations Counselors Inc.	Sunil Sharma	International Monetary Fund
Charles Marston	Infinity Inc.	Thomas Rumbaugh	International Monetary Fund
Thomas P. Rothrock	Info Tech Inc.	Toshiro Nishizawa	International Monetary Fund
Bruce McKinlay	Information Systems Group	Vikram Haksar	International Monetary Fund
Jon Christianson	Inst. for Health Services Research	Wayne E. Lewis	International Monetary Fund
Geoffrey Carlner	Institute for International Economics	William L. Hemphill	International Monetary Fund
Robert J. Muscat	Institute for Policy Reform	Zeljko Bogetic	International Monetary Fund
Richard Webb	Instituto Cuanto	Jonathan Levin	International Monetary Fund Ltd.
Charles Richter	Inter-American Development Bank	Robert F. Lundy	Interstate Commerce Commission, Rtd.
Michael A. Gomez	Inter-American Development Bank	Roger Williams	INVEST
Michael Gavin	Inter-American Development bank	David Hennessy	Iowa State University
Orlando A. Reos	Inter-American Development Bank	J. Peter Mattila	Iowa State University
Alan McInnes	Internal Revenue Service	John A. Miranowski	Iowa State University
Joseph M. Grews	Internal Revenue Service	Peter Orazem	Iowa State University
Peter C. Balash	Internal Revenue Service	Stanley A. Johnson	Iowa State University
Agnes R. Quisumbing	International Food Policy Research Institute	William Merrill	Iowa State University
Dean Jolliffe	International Food Policy Research Institute	Cynthia Hacımun	Iowa Wesleyan College

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNEY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Theodore Palivos	Louisiana State University	John P. Hoehn	Michigan State University
Howard Baetser, Jr.	Loyola College	Kenneth D. Boyer	Michigan State University
James Konow	Loyola Marymount University	Mordechai Kreinin	Michigan State University
Bruce Vanderporten	Loyola University, Chicago	Norman P. Obst	Michigan State University
George Kaufman	Loyola University, Chicago	Paul L. Menchik	Michigan State University
Marc Douglas Hayford	Loyola University, Chicago	Paul Segerstrom	Michigan State University
Robert Carow	Loyola University, Chicago	Richard T. Baillie	Michigan State University
Dan C. Messerschmidt	Lynchburg College	Robert J. La Londe	Michigan State University
D. Sykes Willford	M.D. Bankers Trust	Scott M. Swinton	Michigan State University
Marshall Pomer	Macroeconomic Institute	Stephen A. Woodbury	Michigan State University
Emily Sun	Manhattan College	W. Paul Strassmann	Michigan State University
John F. Tomer	Manhattan College	Paul A. Nelson	Michigan Technological University
Bruce Carpenter	Mansfield University	Atanu Saha	Micronomics Inc.
Joan E. Gadsby	Market Media International Corporation	Bichaka Fayissa	Middle Tennessee State University
James Tober	Marlboro College	Reuben Kyle	Middle Tennessee State University
David E. Clark	Marquette University	John Craven	Middlebury College
David L. Marshall	Marshall & Associates	Yoshi Fukasawa	Midwestern State University
Harlan M. Smith, II	Marshall University	Alec R. Levenson	Milken Institute
Mark A. Thompson	Marshall University	Kurt R. Schaefer	Miller Freeman Inc.
Amy M. Diduch	Mary Baldwin College	Ross Miller	Miller Risk Advisors
Amata	Marygrove College	Marion Ross	Mills College
Calvin Timmerman	Maryland Public Service Commission	Patrick A. Taylor	Millsaps College
Steven Payson	Marymont University	Kevin Richardson	Minute Maid Company
Lyle Nelson	Mathematica Policy Research	Paul W. Grimes	Mississippi State University
Merrile Sing	Mathematica Policy Research	Robert O. Weagley	Missouri University
Walter Corson	Mathematica Policy Research	Alberto Bisin	MIT
Karen Akerhielm	Mathtech Inc.	Carl Kaysen	MIT
Ramsey Nguon Lay	McDonnell Douglas Aerospace West	Donald Lessard	MIT
David Wyss	McGraw Hill	E. Cary Brown	MIT
Anthony Pennington-Cross	McGraw-Hill	Eli Shapiro	MIT
Susan M. Lund	McKinsey & Company	Evsey D. Domar	MIT
B. David Collier	Medical College of Wisconsin	Franklin M. Fisher	MIT
Charles H. Andrews	Mercer University	George W. Rathjens	MIT
C.W. Blowens	Metro-Dade County Planning Department	Jorn Steffen Pischke	MIT
David J. O'Hara	Metropolitan State University	M. A. Adelman	MIT
O. Homer Erekson	Miami University	* Paul Krugman	MIT
Raymond Gorman	Miami University	Paul Smoke	MIT
Robert L. Conn	Miami University	* ** Robert Solow	MIT
William K. Hutchinson	Miami University	Robin Wells	MIT
William R. Hart	Miami University	Scott Stern	MIT
Peter Eckstein	Michigan AFL-CIO	Susan Athey	MIT
H. William Rockwell, Jr.	Michigan Dept. of Natural Resources	Tim Riddiough	MIT
Corianne M. Krupp	Michigan State University	William C. Wheaton	MIT
Daniel R. Talhelm	Michigan State University	Alan M. Strout	MIT, Rtd.
Harry J. Holzer	Michigan State University	B. Wernertelt	MIT, Sloan School of Management
James L. Dornick	Michigan State University	Erik Brynjolfsson	MIT, Sloan School of Management

SPONSORED BY:

ONE KRAMER STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Lori Leachman	Northern Arizona University	Mario J. Miranda	Ohio State University
Richard J. Downen	Northern Illinois University	Nancy Ettlinger	Ohio State University
Todd Knoop	Northern Illinois University	Nelson C. Mark	Ohio State University
Virginia Wilcox-Cok	Northern Illinois University	Peter Howitt	Ohio State University
Young C. Kim	Northern Illinois University	Richard A. Tybout	Ohio State University
Gary E. Clayton	Northern Kentucky University	Robert J. Caswell	Ohio State University
Martin G. Giesbrecht	Northern Kentucky University	Stephen G. Cecchetti	Ohio State University
Tom Cate	Northern Kentucky University	Chulho Jung	Ohio University
Hillar D. Neumann, Jr.	Northern State University, South Dakota	Kurt A. Schwabe	Ohio University
R. Stephen Elliott	Northwestern State University	James V. Koch	Old Dominion University
Alan M. Taylor	Northwestern University	Paul R. Koch	Olivet Nazarene University
Boaz Moselle	Northwestern University	Vartkes L. Broussalian	OMB, Washington, Rtd.
Burton A. Weisbrod	Northwestern University	Rohit Sah	Oppenheimer Funds, Inc
Deborah Lucas	Northwestern University	Carol Horton Tremblay	Oregon State University
Mark A. Satterthwaite	Northwestern University	Emery N. Castle	Oregon State University
Michael Wallerstein	Northwestern University	Joe Kerkvliet	Oregon State University
Todd Pulvino	Northwestern University	Laura S. Connolly	Oregon State University
Donald P. Jacobs	Northwestern University, J.C. Kellogg School	Ronald A. Oliviera	Oregon State University
Sr. Beth Anne Tercek	Notre Dame College	Bronwyn H. Hall	Oxford University, UK
Liang-rong Shiau	NSU	Jacques J. Polak	P. Jacobson Foundation
John Tepper Marlin	NYC Comptroller's Office	Richard Ottinger	Pace Law School
Eileen R. Kaufman	NYC Dept of Design & Construction	Michael Szenberg	Pace University
Larry M. Blair	Oak Ridge Associated Universities	Bruce McWilliams	Pacific Institute
C. J. Austermliller	Oakland Community College	Marlen Miller	Pacific Lutheran University
Kevin J. Murphy	Oakland University	Norris A. Peterson	Pacific Lutheran University
A. T. Aburachis	Oannon University	Rachel Nugent	Pacific Lutheran University
David L. Cleeton	Oberlin College	John A. Jaksch	Pacific Northwest National Laboratory
Hirschel Kasper	Oberlin College	Joseph M. Roop	Pacific Northwest National Laboratory
James Whitney	Occidental College	Michael J. Scott	Pacific Northwest National Laboratory
Michael K. Tamada	Occidental College	H. Joe Story	Pacific University
Robert L. Moore	Occidental College	Phillip J. Ruder	Pacific University
Edward H. Clarke	Office of Management & Budget	Loren A. Lee	Palomar College
Joseph R. Mason	Office of the Comptroller of the Currency	Teresa L. C. Laughlin	Palomar College
Robert DeYoung	Office of the Comptroller of the Currency	Craig Paxton	Paxton Analysts
William O. Shropshire	Oglethorpe University	Brandt Witte	Peace Corps
Frederick Church	Ohio Legislature Budget Office	Daniel A. Underwood	Peninsula College
Alan Randall	Ohio State University	Colin Polsky	Penn. State Univ., Earth System Science Center
Amy Jocelyn Glass	Ohio State University	Mark D. Agee	Pennsylvania State University
Belton M. Fleisher	Ohio State University	Ali Abderrezak	Pennsylvania State University
Brent Sohngen	Ohio State University	Ann Fisher	Pennsylvania State University
Elián Khalil	Ohio State University	Barry N.	Pennsylvania State University
Eric Fisher	Ohio State University	Chidem Kudas	Pennsylvania State University
Hassan Y. Aly	Ohio State University	Donald J. Epp	Pennsylvania State University
Herbert Parnes	Ohio State University	Gary Bolton	Pennsylvania State University
Jay L. Zagorsky	Ohio State University	Jacob DeRooy	Pennsylvania State University
Jingang Zhao	Ohio State University	James D. Rodgers	Pennsylvania State University

SPONSORED BY:

REDEFINING PROGRESS

ONE KENNEDY STREET

FOURTH FLOOR

SAN FRANCISCO

CALIFORNIA

415.781.3111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Bernard Rose	Rocky Mountain College	Patricia Dillon	Scripps College
Kenna Taylor	Rollins University	Jere W. Clark	SCSC
Ron Balman	Roosevelt University	M. Louise Curley	Scudder, Stevens & Clark
Dale Bremner	Rose - Hulman Institute of Technology	Allen S. Bellas	Seattle University
Stephen Smith	Rose State College	Vinay Datar	Seattle University
Manijeh Sabl	Russell Sage College	William L. Weber	SEMO State University
A. Myrick Freeman III	Rutgers University	Jerry Jenkins	Sequoia Institute
Bruce Mizrach	Rutgers University	Henry C. F. Arnold	Seton Hall University
Carlos Seiglie	Rutgers University	Tony Loviseck	Seton Hall University
Edmund M. Tavernier	Rutgers University	Alan G. Myers	SEWS
Horace J. De Podwin	Rutgers University	Michael J. Chapman	Shearman & Sterling
Leslie E. Small	Rutgers University	Thomas H. Sheenan, Jr.	Sheenan International
Marlene Kim	Rutgers University	Daneil A. Pavsek	Shenandoah University
Michael A. Crew	Rutgers University	Signe L. Sherman	Sherman Holdings
Michael K. Taussig	Rutgers University	Kirk E. Vandezande	Simon Fraser University
Richard W. Johnson	Rutgers University	Sharon Pang	Skadden, Arps, Slate, Meaher & Flonn
Robert H. Patrick	Rutgers University	Deborah Haas-Wilson	Smith College
Marjorie W. Munson	Rutgers University, Douglass College	Roger T. Kaufman	Smith College
William H. Wrean	Sacajawea & Company	L. Scott Muller	Social Security Administration
Lucjan Orlowski	Sacred Heart University	Michael V. Leonasio	Social Security Administration
Alannah Orrison	Saddleback College	Carlos A. Benito	Sonoma State University
Kenneth G. Woodward	Saddleback College	Stephen D. Lewis	Sonoma State University
Hong Y. Park	Saginaw Valley State University	Robert C. McGillivray	Sound Economics
Charles Henning	SAIC	Thomas Mitchell	South Illinois University
Gilbert Becker	Saint Anselm College	Elizabeth Granitz	Southampton College
Reza Ramazani	Saint Michael's College	Christopher R. Mann	Southeast Michigan Council of Govts.
Thampy Mammen	Saint Norbert College	Kenneth Chinn	Southeastern Oklahoma State University
Dorothy Ryan Siden	Salem State College	Scott Bellamy	Southern Arkansas University
Chee Y. Thum	Salomon Brothers Inc.	Paul Shrier	Southern California College
Adam Gifford, Sr.	San Diego State University	David Lui	Southern California Edison
Douglas B. Stewart	San Diego State University	Donald Elliott	Southern Illinois University
James Gerber	San Diego State University	Jim Musumeci	Southern Illinois University
S. Grossbay-Shechtman	San Diego State University	Julius Horvath	Southern Illinois University
Dluchi O. Nnachi	San Francisco Juvenile Court	Paul Trescott	Southern Illinois University
Betty J. Blecha	San Francisco State University	S. Grosskopf	Southern Illinois University
Joanna Moss	San Francisco State University	Stanford L. Levin	Southern Illinois University
R. Newby Schweitzer	San Francisco State University	R.W. Hafer	Southern Indiana University
Yea-Mow Chen	San Francisco State University	J. Carter Murphy	Southern Methodist University
Douglas F. Greer	San Jose State University	Thomas Osang	Southern Missouri University
Thomas Drennen	Sandia National Laboratories	Thomas Dalton	Southern University at New Orleans
Helen Popper	Santa Clara University	C. E. Chang	Southwest Missouri State University
Michael Kevane	Santa Clara University	E. Dale Wasson	Southwest Missouri State University
R. D. Norton	Sarkisian	Anne R. Hornsby	Spelman College
Edward Alban	Savannah State University	Bernice de Gaines Scott	Spelman College
John Watters	SBC Communications	Kenneth N. Hamilton	Spring Hill College
Frank D. Weiss	School of Advanced International Studies	Brian K. Stahr	Sprint

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1991

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Stephen Golub	Swarthmore College	Ronald H. Miller	The Hudson Group
Roger C. Dower	Sycom Enterprises	Thomas E. O'Hare	The Intertich Group
A. Dale Tussing	Syracuse University	Gina Livermore	The Levin Group
Bernard Jump	Syracuse University	David C. Stapleton	The Lewin Group
Donald H. Dutkowsky	Syracuse University	Linz Audain	The Mandate Corporation
Michael Wasylenko	Syracuse University	William G Rhoads	The Nature Conservancy
David I. Goldeberg	Systematic Forecasting, Inc.	Martin Duffy	The Perseus Group
Faith Breen	Systems Resource Management	Hiroshi Kawamura	The United Nations
Dana Stevens	Takashi Corporation	Larry Willmore	The United Nations
Cindy Houser	TAMU	Fernando Losada	The Weston Group
William L. Beaty	Tarleton College	Peter C. Moll	The World Bank
Thomas D. Legg	TD Legg Financial Economics	A. Mead Over, Jr.	The World Bank
Robert E. Lucore	Teamsters Union	Andrew Steer	The World Bank
Michael J. Ileo	Technical Associates, Inc.	Carter Brandon	The World Bank
Charles P. Hall	Temple University	Charles C. Griffin	The World Bank
Charlotte Phelps	Temple University	David Dollar	The World Bank
J. Jay Choi	Temple University	Delbert Fitchett	The World Bank
Thomas E. Getzen	Temple University	Estelle James	The World Bank
Seisel Jonakin	Tennessee Tech. University	Gianni Zanini	The World Bank
Whewon Cho	Tennessee Tech. University	Gunnar S. Eskeland	The World Bank
Lonnie L. Jones	Texas A & M University	Herman Cesar	The World Bank
Wade L. Griffin	Texas A&M University	Hideo Akabayashi	The World Bank
Amy P. Thurow	Texas A&M University	Humayun Tai	The World Bank
C. Richard Shumway	Texas A&M University	Inderjit Singh	The World Bank
Farshid Vahid	Texas A&M University	J. Michael Finger	The World Bank
James H. Ullmer	Texas A&M University	Jacques Van der Gaag	The World Bank
Javier Gimeno	Texas A&M University	John Kellenberg	The World Bank
John R. Moroney	Texas A&M University	John Williamson	The World Bank
Julian E. Gaspar	Texas A&M University	Keith E. Hansen	The World Bank
Manzoor E. Chowdhury	Texas A&M University	Loerane Yap	The World Bank
Noh-Sun Kwark	Texas A&M University	Manuela Ferro	The World Bank
Rajiv Sarin	Texas A&M University	Maria Freire	The World Bank
Ronald C. Griffin	Texas A&M University	Mark W. Leiserson	The World Bank
Thomas D. Jeitschko	Texas A&M University	Martha De Melo	The World Bank
Frank Giesber	Texas Lutheran University	Martin Ravallion	The World Bank
Richard E. Quandt	The Andrew W. Mellon Foundation	Maurice Schiff	The World Bank
Kenneth T. Wise	The Brattle Group	Moshe Syrquin	The World Bank
Paul R. Carpenter	The Brattle Group	Nobuhiko Fuwa	The World Bank
Peter Fox-Penner	The Brattle Group	Pedro Belli	The World Bank
Peter Fox-Penner	The Brattle Group	Robert Armstrong	The World Bank
G.R. Guralnik	The Business Group, Inc.	Robert Hunt	The World Bank
Donald E. Campbell	The College of William & Mary	Saji Thomas	The World Bank
A. Doris Capistrano	The Ford Foundation	Stefan G. Koeberle	The World Bank
Bernard Wasow	The Ford Foundation	Timothy King	The World Bank
Henry E. Cole	The Future Group International	Yi Chen	The World Bank
Gerald Kraft	The GSK Group, Ltd.	Yin-kann Wen	The World Bank

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Robert M. Williams	UCLA	Mark Zupan	University of Arizona
Stuart O. Schweitzer	UCLA	Richard Newcomb	University of Arizona
Tom K. Lieser	UCLA	Roger W. Fox	University of Arizona
Trudy Ann Cameron	UCLA	Ronald J. Vogel	University of Arizona
Wei-Yin Hu	UCLA	Willard T. Carleton	University of Arizona
Werner Z. Hirsch	UCLA	Gary Ferrier	University of Arkansas
Brad Cornell	UCLA, Anderson School of Business	William P. Curington	University of Arkansas
Bhagwan Chowdhry	UCLA, Anderson School of Management	Michael Sher	University of Auckland
David R. Bell	UCLA, Anderson School of Management	David W. Stevens	University of Baltimore
M. J. Brennan	UCLA, Anderson School of Management	Esra Bennis	University of Bristol, UK
Marvin Lieberman	UCLA, Anderson School of Management	Aaron S. Edlin	University of California, Berkeley
Jose' De La Torre	UCLA, Anderson School of Mgmt.	Anne M. Libby	University of California, Berkeley
Richard H. Sander	UCLA, School of Law	Anthony Fisher	University of California, Berkeley
Georgios Karras	UIC	Ben F. Vaughan, IV	University of California, Berkeley
Bill Lord	UMBC	Clair Brown	University of California, Berkeley
Nathaniel Wollman	University of New Mexico	Clark Kerr	University of California, Berkeley
Ella K. Hensley	Union College	David Romer	University of California, Berkeley
J. Douglas Klein	Union College	Frank E. Trink	University of California, Berkeley
Therese McCarthy	Union College	Garland L. Brinkley	University of California, Berkeley
Todd A. Burgman	Union College	Gary Charness	University of California, Berkeley
Dr. Faruk G. Sabet	United Nations	** Gerard Debreu	University of California, Berkeley
Gary W. Grizzle	United Parcel Service	Glenn A. Woroch	University of California, Berkeley
Herbert Traxler	United States PHS	Gordon Rausser	University of California, Berkeley
John Mark Lindrall	Univ. of Phoenix, Southern CA campus	Gregory Grossman	University of California, Berkeley
Stanley Long	Univ. of Pittsburgh, Penn. State Univ.	Hal R. Varian	University of California, Berkeley
James J. Heckman	University of Chicago	Jeffrey S. Petersen	University of California, Berkeley
Richard Bryant	University of Missouri-Rolla	Jerome Siebert	University of California, Berkeley
Gautam Vora	University of New Mexico	John M. Letiche	University of California, Berkeley
Richard W. Stratton	University of Akron	Larry S. Karp	University of California, Berkeley
Harris Schlesinger	University of Alabama	Lee S. Friedman	University of California, Berkeley
Nancy S. Barrett	University of Alabama	Mark Rubinstein	University of California, Berkeley
Walter S. Misiulek	University of Alabama	Maurice Obstfeld	University of California, Berkeley
Robert A. McLean	University of Alabama, Birmingham	Miguel Cantillo	University of California, Berkeley
Seung-Dong Lee	University of Alabama, Birmingham	Oliver E. Williamson	University of California, Berkeley
John F. Schnell	University of Alabama, Huntsville	Peter Berck	University of California, Berkeley
William S. Brown	University of Alaska - SE	Richard B. Norgaard	University of California, Berkeley
Todd R. Smith	University of Alberta, Canada	Robert M. Anderson	University of California, Berkeley
Alberta H. Charnay	University of Arizona	Sylvia Lane	University of California, Berkeley
David A. King	University of Arizona	Theodore E. Keeler	University of California, Berkeley
Edward E. Zajac	University of Arizona	David J. Teece	University of California, Berkeley, Haas School
Eric Monke	University of Arizona	** John C. Harsanyi	University of California, Berkeley, Haas School
Gordon Tullock	University of Arizona	Pablo T. Spiller	University of California, Berkeley, Haas School
James C. Cox	University of Arizona	Stephen Penman	University of California, Berkeley, Haas School
John L. Wilson	University of Arizona	Richard H. Holton	University of California, Berkeley, Haas School
Leslie S. Stratton	University of Arizona	Richard Meese	University of California, Berkeley, Haas School
Lester D. Taylor	University of Arizona	Daniel Rubinfeld	University of California, Berkeley Law School

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-761-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Francis Tannian	University of Delaware	John B. Braden	University of Illinois
Lawrence P. Donnelley	University of Delaware	Robert Resek	University of Illinois
Pamela C. Brown	University of Delaware	Robert W. Gillespie	University of Illinois
Pamela J. Smith	University of Delaware	Thomas S. Ulen	University of Illinois
Donald Pemberton	University of Detroit, Mercy	Walter W. McMahon	University of Illinois
Maurice Tsai	University of Evansville	George Rosen	University of Illinois, Chicago
David Denslow	University of Florida	Houston H. Stokes	University of Illinois, Chicago
Elias Dinopoulos	University of Florida	Richard F. Kosobud	University of Illinois, Chicago
Eugene Brigham	University of Florida	William F. Maloney	University of Illinois, Urbana
Ira Horowitz	University of Florida	William F. Malowey	University of Illinois, Urbana
Jay R. Ritter	University of Florida	David J. Balan	University of Illinois, Urbana-Champaign
John F. Scoggins	University of Florida	Koji Taira	University of Indiana
Max R. Langham	University of Florida	Benjamin Wilner	University of Iowa
Richard E. Suttor	University of Florida	Calvin D. Siebert	University of Iowa
Sanford V. Berg	University of Florida	Gerald Nordquist	University of Iowa
Tracy R. Lewis	University of Florida	Joel Horowitz	University of Iowa
Andy Keeler	University of Georgia	John M. Brooks	University of Iowa
P. Mather Lindsay	University of Georgia	S. Y. Wu	University of Iowa
Steve Turner	University of Georgia	Thomas F. Pogue	University of Iowa
W. J. Florkowski	University of Georgia, Griffin	De-Min Wu	University of Kansas
Paul Callaghan	University of Guam	Joseph Sicilian	University of Kansas
Bharat Kolluri	University of Hartford	Neal Becker	University of Kansas
Demetrios Giannaros	University of Hartford	Donald J. Mullineaux	University of Kentucky
Farhad Rassek	University of Hartford	James Stoker	University of Kentucky
Rao Singamsetti	University of Hartford	Yoonbai Kim	University of Kentucky
Chung H. Lee	University of Hawaii	Gonyung Park	University of La Verne
David McClain	University of Hawaii	John Vahaly	University of Louisville
James Moncur	University of Hawaii	Anthony Lanyi	University of Maryland
Louis A. Rose	University of Hawaii	Arvind Panagariya	University of Maryland
Richard E. Peterson	University of Hawaii	Christopher K. Clague	University of Maryland
Sumner La Croix	University of Hawaii	Douglas Meade	University of Maryland
David L. Hammes	University of Hawaii, Hilo	Erik Lichtenberg	University of Maryland
Denise Eby Konan	University of Hawaii, Manoa	John H. Cumberland	University of Maryland
A. Reza Hoshmand	University of Hawaii, West Oahu	John W. Dorsey	University of Maryland
A. Marvasli	University of Houston	Karla Hoff	University of Maryland
D. Andrew Austin	University of Houston	Lee E. Preston	University of Maryland
Janet Kohlhaase	University of Houston	Maureen Cropper	University of Maryland
Steven G. Craig	University of Houston	Paul A. Weinstein	University of Maryland
Roger H. Coupal	University of Idaho	Peter Cramton	University of Maryland
Stephen Devadoss	University of Idaho	R. Betancourt	University of Maryland
Anil K. Bera	University of Illinois	Robert Costanza	University of Maryland
Donald W. Paden	University of Illinois	Suzi C. Kerr	University of Maryland
Eliezer B. Ayal	University of Illinois	Theodore C. Karlotis	University of Maryland
George G. Pennacchi	University of Illinois	Phillip Weitzman	University of Maryland UNW College
Gerrit Knaap	University of Illinois	Branch Ben	University of Massachusetts
Hans J. Brems	University of Illinois	Donald W. Katzner	University of Massachusetts

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Barry M. Popkin	University of North Carolina, Chapel Hill	John Kagel	University of Pittsburgh
David J. Ravenscraft	University of North Carolina, Chapel Hill	Josephine E. Olson	University of Pittsburgh
Michael Luger	University of North Carolina, Chapel Hill	Kevin Sontheimer	University of Pittsburgh
Robert Callman	University of North Carolina, Chapel Hill	Michael H. Spiro	University of Pittsburgh
Teresa L. Kauf	University of North Carolina, Chapel Hill	Steve Husted	University of Pittsburgh
Richard A. Zuber	University of North Carolina, Charlotte	Steven F. Rushen	University of Pittsburgh
Andrew C. Brod	University of North Carolina, Greensboro	Evaldo A. Cabarro	University of Puerto Rico
Donald R. Escarraz	University of North Dakota	Kate Stirling	University of Puget Sound
Fikret Ceyhan	University of North Dakota	Lorenzo Garbo	University of Redlands
Michael Nieswiadomy	University of North Texas	John P. Burkett	University of Rhode Island
Michael A. McPherson	University of North Texas	S. Ghon Rhee	University of Rhode Island
Steven G. Thorpe	University of Northern Iowa	Stephen Swallow	University of Rhode Island
Charles K. Wilber	University of Notre Dame	Jonathan Wight	University of Richmond
Jeffrey H. Bergstrand	University of Notre Dame	Peter W. Schuhmann	University of Richmond
Ralph Chami	University of Notre Dame	Robert Dolan	University of Richmond
Richard G. Sheehan	University of Notre Dame	Florian Zettelmeyer	University of Rochester
Robert E. Florence	University of Notre Dame	James A. Kahn	University of Rochester
James C. Hartigan	University of Oklahoma	Jeffrey S. Banks	University of Rochester
Zhen Zhu	University of Oklahoma	Lionel W. McKenzie	University of Rochester
Shuanglin Lin	University of Omaha	Per Krusell	University of Rochester
Bruce A. Blomgen	University of Oregon	Eric Hanushek	University of Rochester, Walling Institute
James P. Ziliak	University of Oregon	Yhi-Min Ho	University of Saint Thomas
Paul B. Simpson	University of Oregon	Rosalie Liccardo Pacula	University of San Diego
Raymond Mikesell	University of Oregon	Man-Lui Lau	University of San Francisco
Robert E. Smith	University of Oregon	Mike Lehmann	University of San Francisco
Stephen Haynes	University of Oregon	Ed Scahill	University of Scranton
Alan Heston	University of Pennsylvania	John H. McDermott	University of South Carolina
Andrew Postlewaite	University of Pennsylvania	Oliver G. Wood, Jr.	University of South Carolina
Arthur I. Bloomfield	University of Pennsylvania	Randolph C. Martin	University of South Carolina
Herbert S. Levine	University of Pennsylvania	Samuel L. Baker	University of South Carolina
** Lawrence R. Klein	University of Pennsylvania	William S. Rawson	University of South Carolina
Morris Hamburg	University of Pennsylvania	William T. Moore	University of South Carolina
Patricia M. Danzon	University of Pennsylvania	Dennis A. Johnson	University of South Dakota
Paul E. Fischer	University of Pennsylvania	Ella Hanni	University of South Florida
Petra E. Todd	University of Pennsylvania	John C. Briggs	University of South Florida
Daniel Levinthal	University of Pennsylvania, Wharton School	John W. Rowe, Jr.	University of South Florida
David Cummins	University of Pennsylvania, Wharton School	K. Gyimah-Brempong	University of South Florida
Elizabeth E. Bailey	University of Pennsylvania, Wharton School	R. Mark Wilson	University of South Florida
Franklin Allen	University of Pennsylvania, Wharton School	Thomas N. Chirikos	University of South Florida
Richard C. Marston	University of Pennsylvania, Wharton School	Catherine S. Elliott	University of South Florida, New College
William G. Whitney	University of Pennsylvania, Wharton School	Frederick R. Strobel	University of South Florida, New College
Alvin E. Roth	University of Pittsburgh	Semoon Chang	University of Southern Alabama
Daniel Berkowitz	University of Pittsburgh	Baizhu Chen	University of Southern California
Edward Sussna	University of Pittsburgh	Jeff Chapman	University of Southern California
Gene W. Gruver	University of Pittsburgh	Jeff Nugent	University of Southern California
Jerome C. Wells	University of Pittsburgh	Kevin Chang	University of Southern California

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Norman R. Cloutier	University of Wisconsin, Parkside	Bruce Petersen	Washington University
Richard H. Keehu	University of Wisconsin, Parkside	Marcus Berliant	Washington University
Ahdol Sooti	University of Wisconsin, Platteville	Wilhelm Neufeind	Washington University
Lawrence Weiser	University of Wisconsin, Stevens Point	Dennis L. Lambert	Washington University, School of Medicine
Thomas D. Crocker	University of Wyoming	R. W. La Hote	Washtenaw Community College
Mark D. Soskin	University of Central Florida	Kenneth G. McColn	Waterford International
John D. Bitzan	Upper Great Plains Transportation Institute	Yong U. Glasure	Wayland Baptist University
Gerhard N. Rostvold	Urbanomics Research Associates	Doris Gelde-Stevenson	Weber State University
Christine Williams	USG	John Mukum Mbaku	Weber State University
Amit Batabyal	Utah State University	Sarah Tinkler	Weber State University
Carl Lundgren	Valmarpro Forecasting	James Burtle	WEFA Group
Andrea Maneschi	Vanderbilt University	Jeffrey F. Werling	WEFA Group
C. Elton Hinshaw	Vanderbilt University	Virendra Singh	WEFA Group
Fred M. Westfield	Vanderbilt University	Marshall Goldman	Wellesley College
Gian S. Sahota	Vanderbilt University	Gary Yohe	Wesleyan University
Malcolm Getz	Vanderbilt University	John P. Bonin	Wesleyan University
Rudolph C. Blitz	Vanderbilt University	Joyce Jacobsen	Wesleyan University
Stephen Buckles	Vanderbilt University	Lori Bollinger	Wesleyan University
Geoffrey A. Jehle	Vassar College	Marnie W. Mueller	Wesleyan University
Phyllis W. Isley	Vermont Law School	Clifford B. Hawley	West Virginia University
N. Laopodis	Villa Julie College	Douglas W. Mitchell	West Virginia University
Kishor Thanawala	Villanova University	Jerald J. Fletcher	West Virginia University
Wen Mao	Villanova University	Kern O. Kymn	West Virginia University
Amy H. Dalton	Virginia Commonwealth University	Peter V. Schaeffer	West Virginia University
Eleanor C. Snellings	Virginia Commonwealth University	Stratford M. Douglas	West Virginia University
John H. Bowman	Virginia Commonwealth University	Walter C. Labys	West Virginia University
Thomas J. Meeks	Virginia State University	Susan K. Kask	Western Carolina University
Allan Mandelstam	Virginia Tech	James A. Yunker	Western Illinois University
Catherine Eckel	Virginia Tech	Vaman Rao	Western Illinois University
Djavad Salehi-Isfahani	Virginia Tech	Annette N. Brown	Western Michigan University
George W. Norton	Virginia Tech	Bassam E. Harik	Western Michigan University
Glen H. Mitchell	Virginia Tech	Donald L. Alexander	Western Michigan University
Mark Stegeman	Virginia Tech	Emily P. Hoffman	Western Michigan University
Nicholas Tideman	Virginia Tech	Usree Bandyopadhyay	Western Michigan University
Vijay Singal	Virginia Tech	Werner Sichel	Western Michigan University
Vernon O. Roningen	VORSIM	Dennis R. Murphy	Western Washington University
Christopher J. O'Leary	W. E. Upjohn Institute	John R. Wagner	Westfield State College
Jonathan Peters	Wagner College	Maria K. Wrotniak	Westminster College
Donald W. Walls	Walls & Associates	Gordon Well	Wheaton College
Lisa Daniels	Washington College	James Halleman	Wheaton College
Art Goldsmith	Washington & Lee University	John A. Walgreen	Wheaton College
Bruce Herrick	Washington & Lee University	James F. Shepherd	Whitman College
John C. Winfrey	Washington & Lee University	Samuel Webb	Wichita State University
Ernst W. Stromsdorfer	Washington State University	Charles Waldauer	Widener University
Gareth P. Green	Washington State University	Beth A. Wilson	Willamette University
Robert Rosenman	Washington State University	Don Negri	Willamette University

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Peter B. Rosendorff	University of Southern California	Gail Blattenberger	University of Utah
Peter Gordon	University of Southern California	Kenneth P. Jameson	University of Utah
Richard H. Day	University of Southern California	Lance Gorton	University of Utah
Timothy N. Cason	University of Southern California	Mark Glick	University of Utah
Howard F. Chang	University of Southern California Law School	R. Thayne Robson	University of Utah
Lewis R. Gale, IV	University of Southwest Louisiana	Thomas N. Maloney	University of Utah
Charles M. Gray	University of St. Thomas	Abbas Alnasrawi	University of Vermont
Demos P. Hadjiyanis	University of St. Thomas	Alfred L. Thimur	University of Vermont
Marsha Blumenthal	University of St. Thomas	Michael Sesnowitz	University of Vermont
Paul R. Casperson	University of St. Thomas	Charles A. Holt	University of Virginia
Amy Farmer	University of Tennessee	Jane Iltig	University of Virginia
Charles B. Garrison	University of Tennessee	John Elder	University of Virginia
Jean Gauger	University of Tennessee	John K. Whitaker	University of Virginia
John W. Mayo	University of Tennessee	Mark R. Eaker	University of Virginia
Jonathan D. Rubin	University of Tennessee	Michael G. Rukstad	University of Virginia
Matthew N. Murray	University of Tennessee	John Treble	University of Wales
Peter M. Bearse	University of Tennessee	Dan Jacoby	University of Washington
Sidney L. Carroll	University of Tennessee	Gardner Brown	University of Washington
Thomas R. Sadler	University of Tennessee	Haldeh Salehi-Esfahani	University of Washington
E. Bruce Hutchinson	University of Tennessee, Chattanooga	J. Lawarree	University of Washington
William J. Crowder	University of Texas	Kathryn Dewenter	University of Washington
Brian M. Trinqu	University of Texas, Austin	Robert Varadi	University of Washington
Charles C. Holt	University of Texas, Austin	William Beyers	University of Washington
Chrys Dougherty	University of Texas, Austin	Abbas A. Taheri	University of Wisconsin Center Fox Valley
David Kendrick	University of Texas, Austin	Darwin Wassink	University of Wisconsin, Eau Claire
David Scoones	University of Texas, Austin	Maria DaCosta	University of Wisconsin, Eau Claire
Don Fullerton	University of Texas, Austin	Wayne Carroll	University of Wisconsin, Fond du Lac
Dwight Steward	University of Texas, Austin	Sayed Payesteh	University of Wisconsin, Green Bay
Geoffrey T. Andron	University of Texas, Austin	Thomas S. Nesslein	University of Wisconsin, LaCrosse
Paul W. Wilson	University of Texas, Austin	Glenn Knowles	University of Wisconsin, Madison
Ray Marshall	University of Texas, Austin	Donald A. Nichols	University of Wisconsin, Madison
Stephen L. McDonald	University of Texas, Austin	James Andreoni	University of Wisconsin, Madison
Tracy Hofer	University of Texas, Austin	James D. Schilling	University of Wisconsin, Madison
Charles Lackey, Jr.	University of Texas, Brownsville	Kenneth D. West	University of Wisconsin, Madison
Wim P.M. Vijverberg	University of Texas, Dallas	Patricia Hallinan	University of Wisconsin, Madison
Jose A. Pagan	University of Texas, Pan American	Arik Levinson	University of Wisconsin, Madison
John Merrifield	University of Texas, San Antonio	James D. Shilling	University of Wisconsin, Madison
David E. Keefe	University of the Pacific	Martin David	University of Wisconsin, Madison
Michael Ballot	University of the Pacific	Raghar Oygard	University of Wisconsin, Madison
Walter C. Wagner	University of the Pacific	W. A. Brock	University of Wisconsin, Milwaukee
Johannes Overbeek	University of the Virgin Islands	David J. Bernstein	University of Wisconsin, Milwaukee
Alan H. Gleason	University of Toledo	Markos J. Mamalakis	University of Wisconsin, Milwaukee
C. R. Winegarden	University of Toledo	Sol Shalit	University of Wisconsin, Oshkosh
John Murray	University of Toledo	M. Kevin McGee	University of Wisconsin, Oshkosh
Bobbie L. Horn	University of Tulsa	Nancy J. Burnett	University of Wisconsin, Oshkosh
John Karikari	University of Tulsa	Dennis A. Kaufman	University of Wisconsin, Parkside

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Herbert Glwtes	University of Massachusetts	G. Edward Schuh	University of Minnesota
Irving Gershenberg	University of Massachusetts	Grant Haner	University of Minnesota
James K. Kindahl	University of Massachusetts	Jared Creason	University of Minnesota
James T. Camper	University of Massachusetts	Jay S. Coggins	University of Minnesota
Nancy Folbre	University of Massachusetts	Jerrold M. Peterson	University of Minnesota
Norman D. Aitken	University of Massachusetts	John A. Nyman	University of Minnesota
Paul M. Brown	University of Massachusetts	Leonid Hurwicz	University of Minnesota
Andres Torres	University of Massachusetts, Boston	Mahmood A. Zaldi	University of Minnesota
David Terkla	University of Massachusetts, Boston	Margaret Peteraf	University of Minnesota
Joann Stewart	University of Massachusetts, Boston	Pareena Lawrence	University of Minnesota
David M. Kemme	University of Memphis	Phillip M. Raup	University of Minnesota
K. K. Fung	University of Memphis	Robert T. Kudrle	University of Minnesota
Anphonse G. Holtmann	University of Miami	Roger Feldman	University of Minnesota
Bryan W. Roberts	University of Miami	Timothy J. Kehoe	University of Minnesota
David C. Mauer	University of Miami	Vernon W. Ruttan	University of Minnesota
David Letson	University of Miami	Arne Kildergaard	University of Mississippi
Kerry Anne McGeary	University of Miami	Norman K. Womer	University of Mississippi
Alan V. Deardorff	University of Michigan	Chyi-Ing Lin	University of Missouri
Albert Park	University of Michigan	Donald J. Schilling	University of Missouri
Christine PapaJohn	University of Michigan	Floyd K. Hamston	University of Missouri
Edward Gramlich	University of Michigan	Nicholas Kalaitzandonakes	University of Missouri
F. Thomas Juster	University of Michigan	Robert J. Bevins	University of Missouri
Frank Thompson	University of Michigan	Shawn Ni	University of Missouri
J. Kmenta	University of Michigan	W. Whitney Hicks	University of Missouri
James N. Morgan	University of Michigan	Philip B. Thompson	University of Missouri, Rolla
Jeffrey K. Mackie-Mason	University of Michigan	Douglas Dalenberg	University of Montana
Jonathan A. Parker	University of Michigan	John Duffield	University of Montana
Merritt B. Fox	University of Michigan	Michael Kupilik	University of Montana
Michael R. Moore	University of Michigan	Craig R. MacPhee	University of Nebraska
Michael Wellman	University of Michigan	E. Wesley F. Peterson	University of Nebraska
Paul N. Courant	University of Michigan	Gordon Karels	University of Nebraska
Richard A. Hirth	University of Michigan	Lilyan E. Fulginiti	University of Nebraska
Robert Stern	University of Michigan	Roger F. Riefler	University of Nebraska
Steven T. Vass	University of Michigan	Richard K. Perrin	University of Nebraska, Lincoln
Terry L. Roe	University of Michigan	Ronald M. Cronovich	University of Nevada
Warren C. Whalley	University of Michigan	Ricardo Gazel	University of Nevada, Las Vegas
Wolfgang F. Stolper	University of Michigan	Dwayne Wrightsman	University of New Hampshire
Yan Chen	University of Michigan	W. David Bradford	University of New Hampshire
David Weinstein	University of Michigan Business School	Edward A. Downe	University of New Haven
Sugato Bhattacharyya	University of Michigan Business School	Robert Rainish	University of New Haven
Mark J. Perry	University of Michigan, Flint	Christine Sauer	University of New Mexico
N. N. Reddy	University of Michigan, Flint	Geoffrey J. Bannister	University of New Mexico
Bryan Dowd	University of Minnesota	K. Gawande	University of New Mexico
C. Ford Runge	University of Minnesota	Max D. Bennett	University of New Mexico
Edward Coen	University of Minnesota	Arja Turunen-Red	University of New Orleans
Edward Foster	University of Minnesota	Alfred J. Field Jr.	University of North Carolina, Chapel Hill

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Peter S. Menell	University of California, Berkeley, Law School	Michael M. Hutchison	University of California, Santa Cruz
Robert D. Cooter	University of California, Berkeley, Law School	Richard B. Howarth	University of California, Santa Cruz
Robert D. Cooter	University of California, Berkeley Law School	Catherine Y. Co	University of Central Florida
David F. Layton	University of California, Davis	Andres Rodriguez	University of Chicago
John E. Roemer	University of California, Davis	David Hummels	University of Chicago
Klaus Nehring	University of California, Davis	Gale D. Johnson	University of Chicago
Lovell S. Jarvis	University of California, Davis	James D. Fearon	University of Chicago
Peter H. Lindert	University of California, Davis	Lars Peter Hansen	University of Chicago
Robert Smiley	University of California, Davis	Mary Jean Bowman	University of Chicago
Thomas Mayer	University of California, Davis	Milton Harris	University of Chicago
Barrie R. Nault	University of California, Irvine	Stefan Krieger	University of Chicago
David Brownstone	University of California, Irvine	Thomas Sargent	University of Chicago
Dennis J. Aigner	University of California, Irvine	Uzma Qureshi	University of Chicago
Kenneth A. Small	University of California, Irvine	Claire Friedland	University of Chicago, George J. Stigler Center
Michelle R. Garfinkel	University of California, Irvine	Cass D. Sunstein	University of Chicago, Law School
Peter Navarro	University of California, Irvine	Austan Goolsbee	University of Chicago, School of Business
Aziz Khan	University of California, Riverside	Lars A. Stole	University of Chicago, School of Business
Jang-Ting Guo	University of California, Riverside	Timur Kuran	University of Chicago, School of Business
Keith C. Knapp	University of California, Riverside	Dennis Hanseman	University of Cincinnati
Keith Griffin	University of California, Riverside	Wolfgang Mayer	University of Cincinnati
R. Robert Russell	University of California, Riverside	Naci Mocan	University of Colorado
Steven Helfand	University of California, Riverside	Bernard Udis	University of Colorado, Boulder
Victor D. Lippit	University of California, Riverside	Charles De Bartolome	University of Colorado, Boulder
Takeo Hoshi	University of California, San Diego	Charles W. Howe	University of Colorado, Boulder
Alex Kane	University of California, San Diego	Keith E. Maskus	University of Colorado, Boulder
Allan Timmermann	University of California, San Diego	Kenneth R. Beauchemin	University of Colorado, Boulder
Christopher Woodruff	University of California, San Diego	Mark Cronshaw	University of Colorado, Boulder
Joel Watson	University of California, San Diego	Paul Stutsman	University of Colorado, Boulder
John Conlisk	University of California, San Diego	Robert K. Davis	University of Colorado, Boulder
Joseph Grunwald	University of California, San Diego	Robert McNown	University of Colorado, Boulder
Lawrence B. Krause	University of California, San Diego	Russell R. Wermers	University of Colorado, Boulder
Michael Willoughby	University of California, San Diego	Daphne Greenwood	University of Colorado, Colorado Springs
Richard T. Carson	University of California, San Diego	Michael J. Mueller	University of Colorado, Colorado Springs
Richard W. Ruppert	University of California, San Diego	Arthur W. Wright	University of Connecticut
Elliot Marseille	University of California, San Francisco	C. P. Hallwood	University of Connecticut
Harold S. Luft	University of California, San Francisco	Lanse Minkler	University of Connecticut
Charles D. Kolstad	University of California, Santa Barbara	Peter Barth	University of Connecticut
Doug Steigerwald	University of California, Santa Barbara	Susan Randolph	University of Connecticut
Lloyd J. Mercer	University of California, Santa Barbara	Walter Dolde	University of Connecticut
Robert T. Deacon	University of California, Santa Barbara	John Rapp	University of Dayton
Stephen J. DeCanio	University of California, Santa Barbara	George R. Parsons	University of Delaware
William S. Comanor	University of California, Santa Barbara	Kenneth A. Lewis	University of Delaware
Alan Richards	University of California, Santa Cruz	Laurence Seidman	University of Delaware
Daniel Friedman	University of California, Santa Cruz	Russell F. Settle	University of Delaware
Lori Kletzer	University of California, Santa Cruz	Stacie E. Beck	University of Delaware
Menzie D. Chinn	University of California, Santa Cruz	David E. Black	University of Delaware

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Edward K. Hawkins	The World Bank, Rtd.	Marshall Reinsdorf	U. S. Bureau of Labor Statistics
Enrique Lerda	The World Bank, Rtd.	Adam A. Sokoloski	U. S. Bureau of Land Management
George C. Maniatis	The World Bank, Rtd.	Marc Rubin	U. S. Bureau of the Census
Philip J. Glaessner	The World Bank, Rtd.	Anthony C. Homan	U. S. Consumer Product Safety Commission
Ralph H. Hofmeister	The World Bank, Rtd.	Elliot Levy	U. S. Department of Commerce
Theodore Lang	Thomas Lane & Associates	H. Kemble Stokes, Jr.	U. S. Department of Commerce
Michael H. Thomson	Thomson Econometrics	John E. Jelacic	U. S. Department of Commerce
James W. Thomson	Thomson Investing	Inja K. Palk	U. S. Department of Energy
Richard Skolnik	Tiffin University	Robert Copaken	U. S. Department of Energy
Nayyer Hussain	Tougaloo College	Joseph M. Burns	U. S. Department of Justice
B. Michael Gilbar	Town of Hanover, New Hampshire	Robert Blicksilver	U. S. Department of Labor
Chang Min Kong	Towson State University	C. Anne Pence	U. S. Department of State
George C. Georgiou	Towson State University	Jon H. Goldstein	U. S. Department of the Interior
William Ingram	Tradewinds Realty	Stewart E. Butler	U. S. Department of Transportation
Bruce Vermeulen	Training & Development Corp.	Deborah Shields	U. S. Dept. of Agriculture
Andrew J. Gold	Trinity College	Robbin Shoenaler	U. S. Dept. of Agriculture
Ward S. Curran	Trinity College	James M. MacDonald	U. S. Dept. of Agriculture, Economic Research
William Breit	Trinity University	Kenneth Hanson	U. S. Dept. of Agriculture, Economic Research
David Gillette	Truman State University	David Schimmelpfennig	U. S. Dept. of Agriculture ERS
Jane Sung	Truman State University	Tanya Roberts	U. S. Dept. of Agriculture, ERS
Seymour Patterson	Truman State University	Ken Borghese	U. S. Dept. of Commerce
Werner Sublette	Truman State University	Christian Ehemann	U. S. Dept. of Commerce, Bureau of Economic
Carsten Kowalczyk	Tufts Univeristy	Paul D. Gayer	U. S. Dept. of Health and Human Services Rtd.
David M. Garman	Tufts University	Monroe Burk	U. S. Foreign Service
Gilbert Metcalf	Tufts University	Michael E. C. Ely	U. S. Foreign Service, Rtd
Jonathan Harris	Tufts University	William B. Shear	U. S. General Accounting Office
Joseph A. DiMasi	Tufts University	William McNaught	U. S. General Accounting Office
Neva Goodwin	Tufts University	Charles Collier	U. S. Government
Thomas A. Downes	Tufts University	Edgar A. Peden	U. S. Government
Dahlia Remler	Tulane University	Thomas F. Jennings	U. S. International Trade Commission
David Hotchkiss	Tulane University	Oscar A. Echevarria	U. S. Investment Group
David Malueg	Tulane University	John Heinberg	U. S. Labor Department
Eamon M. Kelly	Tulane University	Adrian Kendry	U. S. Naval Academy
Irving H. LaValle	Tulane University	Brian J. Richter	U. S. Nuclear Regulatory Commission
Jonathan B. Pritchett	Tulane University	Donald Rousslang	U. S. Treasury Department
William H. Oakland	Tulane University	James M. Russell	U. S. Treasury Department
John H.Y. Edwards	Tulane University, The World Bank	William B. Trautman	U. S. Treasury Department
Campat Ramesh	U.N. Development Program	Lawrence D. Krohn	UBS Securities
David A. Heesen	U.S.A.I.D.	Donald Shoup	UCLA
Donald A. Sillers	U.S.A.I.D.	Hilary Sigman	UCLA
James L. Mudge	U.S.A.I.D.	Jack Hirshleifer	UCLA
Jerre A. Manarolla	U.S.A.I.D.	John G. Riley	UCLA
Michael Crosswell	U.S.A.I.D.	John J. McCall	UCLA
Liliana E. Pezzin	U. S. Agency for Health Care Policy & Research	Mohan Penubarti	UCLA
Arden K. Sansom	U. S. Army Corps of Engineers	Paul M. Ong	UCLA
Frank D. Campbell	U. S. Army Trade Analysis	Rebecca Menes	UCLA

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1177

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Theodore S. Woodruff	St. Ambrose University	Charles E. McLure, Jr.	Stanford University, Hoover Institute
Mark Partridge	St. Cloud State University	Gerald M. Meier	Stanford University, School of Business
Patricia Hughes	St. Cloud State University	Thomas Hellman	Stanford University, School of Business
Michael St. John	St. John & Associates	Andrea Shepard	Stanford University, School of Business
Daniel Finn	St. John's University	Jeremy Bulow	Stanford University, School of Business
Sara Gordon	St. John's University	Patricia Bowles	State Education
Ralph A. Terregrossa	St. Johns University	Gregory Vitale	State of Iowa
Linda R. Rudolph	St. Lawrence University	Khosrow Khojasteh	State of Iowa
Robert A. Blewett	St. Lawrence University	Bernard Brown	State of New Jersey
Sarah A. Stevens	St. Lawrence University	Richard Fryman	State University of West Georgia
Kathleen N. Gillespie	St. Louis University, School of Public Health	Siegfried C. Karsten	State University of West Georgia
Andrea T. Williams	St. Mary's College of California	William C. Schaniel	State University of West Georgia
Joan Underhill Hannon	St. Mary's College of California	James E. Mallett	Stetson University
Theodore Tsukahara, Jr.	St. Mary's College of California	Ranjini Thaver	Stetson University
Gary Scott	St. Mary's University	Richard H. Wood, Jr.	Stetson University
Roy E. Robbins	St. Mary's University	Richard M. O'Connor	Stockholm School of Economics
Herbert Kessel	St. Michael's College	Hossein S. Kazemi	Stonehill College
David Emery	St. Olaf College	Raymond A. Pepin	Stonehill College
David W. Schodf	St. Olaf College	Jeffrey H. Rohlfis	Strategic Policy Research
Paul Wojick	St. Olaf College	Karen Nelson	Streamline Training & Documentation
Rebecca Judge	St. Olaf College	Shahruz Mohtadi	Suffolk University
Xum Z. Pomponio	St. Olaf College	Jonathan Sunshine	Sunshine and Associates
John J. Donohue	Stanford Law School	Betty C. Daniel	SUNY, Albany
William F. Baxter	Stanford Law School	Jim H. Wyckoff	SUNY, Albany
A. Michael Spence	Stanford University	Kajal Lahiri	SUNY, Albany
Anne O. Krueger	Stanford University	Terrence Kinal	SUNY, Albany
Auner Greif	Stanford University	John S. Nader	SUNY at Delhi
B. Douglas Bernheim	Stanford University	Edward C. Kukkelenberg	SUNY, Binghamton
Bert G. Hickman	Stanford University	Manas Chatterji	SUNY, Binghamton
Bruce F. Johnston	Stanford University	Robert L. Basmann	SUNY, Binghamton
Ciaran S. Phibbs	Stanford University	Richard M. Romano	SUNY, Broome
Ezra Solomon	Stanford University	Frederick G. Floss	SUNY, Buffalo
Henry M. Levin	Stanford University	Murray Brown	SUNY, Buffalo
Hung-po Chao	Stanford University	Thomas Romans	SUNY, Buffalo
John Earle	Stanford University	David Ring	SUNY, College at Oneonta
Karine Nyborg	Stanford University	Edward I. Beck	SUNY, College at Oneonta
*,** Kenneth J. Arrow	Stanford University	Amar K. Parai	SUNY, Fredonia
Lawrence J. Lau	Stanford University	William H. Foeller	SUNY, Fredonia
Martin Carnoy	Stanford University	David A. Martin	SUNY, Geneseo
Mordecai Kurz	Stanford University	Roman A. Ohrenstein	SUNY, Nassau College
Myra H. Strober	Stanford University	Peter Vukasin	SUNY, New Paltz
Rosamond Naylor	Stanford University	Wade L. Thomas	SUNY, Oneonta
Scott Rozelle	Stanford University	William P. O'Dea	SUNY, Oneonta
Victor R. Fuchs	Stanford University	Michael A. Stoller	SUNY, Plattsburgh
Jeffrey Williams	Stanford University, Food Research Institute	Warren L. Fisher	Susquehanna University
Pan A. Yotopoulos	Stanford University, Food Research Institute	Larry E. Westphal	Swarthmore College

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1100

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
James F. Kasting	Pennsylvania State University	Antonio L. Rosado	Puerto Rico Economist Association
Jeffrey K. Lazo	Pennsylvania State University	Dan Kovenock	Purdue University
Lawrence L. Blacchi	Pennsylvania State University	George R. Averitt	Purdue University
Norman R. Swanson	Pennsylvania State University	Gerald E. Shively	Purdue University
Philip A. Klein	Pennsylvania State University	Hedayeh Samavati	Purdue University
Thomas A. Gresik	Pennsylvania State University	James C. Moore	Purdue University
Tim Considine	Pennsylvania State University	Janel S. Netz	Purdue University
William J. Wheeler	Pennsylvania State University	John M. Connor	Purdue University
Elizabeth T. Hill	Pennsylvania State University, Mont Alto	Larry De Boer	Purdue University
M.M. Shahjahan	PEPCO	Patrick McCarthy	Purdue University
Morton Zeman	Perimeter Adult Learning & Services	Paul L. Farris	Purdue University
Peter L. Bernstein	Peter L. Bernstein, Inc.	George R. Hall	Putnam, Hayes & Barlett, Inc.
Yoon Kim	Phoenix, Inc.	Trish Kelly	Quinnipiac College
James Lehman	Pitzer College	Rex J. Bates	R. J. Bates
Sailaja Raparla	Point Systems Solutions, Inc.	Robert L. Randall	RainForest ReGeneration
Hans Lofgren	Policy Research Institute	Dana Goldman	RAND
Jane Venohr	Policy Studies, Inc.	Julia Lowell	RAND Corp.
Eleanor Brown	Pomona College	Sheila Nataraj Kirby	RAND Corp.
Frank C. Wykoff	Pomona College	William Dow	RAND Corp.
James D. Likens	Pomona College	C. Barry Pfitzner	Randolph Macone College
Michael Kuehlwein	Pomona College	Antoinette J. Criss	Randolph-Macon Woman's College
Stephen V. Marks	Pomona College	Eugenio Diaz-Bonilla	RDP Consulting Group
Giles H. Burgess Jr.	Portland State University	Richard B. Parker	Red Oak Research
Harold G. Vatter	Portland State University	Carl M. Stevens	Reed College
Helen Youngelson-Neal	Portland State University	Heidi Brown	Reed Consulting Group
John F. Walker	Portland State University	Benjamin H. Stevens	Regional Science Research Center
Myron B. Katz	Portland State University	H. Michael Coiner	Regis College
Thomas P. Podlowsky	Portland State University	Mary J. Oates	Regis College
Robert Kirchner	Potomac Electric Power Company	Robert L. Lessne	Rehabilitation Services, Inc.
Peter Merrill	Price Waterhouse	Donald F. Vitaliano	Rensselaer Polytechnic Institute
Burton Malkiel	Princeton University	Gary Zarkin	Research Triangle Institute
Elizabeth C. Bogen	Princeton University	Katherine B. Heller	Research Triangle Institute
Gregory Chow	Princeton University	Sheila A. Martin	Research Triangle Institute
Maria Hanratty	Princeton University	Marvin Feldman	Resource Decisions
Timothy Van Zandt	Princeton University	Dallas Burtraw	Resources for the Future
Albert O. Hirschman	Princeton University, Inst. for Adv. Studies	Alema Karim	Rhode Island College
John P. Lewis	Princeton University, Woodrow Wilson School	Dagobert L. Brito	Rice University
Kenneth Rogoff	Princeton University, Woodrow Wilson School	Gordon W. Smith	Rice University
Mark Watson	Princeton University, Woodrow Wilson School	Kei-Mu Yi	Rice University
Michael Rothschild	Princeton University, Woodrow Wilson School	Melaku Lakew	Richard Stockton College of New Jersey
R. Thomas Burge	Proctor & Gamble Pharmaceuticals	Kirk D. Gifford	Ricks College
Curt Mueller	Project Hope	Henry J. Frank	Rider University
David Zalewski	Providence College	Paul J. Schoofs	Ripon College
Mary Jane Lenon	Providence College	Clare W. Zempel	Robert W. Baird & Co. Incorporated
YJ Yoon	Public Choice Center	Michael J. Vernarelli	Rochester Institute of Technology
Evan White	Public Utility Commission of Oregon	Albert Keidel, III	Rock Creek Research, Inc.

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Ernst R. Berndt	MIT, Sloan School of Management	Carol L. Osler	New York Federal
** Franco Modigliani	MIT, Sloan School of Management	William J. Lawrence	New York Institute of Technology
Dale W. Larson	Mitsubishi Research Institute	Sonya Kornreich	New York State Dept. of Labor, Ind.
Michael H. Lee	Montana Public Service Commission	Janusz A. Ordovery	New York University
Phillip LeBel	Montclair State University	Adam Przeworski	New York University
William Gissy	Morehouse College	Amy Ellen Schwartz	New York University
Michael Rolins	Mount Holyoke College	Dick Netzer	New York University
Frank Zarnowski	Mount St. Mary's College	Edward Wolff	New York University
Arthur J. Raymond	Muhlenberg College	Holger C. Wolf	New York University
George Heilmann	Muhlenberg College	Jacob A. Toby	New York University
Rohini P. Sinha	Muhlenberg College	Jess Benhabib	New York University
Martin Milkman	Murray State University	Joshua Ronen	New York University
Seid Y. Hassan	Murray State University	Lawrence White	New York University
Brian Thomas	MWD	Lewis A. Kornhauser	New York University
Brian Crumb	NACT	Paul Wachtel	New York University
C. Stuart Callison	Nathan Associates, Inc.	Rita Maldonado-Bear	New York University
Gary L. French	Nathan Associates, Inc.	Roy Radner	New York University
John Varley	Nathan Associates, Inc.	W. Van Der Klaauw	New York University
Abraham J. Fallick	National Association of Business Economists	Walter W. Haines	New York University
Brian J. Ostrom	National Center for State Courts	** Wassily Leontief	New York University
Gerald C. Berg	National Defense University	William J. Baumol	New York University
Robert W. Beckstead	National Defense University	Robert A. Kavesh	New York University, Stern School
Alan J. Daskin	National Economic Research Associates Inc.	Thomas A. Pugel	New York University, Stern School
David Tabak	National Economic Research Associates Inc.	Mark J. Lawless	NFPA International
Leonardo Giacchino	National Economic Research Associates Inc.	Thomas A. Foulkes	NHTI
Li-Lan Cheng	National Economic Research Associates Inc.	Stanton A. Warren	Niagara University
Marci Kramer Mayer	National Economic Research Associates Inc.	Yuzo Kumasaka	NLI Research Institute
Robert Petersen	National Economic Research Associates Inc.	Blair T. Bower	NOAA Consultant
Stephen E. Usher	National Economic Research Associates Inc.	Carol A. Jones	NOAA Damage Assessment Center
Carolyn Dewa	National Opinion Research Center	Gregory N. Price	North Carolina A&T University
Ted R. Miller	National Public Services Research Institute	Lawrence B. Morse	North Carolina A&T University
Chris Wise-Mahr	National Science Foundation	Ryoichi Sakano	North Carolina A&T University
Robert Schmidt	National University	Darren L. Frechette	North Carolina State University
Bill Gates	Naval Postgraduate School	Duncan M. Holthausen	North Carolina State University
David Whipple	Naval Postgraduate School	Fanis Tsoulouhas	North Carolina State University
Joseph DaBoll-Lavoie	Nazareth College	Michael B. McElroy	North Carolina State University
Edward A. Schroeder, IV	Nazareth College of Nazareth	Samim Cilem	North Carolina State University
Joyce Gleason	Nebraska Wesleyan University	J. Carl Poindexter	North Carolina State University
Richard McGahey	Neece, Cator & McGahey	Allen Vander Muelen	North Central College
Richard L. Kaluzny	New Jersey Division of Taxation	Thomas M. Love	North Central College
David T. Geithman	New Jersey Institute of Technology	Lynn Schneider	North Georgia College & State University
Eliot Orton	New Mexico State University	Watson Collins	Northeast Utilities
Robert Heilbroner	New School for Social Research	Barbara M. Fraumeni	Northeastern University
Willi Semmler	New School for Social Research	Gustav Schachter	Northeastern University
Alex L. Yufa	New York City Economic Dev. Corp.	John Adams	Northeastern University
Sidney Friend, Jr.	New York City Police Department	Kamran M. Dadkhah	Northeastern University

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Shawky El Toukhy	ITA of New Jersey	John P. Brown	KPMG Economic Consulting Services
Elia Kacapyr	Ithaca College	Richard A. Boykin	KPMG Economic Consulting Services
M. Raquibuz Zaman	Ithaca College	Steven D. Felgran	KPMG Economic Consulting Services
Marc Bilodeau	IUPUI	Stephen E. Baldwin	KRA Corporation
Jannette M. Barth	J.M. Barth & Associates, Inc.	Jon Haveman	Krannert School of Management
Andrew Kohen	James Madison University	David H. Robinson	La Salle University
Joanne M. Doyle	James Madison University	Dr. Mark J. Ratkus	La Salle University
Ehsan Ahmed	James Madison University	James C. Haefner	Labelon Corporation
J. Barkley Rosser, Jr.	James Madison University	Dwayne S. Breger	Lafayette College
William C. Wood	James Madison University	Howard Bodenhorn	Lafayette College
Kevin Stokes	Jefferson Community College	James DeVault	Lafayette University
Ronald Swannstrom	Jefferson High School	Jeffrey O. Sundberg	Lake Forest College
Edward J. Jorgenson	Jet Propulsion Laboratory	Richard F. Dye	Lake Forest College
Lawrence R. Cima	John Carroll University	Robert A. Baade	Lake Forest College
Thomas A. Sears	John F. Kennedy University	William Maskoff	Lake Forest College
Carl F. Christ	Johns Hopkins University	Rolando A. Santos	Lakeland College
Christopher D. Carroll	Johns Hopkins University	Judith Markland	Landmark Strategies
Cristino R. Arroyo	Johns Hopkins University	Thomas W. Langford	Langford & Associates
David G. Fernandez	Johns Hopkins University	Christopher J. Pleatsikas	Law & Economics Consulting Group
Isaiah Frank	Johns Hopkins University	Steven Stoft	LBNL
Louis J. Maccini	Johns Hopkins University	Hui-Liang Tsai	Lebanon Valley College
W. Max Corden	Johns Hopkins University	J. Richard Aronson	Lehigh University
Douglas W. Copeland	Johnson County Community College	Thomas Hydlak	Lehigh University
Nan L. Willson	Johnson County Community College	Todd A. Watkins	Lehigh University
Zohreh M. Niknia	Johnson County Community College	Eban Goodstein	Lewis & Clark College
Milton Russell	Joint Institute for Energy and Environment	James H. Grant	Lewis & Clark College
Joseph A. Swanson	Joseph Swanson & Co.	Shaomin Huang	Lewis Clark State College
Kenneth A. Reinert	Kalamazoo College	Hal Sider	Lexecon Inc.
Amir Tavakkol	Kansas State University	Jeffery T. Collins	Lincoln Memorial University
Andrew Barkley	Kansas State University	Vishwanath Tirupattur	Lincoln National
Patrick Gormely	Kansas State University	Randy R. Grant	Linfield College
Richard L. D. Morse	Kansas State University	Stephen M. Lewarne	LMCL Corp
Robert B. Borges	Kansas State University	Douglas A. Wion	Lock Haven University
Roger Trenary	Kansas State University	Michael Edesess	Lockwood Financial Group
Steve Hamilton	Kansas State University	Gang Feng	Lockwood Trade Journal Co. Inc.
Pierre Carasso	Kayne Anderson	John T. Evans	Long Island University
Carol M. Condon	Kean College of New Jersey	P. M. Rao	Long Island University
Youn-Suk Kim	Kean College of New Jersey	Ranbir Varma	Long Island University
Alexander S. Kelso, Jr.	Kelso International	Brian R. Horrigan	Loomis, Sayles & Co.
Penelope B. Prime	Kennesaw State University	Steven Booth	Los Alamos National Laboratory
Richard J. Kent	Kent State University	Verne W. Loose	Los Alamos National Laboratory
Arthur D. Chesler	Kentucky Wesleyan College	Robby C. Winters	Los Angeles City College
Kottayam V. Natarajan	King Co. Dept. of Natural Resources	Nancy L. Sidener	Louisiana Council for Economic Education
Hamid Hosseini	King's College	Steven J. Prince	Louisiana Scholars' College
Zachary Rolnik	Kluwer Publishers	John M. Church	Louisiana State University Law Center
Wan Ho Cho	Korean Consulate	Marc C. Chopin	Louisiana Tech

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Peter C. Mayer	Guam Power Authority	David T. Ellwood	Harvard University, Kennedy School of Govt.
Louis D. Johnston	Gustavus Adolphus College	Edward A. Parson	Harvard University, Kennedy School of Govt.
Herbert W. Fraser	H. W. Fraser Associates	F. M. Scherer	Harvard University, Kennedy School of Govt.
Ahmad Faruqui	Hagler Bailly	Jose Antonio Gomez-Ibanez	Harvard University, Kennedy School of Govt.
Harold A. Cohen	Hal Cohen, Inc.	Mun S. Ho	Harvard University, Kennedy School of Govt.
Robert E. Dansby	Halcyon Inc.	P. Timothy Bushnell	Harvard University, Kennedy School of Govt.
John Haldi	Haldi Associates, Inc.	Richard F. Garbaccio	Harvard University, Kennedy School of Govt.
Elizabeth J. Jensen	Hamilton College	Robert Stavins	Harvard University, Kennedy School of Govt.
Hilke Kayser	Hamilton College	William Spitz	Harvard University, Kennedy School of Govt.
Burke Burright	Hamon Systems Center	Robert H. Mnouquin	Harvard University, Law School
Robert Charles Graham	Hanover College	W. Kip Viscusi	Harvard University, Law School
Samuel S. Chun	Harvard Business School	Abram Bergson	Harvard University, Littauer Center
Thomas K. McCraw	Harvard Business School	Rashi Fein	Harvard University, Medical School
Randall Bluffstone	Harvard Inst. for International Development	David Hemenway	Harvard University, School of Public Health
Bruce R. Bolnick	Harvard Inst. for International Development	Maurine A. Haver	Haver Analytics
Clifford Zinnes	Harvard Inst. for International Development	Shelley M. Mark	Hawaii, Dept of Bus. Econ. Devel. & Tourism
Clive S. Gray	Harvard Inst. for International Development	Vincent A. Fulmer	Hawthorn College
David C. Cole	Harvard Inst. for International Development	Hilda Kahne	Heller School, Brandeis University
Glenn P. Jenkins	Harvard Inst. for International Development	David E. Ervin	Henry A. Wallace Institute
Jeffrey D. Sachs	Harvard Inst. for International Development	Michael MacCully	High Point University
Jeffrey Vincent	Harvard Inst. for International Development	Michael McCully	High Point University
John Luke Gallup	Harvard Inst. for International Development	Stephen L. Zabor	Hiram College
Amartya Sen	Harvard University	Ugur Aker	Hiram College
Andrew Metrick	Harvard University	James E. Metzger	Histecon Associates Inc.
Brian Hall	Harvard University	Takatoshi Ito	Hitotsubashi University, International
Cheol Soo Park	Harvard University	Matthew K. Loke	HMSA
Claudia Goldin	Harvard University	Jacob Weissman	Hofstra University
* Dale Jorgenson	Harvard University	Walter E. Hoadley	Hoover Institution
David Laibson	Harvard University	Robin Klay	Hope College
Dwight H. Perkins	Harvard University	Linda Marie Dynan	Hospital Research and Education Trust
James K. Hammitt	Harvard University	Chuck Nwaka	Howard University
Jerry R. Green	Harvard University	Cleveland A. Chandler	Howard University
John R. Meyer	Harvard University	Sung Kwack	Howard University
John Y. Campbell	Harvard University	C. Elisabeth Pittman	HPA, Inc.
Lawrence Katz	Harvard University	L. Douglas Lee	HSBC Washington Analysis
Lester E. Gordon	Harvard University	Mark Shroder	HUD (for identification only)
Martin L. Weitzman	Harvard University	David T. Hulett	Hulett & Associates
Michael Whinston	Harvard University	Daniel M. Ihara	Humboldt State University
Nathan Keyfitz	Harvard University	Saeed Mortazavi	Humboldt State University
Oliver Hart	Harvard University	Steven Hackett	Humboldt State University
Raymond Vernon	Harvard University	Tim Yeager	Humboldt State University
Robert Dorfman	Harvard University	Tatsuji Hayakawa	IADB
Roswell G. Townsend	Harvard University	Michael C. Barth	ICF Kaiser
Steven Shavell	Harvard University	Robert Tokle	Idaho State University
Tilman Slembeck	Harvard University	Rob P. Vos	IDB
Christopher Jencks	Harvard University, Kennedy School of Govt.	Mylene Kherallah	IFPRI

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Anne Bunton	Cotley College	Gordon S. Bergsten	Dickinson College
Alice Tepper Marlin	Council on Economic Priorities	Leo Brand	Director, Standard & Poor's
Lenore H. Burckel	Cowers TM	Cono Casella	Dowlire Colege
Naomi Chesler	CPE	William M. Boal	Drake University
Joseph M. Phillips	Creighton Unviersity	Andrew Verzilli	Drexel University
Roberto Riley	Critical Decisions Group	Bijou Y. Lester	Drexel University
P. Hartland-Thunberg	CSIS	Shawkat Hammoudeh	Drexel University
Albert I. A. Bookbinder	CUNY	Vibhas Madan	Drexel University
Ashok Vora	CUNY	Carol Mansfield	Duke University
Hugo M. Kaufmann	CUNY	E. Roy Weintraub	Duke University
Irving Stone	CUNY	Ed Tower	Duke University
Joseph Berechman	CUNY	Mark Y. An	Duke University
Ki-Ho Kim	CUNY	Martin Bronfenbrenner	Duke University
Lawrence Jay Kaplan	CUNY	Philip J. Cook	Duke University
Robert Kaestner	CUNY, Baruch College	Pietro Perello	Duke University
Yehuda L. Klein	CUNY, Brooklyn College	Wesley A. Magat	Duke University
V. Petratos	CUNY, C. S. I.	Richard Henning	E. Elgar Publishers
Howard Chernick	CUNY, Hunter College	C. A. Christofides	East Stroudsburg University
Harvey Gram	CUNY, Queens College	P. Neelakantan	East Stroudsburg University
Peter Ellbott	CUNY, Queens College	Seewoonundun Bunjun	East Stroudsburg University
Zadia H. Feliciano	CUNY, Queens College	Perm S. Mann	Eastern Connecticut State University
Peter Chow	CUNY, The City College	Harold D. Nordin	Eastern Illinois University
Paul G. Althaus	CUNY, York College	James E. Payne	Eastern Kentucky University
Dennis E. Logue	Dartmouth College	Thomas G. Watkins	Eastern Kentucky University
John A. Menge	Dartmouth College	Richard A. Yoder	Eastern Mennonite University
M. O. Clement	Dartmouth College	Adrian J. Lottle	Eastern Michigan University
Michael M. Knetter	Dartmouth College	Michael G. Vogt	Eastern Michigan University
Sang-Seung Yi	Dartmouth College	Thomas W. Bonsor	Eastern Washington University
Sheri L. Aggarwal	Dartmouth College	Hugh Richards	ECON
C. Louise Nelson	Davidson College	Frederic B. Jennings, Jr.	Econologistics
David W. Martin	Davidson College	Richard A. Baum	Economic Analysis
George Szejner	DC Superior Court	Kenneth R. Button	Economic Consulting Services, Inc.
Gary D. Lemon	De Pauw University	Geoffrey H. Moore	Economic Cycle Research Institute
Peter Meenan	Deloitte & Touche LLP	Jared Bernstein	Economic Policy Institute
Richard Sciacca	Deloitte & Touche LLP	Kenneth R. Dunmore	Economic & Policy Studies
Calvin A. Hoerneman	Delta College	John A. Laitner	Economic Research Associates
Craig Walker	Delta State University	Paul F. White	Economic Research Services, Inc.
Pete Morton	Denver University	Steve Holland	Economics Institute
Adolph E. Mark	DePaul University	An-Sik Min	Edinboro University of Pennsylvania
Animesh Ghoshal	DePaul University	Rudi W. Schadt	Edwin L. Cox School of Business, SMU
Bala Batavia	DePaul University	Robert J. Eggert	Eggert Economic Enterprises
Michael Marschoun	DePaul University	Ell Ginzberg	Eisenhower Center, Columbia University
Woods Bowman	DePaul University	E. Somanathan	Emory University
Eric R. Nelson	Development Alternatives, Inc.	Jeffrey A. Rosenweig	Emory University
Martha O. Blaxall	Development Alternatives, Inc.	Richard F. Muth	Emory University
Greig Harvey	DHS Associates	Robert Catlett	Emporia State University

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1111

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Robert Wassmer	Cal State Sacramento	Lester B. Lave	Carnegie Mellon University
James M. Payne	Calhoun Community College	Mark S. Kamlet	Carnegie Mellon University
Tsong-Yue Lai	California State University	Russell Sheldon	Carnegie Mellon University
Malcom Dole, Jr.	California Air Resources Board	Shyam Sunder	Carnegie Mellon University
Seymour Goldstone	California Energy Commission	Amresh Hanchate	Case Western Reserve University
Lionel J. Lerner	California Energy Commission, Rtd.	Bo Carlsson	Case Western Reserve University
Charles R. Plott	California Institute of Technology	Robert E. Schill	Castleton State College
Lance E. Davis	California Institute of Technology	Robert K. Arnold	CCSCE
Phillip Fanchon	California Polytechnic State University	Robert Deuson	Center for Disease Control
James Ahern	California Polytechnic University	Stephen T. Parente	Center for Health Affairs
Franklin Y. Ho	California State Polytechnic University	Zbigniew Bochniarz	Center for Nations in Transition, Univ. of
A. R. Gutowsky	California State University	Carol Moore	Center for Naval Analysis
Anil K. Puri	California State University	Jan Ondrich	Center for Policy Research, Syracuse University
Daniel R. Blake	California State University	Sidney Weintraub	Center for Strategic and Intl. Studies
Don R. Leet	California State University	James Reschovsky	Center for Studying Health System Change
Eduardo M. Ochoa	California State University	Paul B. Ginsburg	Center for Studying Health System Change
Eric J. Solberg	California State University	Brian Peterson	Central College
Madhu S. Mohanty	California State University	Richard Glendenning	Central College
Michael Perelman	California State University	N. Wayne Jordan	Central Florida Community College
Neil Garston	California State University	Paul Natke	Central Michigan University
Tom G. Geurts	California State University	Baird Allen Brock	Central Missouri State University
Donald J. Oswald	California State University, Bakersfield	Bruce K. Johnson	Centre College
Robert G. James	California State University, Chico	David A. Anderson	Centre College
Suleman A. Moosa	California State University, Chico	Robert E. Martin	Centre College
Scott Houser	California State University, Fresno	Michael J. Walsh	Centre Financial Products Ltd.
Paul D. Staudohar	California State University, Hayward	Raymond Sfeir	Chapman University
Robert S. Ozaki	California State University, Hayward	Deloris R. Wright	Charles River Associates
Marion S. Beaumont	California State University, Long Beach	Philip K. Vealecer Sr.	Charles River Associates
Michael J. Farrell	California State University, Long Beach	Robert J. Lamer	Charles River Associates
John A. Tomaske	California State University, Los Angeles	Gladys A. Dejesus	Chowan College
H. Dieter Renning	California State University, Stanislaus	Koenraad M. Driessens	Christensen Associates
Mary Fair Berglund	California Transportation Commission	Laurence D. Kirsch	Christensen Associates
Young J. Park	California University of Pennsylvania	Laurits R. Christensen	Christensen Associates
Julie Elston	Caltech	Samuel Cutting	Christensen Associates
John P. Tiemstra	Calvin College	Philip Schoech	Christiansen Associates
Scott V. Parris	Cambridge University Press	Rita C. Sweeney	Christiansen Associates
Pierre Canac	Cameron School of Business	Kookshin Ahn	Chung-Ang University, Seoul
John M. Courington	Cameron University	Jarl R. Hellemalm-Ashfield	Church of God
Yu-Mong Hsiao	Campbell University	Frederick Schroeder	Cigna Financial Advisors, Inc.
Andrew C. Givens	Cardinal Energy Service, Inc.	Alfred Eisenpreis	City Innovation
Dickson K. Smith	Cardinal Strich College	Alfred Keisenpress	City Innovation
George H. Lamson	Carleton College	Gordon Alexander	City of Austin, Texas
Stephen H. Strand	Carleton College	Greg Hill	City of Seattle
Allan H. Meltzer	Carnegie Mellon University	Paul A. Zak	Claremont Graduate School
Chris I. Telmer	Carnegie Mellon University	Mark Haggerty	Clarion University
George Loewenstein	Carnegie Mellon University	Attlat P. Ott	Clark University

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-781-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
Lorraine M. Connell		Richard B. Goode	
M. G. Zephirin		Richard Gomez	
M. S. Noorzoy		Richard Hooley	
Marianne Ferber		Richard J. Claycombe	
Mark D. Henson		Richard L. Ruth	
Mark W. Rider		Richard Nichols	
Marnie Shaul		Richard Raymond	
Martin J. Wyand		Richard Sabatino	
Martin Muhleisen		Richard Weckstein	
Martine Duchatelet		Richard Young	
Mary McNally		Rick Mines	
Maud Naroll		Robert A. Rennie	
Michael Adler		Robert C. Young	
Michael Rabbitt		Robert D. Stevens	
Mike Denning		Robert Dennis	
Milton A. Wolf		Robert Hawkins	
Milton Garnet James		Robert L. Steiner	
Milton Moss		Robert L. Wood, Jr.	
Mingliang Zhang		Robert Myers	
Nancy H. Wilson		Robert T. Mott	
Nicholas Komninos		Robert V. Bishop	
Nizar Jetha		Robert V. Bishop	
Nora Fiore		Roberto Chang	
Norman Nierenberg		Rod E. Jensen	
Omar Azfar		Rogene A. Buchholz	
P. Michael Laub		Roger D. Little	
Pat Markovich		Roger Mann	
Patricia Godoy-Kain		Rose Jochowitz	
Patrick Karani		Rudolph W. Hardy	
Paul Boyce		S. Scanlon Romer	
Peter F. Freund		Saul L. Smith	
Peter M. Emerson		Scott Goldsmith	
Peter Siegelman		Sergio Perelra Leite	
Peter Zadrozny		Serim Huh	
Phillip A. Dillaber		Shannon R. Brown	
Philip E. Franklin		Shimon Averbuch	
Piljoo Yum		Souleyman Gueye	
Priya Shyamsundar		Stahis S. Panagides	
R.R. Rhomberg		Stella Swetnick	
Rafael Montalvo		Stephen Altheim	
Ralph N. Calkins		Stephen H. Zeller	
Ralph W. Pfouts		Stephen Parkoff	
Raymond A. Miller		Steven Yamarik	
Raymond L. Guarrieri		Teresa Sala-Ruede	
Rebecca A. Havens		Terrence P. Smith	
Rene Bernier		Theodore Borek	

SPONSORED BY:

ENTERPRISE — SAN FRANCISCO — CALIFORNIA — 415-781-1101

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME AFFILIATION

Frank Lerman
 Frank W. Gery
 Fred Morser
 Gary Anders
 Gary Watts
 George A. Jougantos
 George E. Michel
 George Fox
 George L. Perry
 George R. Feiwel
 Gerald A. Pollack
 Gerald T. O'Mara
 Gertrude Schroeder
 Gilbert R. Coleman
 Gordon Irlam
 Gordon K. Douglass
 Gregory L. Rosston
 Gretchen McClain
 H. Lynn Miller
 Harold L. Bryant
 Henry B. McFarland
 Herbert S. Wong
 Howard Gensler
 Hugh Franks
 Irma T. de Alonso
 Irving W. Cheskin
 J. Herbert Burkman
 J. L. Bascunana
 Jack Beebe
 Jacob C. Hurwitz
 Jacques J. Kozub
 James A. Lew
 James Duprey
 James E. Clark
 James E. Glassman
 James L. Hamilton
 James Trask
 Jan Parker
 Jay V. Groves
 Jay Zamikau
 Jeff Bond
 Jeffrey M. Rhodes
 Jessica Gordon Nembhard
 Jiehjou Joe Wu
 John Dean Gaffey
 John H. Wells Jr.

NAME AFFILIATION

John Hayes
 John J. Hisnanick
 John J. Soladay
 John M. Hackett
 John Maher
 John McFarland
 John Navratil
 John P. Shelton
 John R. Moore
 John R. Norsworthy
 John R. Stewart, Jr.
 John S. Coleman
 John Stein
 John Van Dewater
 Jon Manger
 Jonathan Willner
 Joseph E. Bowring
 Joseph F. Shaw
 Joseph Froomkin
 Joseph P. Cain
 Joseph V. Cartwright
 Juan A. Vileta-Trip
 Jules N. LaRocque
 Julie-Anne M. Cronin
 Jurg Niehans
 Karen Van Nuys
 Karl De Schweinitz
 Karl Driessen
 Karl E. Sagner
 Katherine K. Yunker
 Kathleen Short
 Kathleen V. McNally
 Keith Waehrer
 Ken Beier
 Kenan Ogelman
 Kent R. Nilsson
 Kent Sims
 Kevin J. Kiyan
 Kishore Kulkarni
 Kuo Tseng
 Lawrence F. Mansfield
 Lawrence Thurston
 Leah J. Smith
 Lee Cohen
 Leibert Benet Wallerstein
 Li-Teh Sun

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-731-1191

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

LIST OF ECONOMISTS WHO HAVE ENDORSED TO DATE

MARCH 24, 1997

NAME	AFFILIATION	NAME	AFFILIATION
James S. Hanson	Willamette University		
Elizabeth Brainerd	Williams College		
Matthew Hyle	Winona State University		
David Peterson	Wisconsin Department of Revenue		
Marcus Boggs	Wishview Press		
E. B. Gendel	Woodbury University		
Michael J. Radzicki	Worcester Polytechnic Institute		
Paul Faeth	World Resources Institute		
Robert Repetto	World Resources Institute		
Norman S. Anon	Wright State University		
Rishi Kumar	Wright State University		
Thomas Traynor	Wright State University		
Steven C. Agee	XAE Corporation		
Robert O. Zimmerman	Xavier University		
Henry Hansmann	Yale Law School		
Katherine O'Regan	Yale School of Management		
Paul W. MacAvoy	Yale School of Management		
Barry Nalebuff	Yale University		
Dirk Berleemann	Yale University		
** James Tobin	Yale University		
Jody Sindelar	Yale University		
Joel Waldfogel	Yale University		
L. G. Reynolds	Yale University		
Lynne Bennett	Yale University		
M. J. Peck	Yale University		
Robert Evenson	Yale University		
T. Paul Schultz	Yale University		
* William Nordhaus	Yale University		
Gustav Ranis	Yale University, Economic Growth Center		

SPONSORED BY:

REDEFINING PROGRESS — ONE KEARNY STREET — FOURTH FLOOR — SAN FRANCISCO — CALIFORNIA — 415-761-1111

**NOBEL LAUREATE SIGNATORIES
TO
ECONOMISTS' STATEMENT ON
CLIMATE CHANGE**

Kenneth Arrow (1972)
Stanford University

Gerard Debreu (1983)
University of California at Berkeley

John Harsanyi (1994)
University of California at Berkeley

Lawrence Klein (1980)
University of Pennsylvania

Wassily Leontief (1973)
New York University

Franco Modigliani (1985)
Massachusetts Institute of Technology (Emeritus)

Robert Solow (1987)
Massachusetts Institute of Technology

James Tobin (1981)
Yale University

January 3rd, 1997

Dear Colleague,

As you may know, representatives of the world's nations will convene in Kyoto in December, 1997 to negotiate an international agreement addressing the threat of global climate change due to greenhouse gas emissions. This presents a significant opportunity for the United States to exercise a leadership role in ensuring our long-term well-being. Conversely, a failure on the part of the U.S. government to put forward a well-reasoned position would be a major environmental, economic, and diplomatic setback.

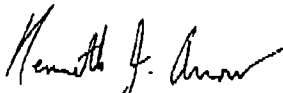
As the climate debate unfolds, it is imperative that public policy be guided by sound economics rather than misleading claims put forward by special interest groups. For this reason, we invite you to join us in endorsing the attached non-partisan consensus statement on the economics of climate change.

Once this statement has been signed by a large number of economists, it will be widely disseminated to leaders in the public and private sectors, and to the general media. This effort is being coordinated by Redefining Progress, a non-partisan, non-profit public policy organization.

Attached please find an endorsement form for your consideration. This letter and endorsement form are being sent to the membership of the American Economic Association. Please feel free to circulate it to your colleagues in case they are not on the AEA mailing list.

We thank you for your prompt attention to this critical issue.

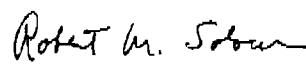
Sincerely,


Kenneth J. Arrow


Dale W. Jorgenson


Paul R. Krugman


William D. Nordhaus


Robert M. Solow

ECONOMISTS' STATEMENT ON CLIMATE CHANGE

*Endorsed by Over 2500 Economists
including eight Nobel Laureates*

I. The review conducted by a distinguished international panel of scientists under the auspices of the Intergovernmental Panel on Climate Change has determined that "the balance of evidence suggests a discernible human influence on global climate." As economists, we believe that global climate change carries with it significant environmental, economic, social, and geopolitical risks, and that preventive steps are justified.

II. Economic studies have found that there are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs. For the United States in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measures may in fact improve U.S. productivity in the longer run.

III. The most efficient approach to slowing climate change is through market-based policies. In order for the world to achieve its climatic objectives at minimum cost, a cooperative approach among nations is required—such as an international emissions trading agreement. The United States and other nations can most efficiently implement their climate policies through market mechanisms, such as carbon taxes or the auction of emissions permits. The revenues generated from such policies can effectively be used to reduce the deficit or to lower existing taxes.

Sponsored By

REDEFINING PROGRESS

One Kearny Street • 4th Floor

San Francisco, CA 94108

Phone: (415) 781-1191

Fax: (415) 781-1198

EMail: info@RProgress.org

REDEFINING PROGRESS

ONE KEARNY STREET • 4TH FLOOR • SAN FRANCISCO • CALIFORNIA 94108

Telephone 415.781.1191 • Facsimile 415.781.1198

FAX TRANSMISSION

DATE: 7/22/97

TO: SANDY DAIGLE

FAX #: 202 - 395-6958

FROM: BRYNN TAYLOR

SUBJECT: NOBEL LAUREATE SIGNATORIES

Number of pages: 4 (including this one)

MESSAGE (if any):

Please let us know if there is

anything else you need.

Our fax number is 415.781.1198. If there are any problems with this transmission, please call 415.781.1191.



United States Department of State

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

Washington, D.C. 20520-7250

July 9, 1997

MEMORANDUM

To: Interagency Climate Change Deputies Group

From: Timothy E. Wirth *TEW*

Subject: Upcoming Luncheon with Robert Repetto and Duncan Austin

We will be meeting for our next Climate Change Luncheon on Friday, July 18 from 12:00 to 1:30 p.m. in the Henry Clay Room at the Main Department of State Building. Our guests will be Robert Repetto and Duncan Austin from World Resources Institute. Please find enclosed a copy of their recent publication *The Costs of Climate Protection: A Guide for the Perplexed*. At the luncheon, Bob and Duncan will engage us in discussion about the results of this research.

Clinton Presidential Records Digital Records Marker

This is not a presidential record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

This marker identifies the place of a publication.

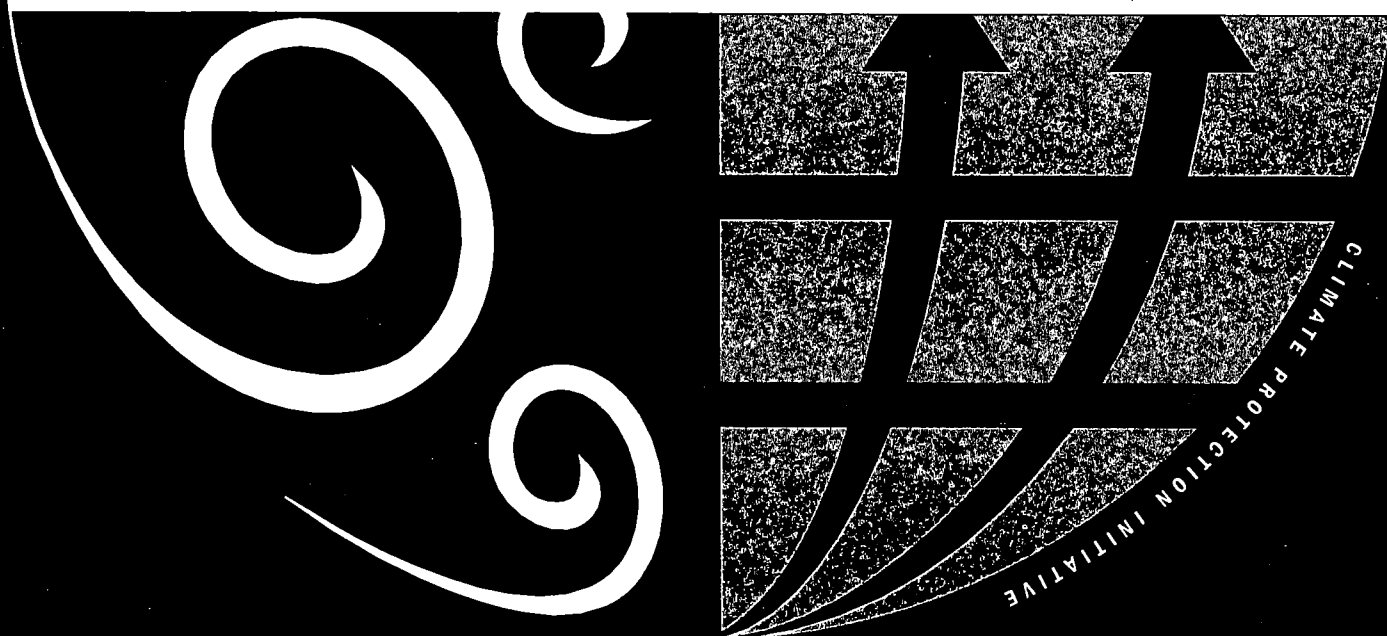
Publications have not been scanned in their entirety for the purpose of digitization. To see the full publication please search online or visit the Clinton Presidential Library's Research Room.

WORLD RESOURCES INSTITUTE



THE COSTS OF CLIMATE PROTECTION:

A GUIDE FOR THE PERPLEXED



ROBERT REPETTO AND DUNCAN AUSTIN

Janet Yellen
FYI
Tim Wirth



UNDER SECRETARY OF STATE
FOR GLOBAL AFFAIRS
WASHINGTON, D.C. 20520-7250

July 3

Dear Larry Summers

Good lunch + discussion - much to be done. We are crashing on the "trigger" idea, + need Treasury's participation. We'll call over - in the meantime, enclosed is the operative language for the Byrd + Chafee resolutions.

Aho, in answer to your question about cost of stabilization, the enclosed Repetto testimony is a good summary of the excellent WITI study.

Best, Thanks again + see you soon.

Sincerely,

Tim

Byrd Resolution

Resolved,

(1) The U.S. should not be a signatory to any protocol to, or other agreement regarding, the United Nations Framework Convention on Climate Change of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would --

(a) mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for developing country Parties within the same compliance period.

Chafee Resolution

The Parties agree to initiate negotiations, not later than 2005, that will lead to the adoption of quantified limitation and reduction objectives to limit or reduce greenhouse gas emissions for those Developing Country Parties that are responsible for a significant share of net global greenhouse gas emissions, beginning not later than 10 years after the commencement of the applicability of quantified limitations and reduction objectives to Developing Country Parties.

HOW WILL CLIMATE PROTECTION AFFECT THE ECONOMY?

Testimony
prepared for the
Senate Foreign Relations Committee
International Economic Affairs Subcommittee
June 26, 1997

by
Robert Repetto
Vice President & Sr. Economist
World Resources Institute
Washington, D.C.

This testimony addresses two issues: the impacts on the U.S. economy of limiting carbon dioxide emissions, and the respective roles of the U.S. and less developed countries in limiting global emissions. What follows provides -- very briefly -- the findings of two new WRI research reports, The Costs of Climate Protection: A Guide for the Perplexed, by Duncan Austin and myself, and Are Developing Countries Already Taking Action to Slow Climate Change?, by Walter Reid and Jose Goldemberg. Copies of those reports have been made available to the Subcommittee.

I. Macroeconomic Impacts of Limiting CO2 Emissions

As the United States approaches the Kyoto negotiations in December under the Framework Convention on Climate Change, the economic impacts of limiting greenhouse gas emissions are coming under increasing scrutiny. The Clinton Administration has analyzed this issue in an InterAgency Taskforce report. Widely divergent predictions about the costs of stabilizing or reducing greenhouse gas emissions are circulating outside government.

All such predictions are based on macroeconomic models that simulate the economic impacts of policies that raise energy costs. These models are complicated and hard to understand, but nonetheless are gross simplifications of the real world; what modellers leave out influences their predictions as strongly as what they put in. The predicted economic impact of policies adopted to reduce carbon dioxide emissions depends totally on the assumptions built into the forecasting models.

Fortunately, one doesn't have to be an econometrician to understand the key assumptions and how they affect the predicted costs. WRI examined 162 different simulations using sixteen widely-used economic models, including all three that the InterAgency Taskforce used to analyze its climate policy options. (Exhibit I) Though the predictions varied substantially, we found that, across all sixteen models, only six basic assumptions account for eighty percent of the differences in the models' predictions. These six basic assumptions determine whether the predicted economic impacts of controlling carbon emissions are large or small, positive or negative. This is remarkable. It implies that the hundreds of other assumptions on which the models are based collectively account for only the remaining twenty percent of the difference in their predictions.

Reasonable people can readily form their own judgements about these key assumptions. The most important ones are these:

1. Will firms and consumers reallocate their expenditures efficiently in the long-run as energy prices increase to take advantage of cost-savings opportunities? Models that assume that firms and consumers reallocate their resources efficiently in the long-run predict much smaller economic impacts from limiting CO₂ emissions.

2. Will some "backstop" non-fossil energy source, such as hydroelectricity, nuclear power, solar and wind energy, be available at a stable competitive price as fossil fuel costs rise? Models that ignore the existence of non-fossil alternative energy sources predict much higher costs of stabilizing carbon dioxide emissions.

3. Will nations cooperate to take advantage of low-cost opportunities to reduce emissions by undertaking "joint implementation" of abatement commitments or by "trading" CO₂ emissions permits internationally? Models that assume that the United States must meet its reduction target in isolation predict a much higher cost.

4. Will revenues from energy taxes or from auctioning off permits to emit carbon dioxide be used to cut income, profits or payroll taxes? Models that ignore the possibility of using energy tax revenues to cut other burdensome taxes predict more adverse economic impacts.

5. Will reducing fossil fuel consumption avoid damages from a changing climate? Models that incorporate the predicted impacts of a changing climate on the economy tend to predict, on balance, a lower net cost of controlling emissions.

6. Will reducing fossil fuel -- and especially coal -- consumption affect damages from the conventional air pollutants? Models that ignore health and environmental damages from rising fuel combustion predict higher net costs from controlling them.

As Exhibit II indicates, people who assume that the unfavorable assumptions on all these points are most realistic should expect -- based on simulations from all sixteen models -- that stabilizing carbon dioxide emissions at 1990 levels by 2010 and holding them steady thereafter would result in economic losses of about 2.4 percent in GDP in the year 2020. That would be about one-year's growth in gross domestic product. Were these impacts to occur, the economy in 2020 would be about 70 percent larger than today's, rather than 74 percent larger under a "business-as-usual" scenario.

Exhibit II also shows the implications of changing those unfavorable assumptions one-by-one. For example, people who think that the firms and households will reallocate their expenditures efficiently over the long-run to minimize the effects of higher energy prices should expect much smaller impacts -- about 1 percent

of GDP in 2020 rather than 2.4 percent. If, in addition, the availability of non-carbon energy sources and the possibility that nations will agree on joint implementation are accepted as reasonable long-run assumptions, then people should expect that meeting this stabilization target would have negligible impacts on the economy twenty-three years down the road. Those who also accept the assumption that revenues from energy taxes or similar policies will be recycled to the economy through other tax cuts should expect a small positive impact on the economy. And, finally, if they believe that avoiding climate change and air pollution will avert health and other economic damages, people should conclude from these models that the overall economic impacts of stabilizing carbon emissions will be even more favorable. The underlying assumptions strongly affect the predicted impacts.

Of course, people need not accept all the best-case or all the worst-case assumptions. The chart indicates the effect of each key assumption singly on the predicted economic impacts of stabilizing emissions.

Three of these assumptions are policy decisions:

- The United States can, and should, negotiate vigorously with other nations to achieve international cooperation in stabilizing carbon emissions through a system of joint implementation. All nations can potentially gain.

- The federal government can choose the policy instruments with which to limit carbon dioxide emissions. It can, and should, restructure the tax system to lower income, profits, or payroll taxes, making up the revenues through energy taxes or revenues from auctioning off carbon emissions permits.

- The federal government, in cooperation with industry can, and should, vigorously pursue research and development programs to make renewable, non-fossil energy sources more widely available at lower prices.

Through such measures the government can make sure that climate protection will not adversely affect the economy.

II. International Competitiveness

The Framework Convention and the Berlin Mandate negotiated in 1995 agreed that developing and developed countries should have differentiated responsibilities, in view of the preponderance of developed country emissions and the lower incomes per capita emissions of developing countries. Nonetheless, a resolution recently circulated in the Senate states that the United States should not accept binding commitments to reduce emissions unless developing countries do likewise.

There are two underlying concerns. First, that any reductions

achieved by the United States and other developed countries would be soon swallowed up by increased emissions from large, rapidly developing countries such as China. Second, that measures adopted only by the United States and other developed countries would put industries in these countries at a competitive disadvantage.

The second concern is exaggerated. There is scant evidence that lower energy prices or weaker environmental standards give countries a competitive advantage in trade or investment. Countries that have had low energy prices -- including the FSU, Mexico, Venezuela, India, and China -- have not been particularly competitive in energy-intensive industrial sectors. Low energy prices lead mainly to energy inefficiency; weak environmental standards result in high environmental damages.

The first concern is more realistic. Annual emissions from developing countries will exceed those of OECD countries by 2020, given current trends. Stabilizing greenhouse gas concentrations requires global cooperation.

However, it's important to realize that without any international commitments developing countries have already taken significant steps to curtail carbon dioxide emissions, purely on "no regrets" economic grounds. They have

- reduced energy subsidies: Between 1990 and 1995 fourteen

developing countries whose combined emissions match those of the United States reduced fossil fuel subsidies by 45 percent. China reduced coal subsidies from 37 to 29 percent and oil subsidies from 55 to 2 percent. The World Bank estimates substantial savings in CO2 emissions as a result.

- **restructured energy markets:** Many developing countries have privatized energy industries or invited participation from private independent power producers and other private energy companies. The result has been increased investment in high-efficiency cogeneration facilities and combined cycle gas-fired power plants, meeting energy needs with lower emissions.
- **promoted energy efficiency and renewable energy:** Mexico, for example, has developed energy efficiency standards for appliances, buildings, electric motors and industrial boilers. India provides immediate write-off and customs exemptions for wind turbines. Brazil has a large-scale ethanol program for automotive fuels.

Such programs as these have reduced developing countries emissions substantially relative to their business-as-usual trend. The importance of these "no regrets" policy changes should not be overlooked.

Predicted Impacts of Carbon Abatement on the U.S. Economy

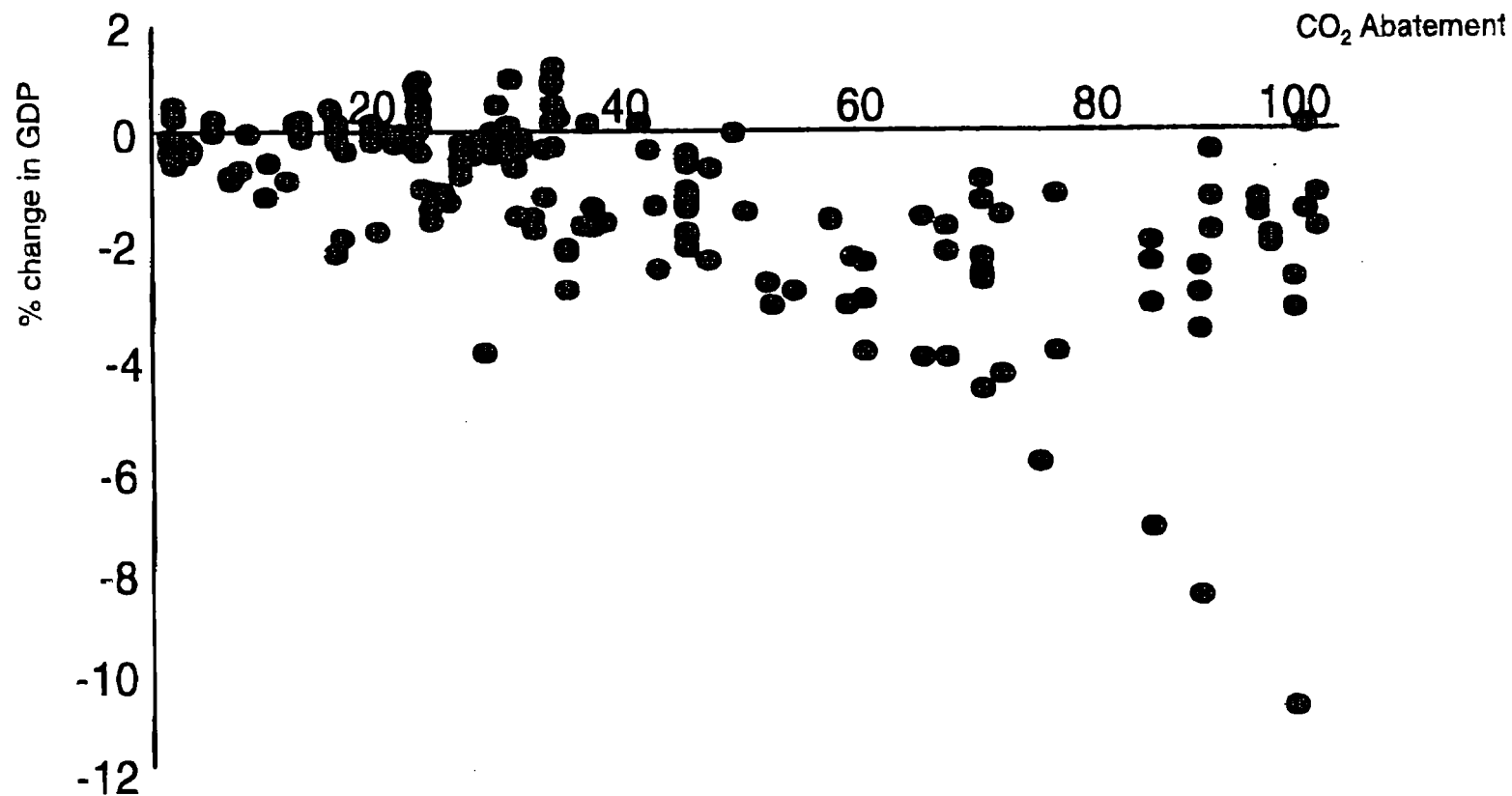
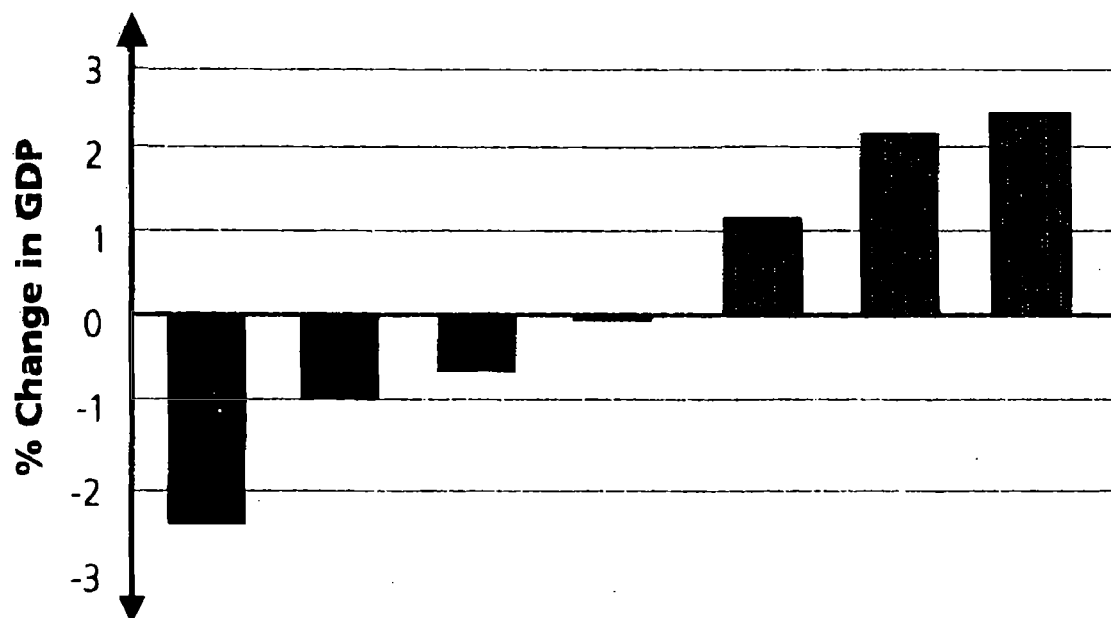


Exhibit 1

World Resources Institute



Predicted Impacts on GDP of Stabilizing CO₂ Emissions at 1990 Levels by 2020: The Effect of Changing Underlying Assumptions



Worst Case Assumptions

1. Inefficient economic responses*
2. No non-carbon backstop fuel
3. No Joint Implementation
4. Revenues recycled lump-sum
5. No air pollution damages averted
6. No climate change damages averted

↑

↑

↑

↑

↑

↑

↑

Best Case Assumptions

1. Efficient economic responses*
2. Non-carbon backstop fuel available
3. Joint Implementation
4. Revenues recycled effectively
5. Air pollution damages averted
6. Climate change damages averted

* Macro Model

* CGE Model

Exhibit 2



CHEMICAL MANUFACTURERS ASSOCIATION

FREDERICK L. WEBBER
PRESIDENT & CEO

June 27, 1997

Webber
JAF
AHM
MJ
JS
SR

The Honorable Janet Yellen
Chairman
Council of Economic Advisors
17th & Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Chairman Yellen:

CMA is deeply concerned with the course of the global climate change negotiations now underway. I've just written a letter to President Clinton to explain these concerns in depth. I am pleased to provide you with a copy of that letter. You or your staff are welcome to call me or call Thomas Parker, Jr., Director, Energy (703-741-6916) if you have any questions. CMA representatives will be happy to meet with you or your staff at any time to discuss issues relevant to the climate change negotiations.

Sincerely,

Attachment



INNOVATION, TECHNOLOGY AND RESPONSIBLE CARE® AT WORK

1300 WILSON BLVD., ARLINGTON, VA 22209 • TELEPHONE 703-741-5100 • FAX 703-741-6086





CHEMICAL MANUFACTURERS ASSOCIATION

FREDERICK L. WEBBER
PRESIDENT & CEO

June 26, 1997

The President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Mr. President:

CMA has followed with interest and concern the international negotiations taking place under the auspices of the U.N. Framework Convention on Climate Change and "the Berlin Mandate" to develop legally binding commitments on developed countries to reduce their greenhouse gas emissions in the years after 2000. CMA is deeply concerned that such commitments could significantly damage the competitiveness of the U.S. chemical industry, with the potential result of exporting economic growth and jobs to developing countries without reducing global greenhouse gas emissions. I would like to inform you of our positions and concerns regarding several of the major issues involved.

The Chemical Manufacturers Association (CMA) is a non-profit trade association whose 191 member companies represent more than 90 percent of the productive capacity of basic industrial chemicals in the United States. The member companies of CMA are actively engaged in the research, development and production of chemical products and are sensitive to the potential impact on the environment, including the global climate. As a major energy consumer, the chemical industry recognizes its responsibility to use energy efficiently and to minimize related environmental impacts. The chemical industry is a major exporting sector of the U.S. economy, having achieved a sectorial trade surplus of \$17 billion in 1996 and a cumulative sectorial trade surplus of \$163 billion the last 10 years.

The emissions reduction targets and timetables now under discussion in the international negotiations would impose large costs and substantial job losses on the U.S. chemical industry. We have considered possible alternative approaches available to our member companies to improve further their energy efficiency and reduce CO₂ emissions and have concluded that only with a reduction in projected industry growth with its associated reduction in jobs could we potentially reduce greenhouse gas emissions to 1990 levels. Lowering emissions below 1990 levels in the time frames being considered would impose much greater sacrifices.

The European Union has proposed that each developed ("Annex I") country reduce its greenhouse gas emissions 15 percent *below* 1990 levels by the year 2010. The chemical industry improved its energy efficiency an average 2.3% per year from 1974-1995. CMA analysis suggests that under current baseline assumptions, the chemical industry will continue to improve its energy efficiency as its production grows almost 60 percent above 1990 levels by the year 2010. During this same



INNOVATION, TECHNOLOGY AND RESPONSIBLE CARE® AT WORK

1300 WILSON BLVD., ARLINGTON, VA 22209 • TELEPHONE 703-741-5100 • FAX 703-741-6086



time period, the chemical industry's projected CO₂ emissions increase *above* 1990 levels would be about 16 percent (9.8 million tons), only a small fraction of the percentage increase projected for production.

The chemical industry has already implemented aggressive energy efficiency measures, switched fuels extensively, and built energy-efficient electricity cogeneration facilities to power its manufacturing plants. Nevertheless, given current economic growth trends, we could not meet the original target of stabilizing emissions at 1990 levels, much less reduce them below 1990 levels, without a serious impact on chemical industry jobs, exports and competitiveness.

It is essential that, prior to entering into binding commitments, the Administration, Congress and the public have a clear understanding of the possible costs to the U.S. economy of measures to achieve desired emissions reductions. Yet it is our understanding that, astonishingly, the Administration has not completed the economic analysis of this critical issue which has been underway on an inter-agency basis for some time.

Further, one study which has been essentially completed for many months, a study performed by Argonne National Laboratory for the Department of Energy of the impact of externally imposed energy price increases ("adders") on six energy-intensive U.S. industries, including the chemical industry, has not been released. We recognize the Argonne study is not a comprehensive or definitive treatment of the issues involved. We do believe, though, it helps to advance our understanding of the issues. In the Argonne study, the lead expert's paper on the chemical industry concluded that as the result of such price adders the chemical industry would suffer a \$10 billion deterioration in the industry's positive trade balance, representing more than half of the industry's 1996 trade surplus, and lose as many as 100,000 jobs, representing about 10 percent of chemical industry employment.

Let me now summarize our position.

CMA opposes mandates at this time. CMA and its member companies believe that a greater understanding is needed in the area of climate change mechanisms and economic analysis of mitigation and adaptation options prior to the development and implementation of national or international response strategies that impose mandates to reduce emissions.

CMA supports voluntary programs. CMA supports the encouragement of voluntary measures by all economic sectors that lead to emission reductions, improved energy efficiency, removal of greenhouse gases from the atmosphere (sequestration) and the development and deployment of advanced technologies that support these goals. We are working to strengthen CMA members' voluntary efforts to address the climate change issue.

CMA supports a global approach. CMA believes it is essential that any policy response be global as no single nation or group of nations can equitably or effectively address conditions that may contribute to climate alteration. We therefore encourage all Parties to the U.N. Framework Convention to develop and implement voluntary response strategies that reduce the risk of dangerous interference with climate systems while concurrently supporting healthy economies and international competitiveness. We believe the focus of the Berlin Mandate on new commitments from Annex I countries, expressly relieving developing countries of such burden, cannot be

The President
June 26, 1997
Page 3

extended into the future. While some differentiation may be required, the dichotomy enshrined in the Berlin Mandate is fundamentally inconsistent with long term resolution of climate change concerns, as developing countries in the aggregate become progressively the largest emitters of greenhouse gases in the future. Further, this approach is likely to be very damaging to the economies of developed countries as production, investment and jobs migrate from these countries to developing countries not subject to comparable obligations. We are aware of the U.S. government's efforts to "advance" implementation of developing countries' commitments under the Framework Convention, and we applaud those efforts, but we are also fully aware of the strong resistance by those countries to U.S. efforts.

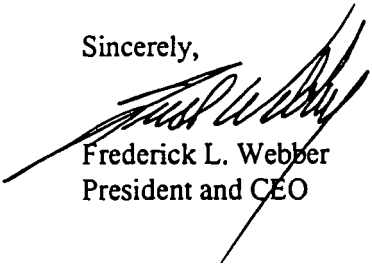
CMA supports additional research. CMA and its member companies encourage and support public and private scientific and economic research to enhance the understanding of the possible causes and implications of climate change, and the response of the global climate to increasing greenhouse gas concentrations. To maximize the credibility and usefulness of the evolving scientific and socio-economic understanding, CMA stresses the need for an open and inclusive scientific process which considers all views and scrupulously follows agreed rules.

CMA supports joint implementation. We oppose mandatory common policies and measures. CMA supports voluntary national and international activities which share the credits for emission reductions or sequestration among activity sponsors ("joint implementation"). In addition, we believe any decisions relating to specific policies and measures should be defined nationally.

I hope the above is helpful to you in understanding clearly CMA's position on these issues. In sum, we remain deeply concerned that the U.S., prior to the completion of essential analysis, may enter into an international agreement which will impose unacceptable economic costs on the United States and, at the same time, be unsuccessful in reducing global emissions of greenhouse gases.

You or your staff are welcome to call me or Thomas Parker, Jr., Director, Energy (703-741-5916) if you have any questions. CMA representatives will be delighted to meet with you or your staff at any time to discuss issues relevant to the climate change negotiations.

Sincerely,



Frederick L. Webber
President and CEO

cc: see attached list

The President
June 26, 1997
Page 4

Attachment to Frederick L. Webber letter to President Clinton, June 26, 1997

Copy recipients:

Secretary of State Madeline Albright
Undersecretary of State Timothy Wirth
Undersecretary of State Stuart Eizenstat
Assistant Secretary of State Eileen Claussen
Secretary of Energy Federico Peña
Assistant Secretary of Energy Marc Chupka
Secretary of Commerce William Daly
Secretary of the Treasury Robert Rubin
Secretary of Labor Alexis Herman
Council of Economic Advisers Chair Janet Yellen
United States Trade Representative Charlene Barshefsky
Office of Management and Budget Director Franklin Raines
Representative Tom Bliley
Representative Dan Schaefer
Representative John Dingell
Senator Frank Murkowski
Senator Dale Bumpers
Senator Jesse Helms
Senator Chuck Hagel
Senator Robert Byrd
Senator Joseph Biden

Jerry J. Jasinowski

President

June 6, 1997

JLY
AHM
JAF
JS

Janet Yellen
Chair
Council of Economic Advisors
314 Old Executive Office Building
Washington, DC 20502

Dear Janet:

Over the next several weeks, the Administration will finalize its position on the EPA's proposed regulations on ozone and particulate matter (PM). As my attached letter of May 7, 1997, to the President states, the EPA has assumed an extreme and unjustified position on these proposed standards.

The EPA's own Clean Air Science Advisory Council (CASAC) stated that a new ozone standard cannot be justified scientifically. On the issue of PM, CASAC concluded in a letter of August 1995 to EPA Administrator Carol Browner, "The information presented ... does not provide the basis to select the agent or agents which need to be regulated nor does it provide a basis for predicting the health benefits of any control strategies." Unanswered questions about the science surrounding the effects of PM on public health and the current state of PM research include --

- o exposure misclassifications, measurement error and influence of confounders;
- o the $PM_{2.5}/PM_{10}$ ratio to estimate local $PM_{2.5}$ concentrations;
- o the fraction of mortality that is advanced by a few days because of pollution;
- o the lack of understanding of toxicological mechanisms and the existence of alternative explanations;
- o the lack of $PM_{2.5}$ data; and,
- o the lack of conclusive health studies and what populations would be affected.

Yet, despite these scientific concerns, the EPA has set a course that will have an extremely negative effect on the economy and American jobs. According to the Council of Economic Advisers, the new ozone standards alone would cost as much as \$60 billion annually, far in excess of the EPA estimate.

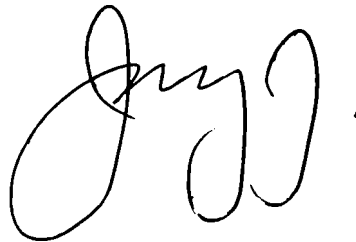
Page Two

We estimate that one-half of the U.S. population would live in non-attainment areas if the proposed rules become final. This would have broad-reaching effects. For example, the economic revitalization of the nation's inner cities would be jeopardized and possibly halted altogether. This is, in part, why organizations such as the National Black Chamber of Commerce have been so vocal against the proposed regulations.

The past several months brought a groundswell of broad, bipartisan opposition from state, local and federal government officials to the EPA-proposed revisions to the air quality standards for PM and ozone. More than 228 Republicans and Democrats in the U.S. Congress have expressed concern about these proposed regulations. Governors and mayors, as well as minority and labor interests, are particularly concerned about the economic and job impact that these regulations will have on their communities. These proposed standards are unjustified scientifically and dangerous economically.

I urge you to add your voice to those advising the President to direct the EPA to retain the existing standards until such time as a proper scientific basis for change has been established.

Sincerely,

A handwritten signature in black ink, appearing to be "J. Edgar Hoover", written in a cursive style.

NAM National Association of Manufacturers

Jerry J. Jasinowski

President

May 7, 1997

The Honorable William J. Clinton
The White House
Washington, D.C.

Dear Mr. President:

On behalf of the National Association of Manufacturers' 14,000 member companies and their employees, I urge you to reject the EPA's proposed regulations concerning ozone and particulate matter (PM). These new regulations are not justified on either scientific or economic grounds. They will be of highly questionable benefit to public health, undermine existing clean air laws and generate enormous costs on the economy and its workers.

If the new rules go into effect, over half the U.S. population will live in areas designated as "non-attainment." Roughly 800 counties, or one of every four nationwide, will be located in non-attainment areas, creating the possible loss of federal funding and placing severe limits on growth and job creation.

For these reasons, opposition to the proposed standards is broad and bipartisan, reaching from communities across the country to senior Members of Congress. The depth of this opposition is underscored by a recent survey of the NAM's Board of Directors. Ninety-three percent of those responding stated they do not believe the new standards have been justified by science, and affirmed their conviction that the new rules will have a large negative impact on jobs and economic growth. While these rules will have an adverse effect on most industrial sectors, they will be particularly harmful to small businesses.

The NAM is joined in opposing the EPA's efforts to change ozone and PM air quality standards by 600 companies and associations, including such groups as the National Governors Association, the National League of Cities and numerous state and local governments. More than 140 resolutions, letters and comments have been submitted to the EPA on behalf of leading public officials at the state and national levels. Clearly, opinion in both parties is running strongly against the new standards.

As noted above, the scientific basis of the new standards is simply not sufficient to justify their implementation. According to White House Science Adviser John Gibbons, the ozone standard suffers from a lack of review and analysis. "I find it hard to believe that we would suffer more than we would gain by taking more time," he wrote the EPA last fall.

Manufacturing Makes America Strong

May 7, 1997

The Honorable William J. Clinton

Page Two

His views are echoed by officials at the Council of Economic Advisers, the Office of Management and Budget, the Office of Science and Technology and the Departments of Transportation and Agriculture.

Dr. George Wolff, the former chairman of the EPA's own scientific review panel, has stated that there is no clear cause and effect link between particulate matter and public health. Much more research must be performed before new regulations are imposed on local governments and industries. Other members of the Administration agree. A March 7 Treasury Department document states that the proposed ozone standard "does not rest on a firm scientific foundation." A March 10 Agriculture Department statement concludes that the new rules "in our judgment are not based on adequate scientific evidence, peer review and interpretation."

As to costs, the EPA appears to have substantially underestimated the impact of its proposals. According to the Council of Economic Advisers, the new ozone standards alone could cost as much as \$60 billion annually, an amount far in excess of that estimated by the EPA. This staggering amount would adversely affect most sectors of the economy, hit heavily-populated regions especially hard and cause job losses in the hundreds of thousands.

In particular, the inability of scores of cities and regions to attain compliance would penalize almost every population center in the country, prohibiting them from obtaining vital federal support for programs on which they and their communities depend. Almost all of California, all of New Jersey, Connecticut, Massachusetts, Rhode Island and Delaware, and large parts of Ohio, Pennsylvania and almost every other state east of the Mississippi would be in immediate non-compliance with federal law should the new rules go into effect.

Existing non-attainment areas (especially in the Northeast and California) will face additional regulations that would make it extremely difficult, if not impossible, to achieve compliance. Many of the urban areas your Administration is attempting to stimulate economically are in what would be non-attainment areas. As a result, rather than experiencing economic growth, these areas are more likely to remain on the path of profound economic stagnation.

The dangers of non-compliance for America's cities were underscored in a letter sent to you in April by John Dingell, the Democratic "Dean of the House," and 41 other

May 7, 1997

The Honorable William J. Clinton

Page Three

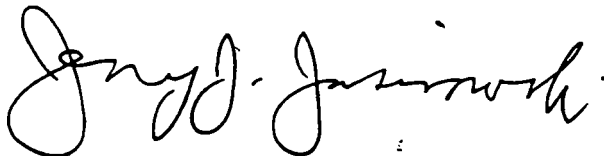
Democratic Members. The letter noted that affected counties "include the vast majority of the nation's urban and suburban areas (and) will face an indefinite future of job restriction and potential disruption of highway funding and other sanctions." Clearly, this is a future none of us wants.

We are eager to work with you and help your staff as you undertake consideration of this most serious issue. But as noted by such Democratic Governors as Lawton Chiles, Paul Patton and James B. Hunt, the new standards are egregious. As Gov. Hunt put it in a recent letter to Ms. Browner, we "strongly urge you to consider the full and very broad range of implications on our citizens and ... urge you to move with caution until there is broader agreement among the scientific community."

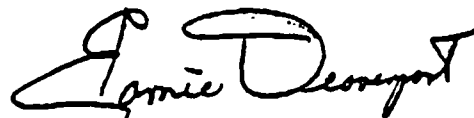
As five Democratic Senators (Ford, Robb, Glenn, Rockefeller, and Byrd) wrote last month in a letter to Ms. Browner, "many areas of the country are struggling to comply with the current standard, let alone one that is more stringent, and must now revise their plans in midcourse." The NAM agrees, and asks you to consider the warning of Senator Robert C. Byrd: "Stop and take stock of our situation before adopting the proposed ozone and PM standards." We endorse these wise words, and respectfully ask you to do so, as well.

We believe these regulations should be postponed until there is a more complete scientific and economic analysis made of the levels and techniques for compliance being advocated.

With best regards.



Jerry J. Jasinowski
President and Chief Executive Officer,
National Association of Manufacturers



Earnest W. Deavenport
Vice-Chairman,
National Association of Manufacturers
Chairman and Chief Executive Officer,
Eastman Chemical Company



CHEMICAL MANUFACTURERS ASSOCIATION

JLY
JAP
AHM
MJ
JS
SR

FREDERICK L. WEBBER
PRESIDENT & CEO

June 27, 1997

The Honorable Janet Yellen
Chairman
Council of Economic Advisors
17th & Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Chairman Yellen:

CMA is deeply concerned with the course of the global climate change negotiations now underway. I've just written a letter to President Clinton to explain these concerns in depth. I am pleased to provide you with a copy of that letter. You or your staff are welcome to call me or call Thomas Parker, Jr., Director, Energy (703-741-6916) if you have any questions. CMA representatives will be happy to meet with you or your staff at any time to discuss issues relevant to the climate change negotiations.

Sincerely,

Attachment



INNOVATION, TECHNOLOGY AND RESPONSIBLE CARE® AT WORK

1300 WILSON BLVD., ARLINGTON, VA 22209 • TELEPHONE 703-741-5100 • FAX 703-741-6086





CHEMICAL MANUFACTURERS ASSOCIATION

FREDERICK L. WEBBER
PRESIDENT & CEO

June 26, 1997

The President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Mr. President:

CMA has followed with interest and concern the international negotiations taking place under the auspices of the U.N. Framework Convention on Climate Change and "the Berlin Mandate" to develop legally binding commitments on developed countries to reduce their greenhouse gas emissions in the years after 2000. CMA is deeply concerned that such commitments could significantly damage the competitiveness of the U.S. chemical industry, with the potential result of exporting economic growth and jobs to developing countries without reducing global greenhouse gas emissions. I would like to inform you of our positions and concerns regarding several of the major issues involved.

The Chemical Manufacturers Association (CMA) is a non-profit trade association whose 191 member companies represent more than 90 percent of the productive capacity of basic industrial chemicals in the United States. The member companies of CMA are actively engaged in the research, development and production of chemical products and are sensitive to the potential impact on the environment, including the global climate. As a major energy consumer, the chemical industry recognizes its responsibility to use energy efficiently and to minimize related environmental impacts. The chemical industry is a major exporting sector of the U.S. economy, having achieved a sectorial trade surplus of \$17 billion in 1996 and a cumulative sectorial trade surplus of \$163 billion the last 10 years.

The emissions reduction targets and timetables now under discussion in the international negotiations would impose large costs and substantial job losses on the U.S. chemical industry. We have considered possible alternative approaches available to our member companies to improve further their energy efficiency and reduce CO₂ emissions and have concluded that only with a reduction in projected industry growth with its associated reduction in jobs could we potentially reduce greenhouse gas emissions to 1990 levels. Lowering emissions below 1990 levels in the time frames being considered would impose much greater sacrifices.

The European Union has proposed that each developed ("Annex I") country reduce its greenhouse gas emissions 15 percent *below* 1990 levels by the year 2010. The chemical industry improved its energy efficiency an average 2.3% per year from 1974-1995. CMA analysis suggests that under current baseline assumptions, the chemical industry will continue to improve its energy efficiency as its production grows almost 60 percent above 1990 levels by the year 2010. During this same



INNOVATION, TECHNOLOGY AND RESPONSIBLE CARE® AT WORK

1300 WILSON BLVD., ARLINGTON, VA 22209 • TELEPHONE 703-741-5100 • FAX 703-741-6086



time period, the chemical industry's projected CO₂ emissions increase *above* 1990 levels would be about 16 percent (9.8 million tons), only a small fraction of the percentage increase projected for production.

The chemical industry has already implemented aggressive energy efficiency measures, switched fuels extensively, and built energy-efficient electricity cogeneration facilities to power its manufacturing plants. Nevertheless, given current economic growth trends, we could not meet the original target of stabilizing emissions at 1990 levels, much less reduce them below 1990 levels, without a serious impact on chemical industry jobs, exports and competitiveness.

It is essential that, prior to entering into binding commitments, the Administration, Congress and the public have a clear understanding of the possible costs to the U.S. economy of measures to achieve desired emissions reductions. Yet it is our understanding that, astonishingly, the Administration has not completed the economic analysis of this critical issue which has been underway on an inter-agency basis for some time.

Further, one study which has been essentially completed for many months, a study performed by Argonne National Laboratory for the Department of Energy of the impact of externally imposed energy price increases ("adders") on six energy-intensive U.S. industries, including the chemical industry, has not been released. We recognize the Argonne study is not a comprehensive or definitive treatment of the issues involved. We do believe, though, it helps to advance our understanding of the issues. In the Argonne study, the lead expert's paper on the chemical industry concluded that as the result of such price adders the chemical industry would suffer a \$10 billion deterioration in the industry's positive trade balance, representing more than half of the industry's 1996 trade surplus, and lose as many as 100,000 jobs, representing about 10 percent of chemical industry employment.

Let me now summarize our position.

CMA opposes mandates at this time. CMA and its member companies believe that a greater understanding is needed in the area of climate change mechanisms and economic analysis of mitigation and adaptation options prior to the development and implementation of national or international response strategies that impose mandates to reduce emissions.

CMA supports voluntary programs. CMA supports the encouragement of voluntary measures by all economic sectors that lead to emission reductions, improved energy efficiency, removal of greenhouse gases from the atmosphere (sequestration) and the development and deployment of advanced technologies that support these goals. We are working to strengthen CMA members' voluntary efforts to address the climate change issue.

CMA supports a global approach. CMA believes it is essential that any policy response be global as no single nation or group of nations can equitably or effectively address conditions that may contribute to climate alteration. We therefore encourage all Parties to the U.N. Framework Convention to develop and implement voluntary response strategies that reduce the risk of dangerous interference with climate systems while concurrently supporting healthy economies and international competitiveness. We believe the focus of the Berlin Mandate on new commitments from Annex I countries, expressly relieving developing countries of such burden, cannot be

extended into the future. While some differentiation may be required, the dichotomy enshrined in the Berlin Mandate is fundamentally inconsistent with long term resolution of climate change concerns, as developing countries in the aggregate become progressively the largest emitters of greenhouse gases in the future. Further, this approach is likely to be very damaging to the economies of developed countries as production, investment and jobs migrate from these countries to developing countries not subject to comparable obligations. We are aware of the U.S. government's efforts to "advance" implementation of developing countries' commitments under the Framework Convention, and we applaud those efforts, but we are also fully aware of the strong resistance by those countries to U.S. efforts.

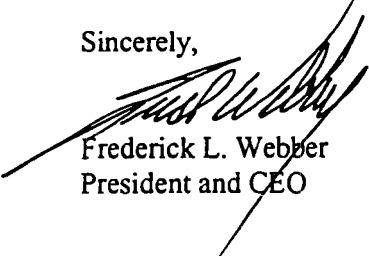
CMA supports additional research. CMA and its member companies encourage and support public and private scientific and economic research to enhance the understanding of the possible causes and implications of climate change, and the response of the global climate to increasing greenhouse gas concentrations. To maximize the credibility and usefulness of the evolving scientific and socio-economic understanding, CMA stresses the need for an open and inclusive scientific process which considers all views and scrupulously follows agreed rules.

CMA supports joint implementation. We oppose mandatory common policies and measures. CMA supports voluntary national and international activities which share the credits for emission reductions or sequestration among activity sponsors ("joint implementation"). In addition, we believe any decisions relating to specific policies and measures should be defined nationally.

I hope the above is helpful to you in understanding clearly CMA's position on these issues. In sum, we remain deeply concerned that the U.S., prior to the completion of essential analysis, may enter into an international agreement which will impose unacceptable economic costs on the United States and, at the same time, be unsuccessful in reducing global emissions of greenhouse gases.

You or your staff are welcome to call me or Thomas Parker, Jr., Director, Energy (703-741-5916) if you have any questions. CMA representatives will be delighted to meet with you or your staff at any time to discuss issues relevant to the climate change negotiations.

Sincerely,



Frederick L. Webber
President and CEO

cc: see attached list

The President
June 26, 1997
Page 4

Attachment to Frederick L. Webber letter to President Clinton, June 26, 1997

Copy recipients:

Secretary of State Madeline Albright
Undersecretary of State Timothy Wirth
Undersecretary of State Stuart Eizenstat
Assistant Secretary of State Eileen Claussen
Secretary of Energy Federico Peña
Assistant Secretary of Energy Marc Chupka
Secretary of Commerce William Daly
Secretary of the Treasury Robert Rubin
Secretary of Labor Alexis Herman
Council of Economic Advisers Chair Janet Yellen
United States Trade Representative Charlene Barshefsky
Office of Management and Budget Director Franklin Raines
Representative Tom Bliley
Representative Dan Schaefer
Representative John Dingell
Senator Frank Murkowski
Senator Dale Bumpers
Senator Jesse Helms
Senator Chuck Hagel
Senator Robert Byrd
Senator Joseph Biden



750 First Street, NE
Suite 1140
Washington, DC 20002
(202) 408-9260 Phone
(202) 408-8896 Fax
e-mail: general@ccap.org

European Office:
Jana Masaryka 1
12000 Praha 2
Czech Republic
(420 2) 691-0841 Phone
(420 2) 691-1742 Fax

Governor Tony Earl*
Quarles & Brady
Chair

Ned Helme
Executive Director

Board of Directors

Richard Abdoo*
Wisconsin Electric Power Company

B.B. Blevins
California Dept. of Conservation

Lawrence R. Codey
Public Service Electric & Gas Company

Congressman Jim Cooper
Equitable Securities Corporation

William Davis
Niagara Mohawk Power Corporation

Governor John A. Kitzhaber
Oregon

Dr. Mark Levine
Lawrence Berkeley Laboratory

Jim Maddy*
National Park Foundation

Senator Gaylord Nelson
The Wilderness Society

D. Louis Peoples
Orange & Rockland Utilities, Inc.

Paul Portney
Resources for the Future

Marilynne Roberts
Hamline University School of Law

William G. Rosenberg
E³ Ventures

Ron Russell
Russell Energy Services Company

Conrad Schneider
Natural Resources Council of Maine

Commissioner Robert Shinn
New Jersey DEP

Governor Mike Sullivan*
Brown, Drew, Matthews & Sullivan

Governor Tommy Thompson
Wisconsin

Victoria J. Tschinkel*
Landers & Parsons

June 23, 1997

Joseph Stiglitz
Presidents Council of Economic Advisors
17th and Pennsylvania Ave., NW
Washington, DC 20506

Jay S
Mark M

Dear Mr. Stiglitz:

Attached please find two papers that we have completed on the subjects of greenhouse gas trading and joint implementation. Both papers, which have been circulated within the U.S. Administration, address key issues that will be addressed by the Conference to the Parties in their upcoming meeting in Kyoto.

In the first paper, *Integration of Joint Implementation into an Annex I Greenhouse Gas Trading System*, we recommend that the U.S. **drop the additionality test** for 1) projects that reduce net emissions (fuel switching, efficiency improvement and other projects that reduce emissions at existing facilities); and 2) all renewable energy projects, which clearly do not increase GHG emissions. Dropping the additionality test would make credits produced by these projects more fungible, increase transparency and reduce transaction costs associated with the current JI process both here and abroad.

We also recommend the **discounting of JI project credits** to account for uncertainty and to improve the credibility of JI generally. Discounting JI credits across the board by ten percent would provide non-Annex I countries with financial incentives to opt into binding commitments. In addition to this system-level discount, we suggest that a country-level discount of 20 percent be applied to JI project credits flowing from countries with weaker monitoring and reporting systems. Based on in-country review, the Secretariat would decide whether or not this discount should be applied to a particular country.

In the second paper, *Methods for Ensuring Compliance in an International Greenhouse Gas Trading System*, we argue that **maintaining the integrity of the trading system** will be of primary importance in ensuring that trading is successful in helping Annex I countries to meet their GHG commitments. This may best be accomplished by restricting participation in trading to a subset of Annex I countries with strong domestic compliance systems. We suggest that the preconditions for participation in trading include the establishment of *tough domestic financial penalties* greater than the cost of compliance on companies that exceed allowed emissions, in addition to the requirements already provided for in the U.S. proposal (adoption of measurement standards, establishment of compliance and enforcement programs).

*Executive committee member



Printed on recycled paper
using soy based ink

In the paper we also recommend a *rigorous international compliance system*, the features of which would include: annual monitoring and reporting (as called for in the U.S. protocol proposal), in-depth reviews both during and at the end of budget periods, and, if interim in-depth reviews uncover major weaknesses in domestic administrative systems, interim sanctions such as the *loss of the right to sell allowances or inclusion on a Greenhouse Watch List*. In addition, strict end-of-period sanctions also should be imposed. *Trade sanctions and financial penalties on countries* probably would be most effective but probably are not politically feasible. Other options include *a reduction of future allowances and loss of the right to sell allowances*.

If you have any questions or comments on the papers, please do not hesitate to share them with me or my staff. We thank you for taking the time to consider our ideas.

Sincerely,

A handwritten signature in black ink, appearing to read 'ed', with a stylized flourish at the end.

Edward A. Helme
Executive Director

Integration of Joint Implementation into an Annex I Greenhouse Gas Trading System Summary of Key Points

1. The U.S. is advocating the establishment of a greenhouse gas (GHG) **trading** system and the continuation of **joint implementation** (JI).
 2. A critical issue that policymakers will face is **how to integrate** GHG reductions from JI projects into a trading system. Two characteristics of the current JI system could impede the integration of JI into the trading system:
 - the **administrative burden** associated with JI project approval, which restricts the flow of JI project credits. In particular, the additionality test is time-consuming and subjective; and
 - **uncertainty** about the legitimacy of some JI project credits, which could undermine confidence in trading and create doubt as to whether trading was contributing to the meeting of Annex I GHG emissions targets. Reasons behind the uncertainty of JI credits include: a lack of national caps in host countries, which means that **leakage** of emissions from JI projects to other activities may occur; problems in developing **baselines** against which projects are judged; and difficulty in **measuring** project emissions.
 3. We advocate that the **additionality test be dropped** for 1) projects that reduce net emissions (fuel switching, efficiency improvement and other projects that reduce emissions at existing facilities); and 2) all renewable energy projects, which certainly do not increase GHG emissions. Dropping the additionality test would make credits produced by these projects more fungible.
 4. In addition, we advocate the **discounting of JI project credits**. Discounting would reduce the number of credits flowing from JI projects to **account for uncertainty**. Two discounts would be applied:
 - **system level:** All JI project credits entering the trading system would be subject to one uniform discount relative to Annex I emissions allowances.
 - **country level:** This discount would adjust for the fact that the quality of GHG monitoring and reporting systems will vary across countries. Based on in-country review, the Secretariat would decide whether or not this discount should be applied to the country in question.
- Discounting would provide non-Annex I countries with **financial incentives** to opt into binding commitments and to develop stronger administrative systems.
5. Predetermined discounting would be preferable to leaving discounting to the market because it would provide **added incentive to adopt targets and develop strong GHG control infrastructure**. In addition, under market-driven discounting, buyers would address uncertainty by reducing the *price* they offer rather than by discounting reductions. This would introduce doubt as to whether purchasing countries were really meeting their emissions reduction targets.

Integration of Joint Implementation into an Annex I Greenhouse Gas Trading System

1. Introduction

The U.S. has proposed in its draft protocol that a greenhouse gas (GHG) trading system be established among countries in Annex I of the FCCC. The purpose of a trading system would be to reduce the cost of complying with binding GHG targets. The U.S. also has argued for the continuation of joint implementation (JI), or the purchase by parties in Annex I countries of emissions reductions achieved by projects in non-Annex I countries. Joint implementation would reduce the cost to Annex I countries of meeting targets and, because it would transfer capital and technology to developing countries, would provide these countries with an incentive to make GHG reductions. JI may be seen as a first step in moving non-Annex I countries toward the adoption of GHG emissions targets, though these targets would likely be less stringent than those of Annex I countries.

A critical issue that international policymakers will face in establishing an international GHG trading system is the integration of GHG reductions from JI into the system. There are two characteristics of the current JI system that could hamper the smooth integration of JI into a trading regime:

1. The JI project approval process requires significant involvement on the part of both the host and investing country governments. The additionality criterion requires particular attention and resources, because it calls for the consideration of many factors and the exercise of subjective judgment. The high transaction costs and lengthy bureaucratic process associated with the approval process restricts the flow of JI project credits and therefore would inhibit the integration of JI into a trading system.
2. For the reasons discussed below, in some cases it is difficult to ensure that the emissions credits produced by JI projects represent real GHG emissions reductions. Under the current voluntary approach to GHG mitigation, the overstatement of JI project GHG emissions benefits is tolerable, because it does not create doubt as to whether countries are meeting their binding commitments (since there are none). Under a system with binding commitments, however, the inclusion of JI credits not backed by real reductions in a trading system would undermine confidence in trading and introduce uncertainty as to whether or not trading was truly moving nations toward their GHG targets.

This paper presents a new approach to JI that attempts to resolve these tensions. This approach has two components. The first is the dropping of the additionality test for "net reduction" and renewable energy JI projects. Doing this would increase the transparency of the JI approval process and would reduce the transaction costs of projects of these types.

Reductions from these projects therefore could be more easily brought into circulation in the trading system.

The second component is discounting: JI project GHG reductions offered for sale in the international trading system would be discounted to reflect the uncertainty associated with the emissions reductions claimed. Two types of discounts would be applied: country level, which would account for the strength of the host country's GHG monitoring and reporting systems; and system level, which would discount all JI projects relative to reductions made in Annex I countries. The strength of discounting is that it would provide non-Annex I countries with financial incentives to establish strong domestic GHG administrative infrastructure and move from joint implementation to full participation in an international GHG trading system.

II. International GHG Trading

The third Conference of the Parties to the FCCC in Kyoto this December will include discussion of the establishment of a GHG emissions cap-and-trade system, a development that the U.S. is advocating.

At least initially, trading probably will take place among a small group of Annex I countries only. The system probably would follow an "allowance" model, in which countries would be allowed to emit certain amounts of GHGs and could sell any allowances that they did not need. Because countries will be the parties to the protocol, countries rather than companies will agree to engage in trading. It is hoped, however, that the system would quickly evolve to include trading by companies.

The key reasons that trading will at first be limited to specific Annex I countries are that 1) these countries will have developed the strong domestic GHG monitoring, reporting and enforcement mechanisms needed to ensure the legitimacy of reported emissions and reductions; and 2) they will have adopted GHG emissions caps. These features assure the buyer that the allowance fits into a national reduction strategy and is truly a reduction of emissions below allowed levels. Together these features ensure that confidence in the trading system is maintained and that there is certainty that GHG emissions are being reduced.

Eventually it is hoped that the cap-and-trade system will expand to include Annex I and non-Annex I countries alike. Such expansion would bring more emissions sources under a cap, prevent emissions from leaking from countries with caps to those without them, and reduce the systemwide cost of making reductions. At the present time, however, most developing countries cannot and will not make the commitments needed to become full members of the trading regime. Therefore another mechanism is needed to encourage their participation in trading.

III. Reducing the Administrative Burden of JI

One option for bringing non-Annex I countries into the trading system would be to continue joint implementation activities and simply allow such projects to generate allowances equal to GHG reductions achieved. JI projects are GHG mitigation projects that take place in non-Annex I countries but are financed by Annex I entities. By sponsoring JI projects companies from Annex I countries essentially purchase GHG emissions reductions. JI projects have taken place in a number of non-Annex I countries and have included forestry, renewable energy, energy efficiency, fuel switching and high-efficiency fossil fuel power generation projects.

In practice, integrating JI projects credits into an allowance system would be made problematic by a variety of difficulties that have been encountered in operationalizing JI. The first of these is the considerable review process and high transaction costs associated with JI project approval. To qualify as a JI project, a project must result in GHG reductions, gain host country approval, provide local benefits and be “additional.” Additionality means that project promoters must demonstrate that they would not have undertaken the project “but for” the fact that they would receive the GHG credits generated by the project.

Application of the additionality criterion requires the reviewer to make a judgment as to why investors would finance the project. This requires that the reviewer consider and determine the relative importance to investors of business considerations such as financial returns, GHG benefits, access to new markets, experience with particular technologies and publicity. The additionality test is therefore time-consuming and subjective. It restricts the flow of JI credits and makes the JI approval process non-transparent.

We advocate that **the additionality test be dropped** for “net reduction” projects – i.e., projects in areas such as fuel switching and energy efficiency that are made at existing facilities rather than at greenfield sites and that certainly reduce GHG emissions to levels below what they otherwise would have been. Because they provide clear global environmental benefits, projects of this type should be rewarded regardless of why they were undertaken.

The additionality test also should be dropped for renewable energy projects. Although the reductions reported from renewables projects are a function of baseline assumptions, these projects definitely do not increase emissions, and it is important that their further deployment be encouraged. Dropping the additionality test for these projects would enhance their attractiveness. In the long run, fostering a transition to renewables in developing countries is a critical piece of any solution to the climate change problem. This value should outweigh the uncertainties about the level of emissions increases avoided. Furthermore, questions about baseline assumptions can be addressed through the development of international benchmarks for displaced technologies, their emissions

characteristics, project lifetimes and other factors. These benchmarks would ensure consistency across projects in the calculation of avoided emissions.

IV. Addressing Uncertainty

A second aspect of JI that could increase the difficulty of integrating JI into an Annex I trading system is the uncertainty associated with the emissions reductions reported by some projects. While many JI projects produce real, quantifiable and verifiable emissions reductions, uncertainty has arisen about the accuracy of the reported emissions benefits of some JI projects. This uncertainty is acceptable under current conditions, because none of the Parties to the FCCC has adopted binding commitments. If Annex I parties were to commit to GHG caps, however, uncertainty regarding emissions levels would have to be addressed. Introducing uncertain JI credits into the trading system would undermine confidence in the system by establishing a "gaming" dynamic. Because purchasers of credits would have an incentive to seek out and purchase low-cost credits that were not backed by real reductions, countries not buying such credits might feel that they were at a competitive disadvantage in the marketplace, and might also doubt that countries purchasing JI credits were really in compliance with targets.

Factors that have led to uncertainty about some JI credits include the following:

- **Leakage:** Because JI projects take place in countries that have not agreed to emissions targets, it is possible that emissions reductions associated with a given project have been offset by emissions increases elsewhere. This is not an issue for many, indeed most, JI projects; some projects, though, do shift GHG-producing activities rather than reduce them. For example, carbon sequestration by a forest preservation project could be nullified by GHG emissions from forest clearing in another part of the host country (or in another country.) If the demand for wood products or cleared land has not been reduced, the forest preservation project may simply shift forest clearing to another area.
- **Baselines:** Choosing a project baseline requires one to determine what would have happened in the absence of the JI project. While making this determination in many cases is straightforward, in other cases it is subjective and may even present moral hazard. In establishing a project baseline, the project sponsor has an incentive to assume high fossil fuel use, so that the project looks better. Greenfield fossil fuel power projects that shave growth are particularly vulnerable to this problem: Although they increase emissions they may be credited with causing reductions when compared to a baseline that includes higher-emitting fossil fuel plants. A complicating factor is that some countries have not developed sectoral baselines that could be used to check the assumptions behind project baselines.

- **Measurement:** Accurately measuring the carbon emitted or sequestered by a project or quantifying baseline emissions may be difficult. This is most often true with carbon sequestration projects, where uncertainty about emissions impacts arises from difficulty in determining: the amount of carbon trapped in soil; which species will grow at the project site, and which would have grown there otherwise; and the ultimate fate of the biomass.

These issues are not unique to JI projects; they arise in GHG mitigation projects in developing and industrialized countries alike. While not common, they are more likely to be found in JI projects, however, because host countries may not possess the GHG monitoring systems needed to ensure that measurement issues have been carefully resolved.

Given these problems, how could the international trading system incorporate JI project GHG reductions and at the same time ensure that confidence in the trading system is not compromised?

One method would be to restrict entry to credits generated by particular types of projects, such as renewable energy and energy efficiency JI projects. The two problems with this approach are first, that it would automatically exclude certain worthwhile projects, and second, that it would provide little incentive to non-Annex I countries to develop strong GHG regulatory infrastructure and opt in to GHG emissions commitments. This is because reductions from JI projects would be equal in weight to emissions allowances sold by member countries of the trading system.

A second approach is **discounting**, which would send market signals to host countries and investors. Under this method the emissions reduction credits offered by a project would be discounted to account for uncertainty about the validity of credits. The number of credits offered by the project would thus be lower than the number of reductions claimed by project sponsors. For example, the buyer of credits from a project that generated an estimated 100 thousand tons of reductions per year and was subject to a total discount of 30 percent would increase its emissions budget by only 70 thousand tons per year. Host countries could increase investment by reducing the uncertainty associated with their JI projects.

We envision two levels of discounts. These are:

- **System level:** All JI project credits entering the trading system would be subject to a discount relative to Annex I emissions allowances. This discount factor would account for the uncertainty about credit value that is introduced by the fact that JI credits will be generated in countries that have not adopted emissions targets. In addition, it will provide countries with an incentive to opt in to commitments. System level discounts

would be the same for all JI projects and would equal ten percent. A discount of this size would not be so deep that it priced JI credits out of the emissions trading market.

- **Country level:** This discount factor would make adjustment for the fact that the quality of GHG monitoring and reporting systems will vary across countries. Credits from countries that file timely national communications and have adopted international GHG monitoring and reporting protocols would face no discount, while credits from countries that have not taken these steps would be discounted. This discount factor will give countries an incentive to develop stronger systems. Provision could be made to waive this discount for projects that could demonstrate that they were able to overcome the administrative weaknesses of their host countries.

In practice, simplicity dictates that only one country level discount factor be used: The Secretariat would determine whether or not the discount should be applied to a particular country, based on the results of the in-country review conducted by an international audit team under the Secretariat's lead. A country-level discount of 20 percent would adequately account for the uncertainty associated with credits from projects in countries with poor administrative systems. An important consideration in the application of this discount factor would be technical and financial assistance to countries, for it would be important that all countries have the same opportunity to develop strong monitoring and reporting systems.

One objection to using predetermined discounts is that they will be artificial and will not account for the fact that the uncertainty associated with project reductions varies across projects. An alternative approach would be to leave discounting to market forces. There are two reasons that predetermined discounting is preferable. First, under a system of market-driven discounting, buyers will have an incentive to overstate the number of reductions purchased. A buyer that is concerned that project reductions are overstated will respond by reducing the *price* offered for each reduction, rather than discounting the number of reductions. This resolution would leave doubt as to the actual number of reductions flowing from the project and therefore would introduce uncertainty as to whether or not the purchasing country was meeting its environmental target.

Second, predetermined discounting would give countries incentives to develop strong GHG accounting systems, make binding GHG commitments and enter the trading system. In contrast, market actors would discount reductions only to account for the uncertainty associated with reported reductions. They would be indifferent as to whether reductions came from inside or outside the trading system, or from countries with strong or weak administrative structures.

The Appendix to this paper provides examples that illustrate the application of discounting.

V. Summary

Given that non-Annex I countries are not likely to soon adopt binding GHG emissions reduction commitments, joint implementation will be an important mechanism for encouraging GHG reduction activities in those countries. Difficulty would arise in integrating JI into an Annex I GHG trading system, however, because of the high administrative burden associated with JI projects and the uncertainty associated with the value of some JI credits, which could undermine confidence in the trading system. In a voluntary climate change regulatory regime, all JI project credits may be counted because they are not scored against a cap; in a system with binding targets, however, trading countries will need a more rigorous system to ensure that confidence in the trading system is maintained and that trading is truly leading to compliance with emissions targets. This paper advocates the dropping of the additionality test for renewable energy and "net reduction" projects as a means of increasing the flow of JI credits. The additionality test has led to the development of a non-transparent process that has raised questions about the objectivity of the JI approval process and increased the transaction costs of developing JI projects. Dropping the test for projects that clearly provide GHG reductions will reduce bureaucracy and increase the fungibility of JI project credits.

The paper also offers the discounting of JI credits as a tool for addressing the uncertainty associated with reported JI project emissions reductions. By reducing the credits awarded to JI projects to account for uncertainty, discounting both protects against the introduction of false emissions reduction credits into the trading system and encourages non-Annex I countries to develop strong GHG monitoring and reporting systems and make firm commitments to control their GHG emissions.

Appendix: Examples of Discounting

This appendix provides examples of how discount factors would be applied. All examples assume that the buyer is located in the U.S., that the emissions trading market price for GHG reductions is five dollars per ton, and finally, that all projects yield 100 thousand tons of GHG reductions per year.

The examples presented illustrate the number of tradable credits that would be generated by diverse project types as well as the financial flows to project sponsors. The examples demonstrate that projects in countries with strong monitoring and reporting systems will attract more capital than other types of JI projects.

Example 1: An Annex I emissions allowance trade	
Tons of CO ₂ reduced annually (beyond allowed levels):	100,000
System Discount	0
Country Discount	0
Net tons eligible for trading	100,000
Trade Amount (U.S. price per ton \$5 X 100,000 tons)	\$500,000
Price received per ton	\$5

Example 2:: JI project in Costa Rica	
Tons of CO ₂ reduced annually	100,000
System Discount (Assume 10% for all JI projects)	-10,000
Country Discount (Assume top country rating)	0
Net tons eligible for trading	90,000
Trade Amount (U.S. price per ton \$5 X 90,000 tons)	\$450,000
Price received per ton	\$4.50

Example 3:: JI project in another developing country	
Tons of CO ₂ reduced annually	100,000
System Discount (Assume 10% for all JI projects)	-10,000
Country Discount (Assume discount of 20%)	-20,000
Net tons eligible for trading	70,000
Trade Amount (U.S. price per ton \$5 X 70,000 tons)	\$350,000
Price received per ton	\$3.50

Acknowledgements

The Center for Clean Air Policy would like to thank the following reviewers for their insightful comments: Daniel Klein, ICF Inc.; Nuno Lacasta, Center for International Environmental Law; Dan Lashof, Natural Resources Defense Council; Alice LeBlanc; Martin Smith, Niagara Mohawk Power; Michael Toman, Resources for the Future; and Jonathan Wiener, Duke University School of Law.

The viewpoints expressed in this paper are solely those of the Center for Clean Air Policy.

Methods for Ensuring Compliance in an International Greenhouse Gas Trading System: Summary of Key Points

1. An **international cap-and-trade system** in principle appears to be one of the most cost-effective means of reducing GHG emissions.
2. **Maintaining the integrity of the trading system** is of primary importance in ensuring that trading helps countries to meet their GHG commitments. This may best be accomplished by limiting participation in trading to **Annex I countries that maintain strong domestic compliance systems**. At first, trading will be country-to-country but should quickly evolve to **include companies**. Preserving the integrity of the trading system will also require the establishment of a **strong international compliance system**.
3. **Domestic Compliance**: The U.S. protocol proposal establishes a number of preconditions for participation in trading. These include the adoption of international measurement standards and the establishment of domestic compliance and enforcement programs. In addition to these, minimum preconditions for participation in trading should include establishment of a) **tough domestic financial penalties** on companies that exceed allowed emissions; and b) **seller responsibility** for the quality of allowances traded.
4. **International Compliance**: Key features of the international compliance system include:
 - A. **Interim compliance**: Reporting should occur annually, as called for in the U.S. proposal, while in-depth reviews should take place both during and at the end of budget periods. If interim in-depth reviews uncover major weaknesses in domestic administrative systems, then interim sanctions should be applied. These could include *loss of the right to sell allowances or inclusion on a Greenhouse Watch List*.
 - B. Strict rules regarding the **participation of companies from countries not adopting cap-and-trade systems**. Only the governments of these countries should engage in trading; they could make side arrangements with companies making GHG reductions.
 - C. **The imposition of sanctions**: End-of-period sanctions could include *trade sanctions and financial penalties on countries*, although both of these would be politically difficult to achieve. Financial penalties would be imposed per ton of exceedance and be large enough to deter violations. More feasible sanctions options include *a reduction of future allowances and loss of the right to sell allowances*.
5. The **protocol** adopted in Kyoto should establish the preconditions for participation in trading. In addition to the requirements already provided for in the U.S. protocol, these preconditions should include the establishment of tough domestic financial penalties for non-compliance.

Methods for Ensuring Compliance in an International Greenhouse Gas Trading System

I. Introduction

An international cap-and-trade system in principle appears to be one of the most cost-effective means of reducing GHG emissions. The success of such a system, however, would depend upon establishment of the proper administrative structure to ensure compliance.¹ Key administrative functions would include monitoring and enforcement, both of which must be performed nationally (national governments must regulate entities) and internationally (the international community must regulate countries.)

This paper describes certain features of the GHG trading regulatory infrastructure that would help ensure compliance with GHG emissions caps. The focus of the paper is on compliance by countries within the GHG trading system rather than the integration of reductions from non-participating countries into the system. The latter topic is discussed in a companion paper.

The paper takes the position that **maintaining the integrity** of the trading system is of primary importance in ensuring that trading helps countries to meet their GHG commitments. The system must ensure that allowances sold represent reductions of emissions below required levels. The paper describes two ways that this could be done:

- First, participation in trading should take place only among Annex I nations that have established and maintain ***strong domestic compliance programs***. These programs should incorporate international standards for GHG emissions measurement and should include appropriate monitoring and enforcement provisions, as called for in the current U.S. protocol proposal. In addition, countries that wish to participate in the trading system and plan to adopt domestic cap-and-trade programs would be expected to impose and enforce *strict financial penalties on companies* in non-compliance. The basis for this recommendation is the recognition that emissions sources will be motivated to comply primarily by the threat of strict financial penalties. Establishment of tough domestic compliance systems is of primary importance in ensuring that targets are met because these domestic systems will directly regulate GHG emitters. An example of the effectiveness of such systems is provided by the U.S. Acid Rain program, in which continuous monitoring and financial penalties that far exceed the cost of allowances have led to 100 percent compliance.

¹ Under a cap-and-trade system non-compliance would occur when net emissions for a particular country in a given budget period exceeded the country's initial allocation of allowances, plus allowances purchased, plus JI credits purchased, minus allowances sold.

- A second, complementary component is the development of a tough **international compliance system that includes sanctions for non-compliance**. To ensure the integrity of allowances traded, emissions reporting should occur every year (as called for in the U.S. proposal), in-depth review of country GHG administrative structures should occur during multiyear budget periods, and measures should be taken during budget periods against countries that are found to have poor administrative systems. These interim measures could include loss of the right to sell allowances and inclusion on a "Greenhouse Watch List." In addition, sanctions should be applied at the end of budget periods. Options include trade sanctions and strict financial penalties on countries, although these would be difficult to accomplish politically. More feasible options include a reduction in future allowances and loss of the right to sell allowances.

The protocol adopted in Kyoto at the third Conference of the Parties should establish the legitimacy of trading as a mechanism for addressing GHG targets, and it should establish the rules for participation in trading. In addition to those already included in the U.S. protocol proposal, these should include the establishment and enforcement of strong domestic penalties on firms that violate their GHG emissions allowances.

II. The Trading and Regulatory Structures

The third Conference of the Parties to the FCCC in Kyoto this December will include discussion of the establishment of a GHG emissions cap-and-trade system, a development that the U.S. is advocating.

It is likely that the trading system would follow an "allowance" model, in which countries would be allowed to emit certain amounts of GHGs and could sell any allowances that they did not need. Because countries will be the parties to the protocol, countries rather than companies will agree to engage in trading. It is desirable, however, that countries be allowed to assign allowances to domestic entities, which could then trade them internationally.

UNCTAD has recently completed a study that suggests a legal infrastructure for an international trading system (Stewart et al., 1996.) According to this proposal, to establish an international trading system countries would make an agreement to establish an international **Governing Body** to implement the system and enforce penalties in cases of trading violations. The agreement also would establish a **Monitoring Body** to monitor and certify the annual GHG emissions of the trading nations, and a **Trading Body**, which would oversee the trading of allowances. One possible arrangement is that the Monitoring Body would independently certify net emissions to the Trading Body, which would then determine whether or not the trading country was eligible for trading. If the country was

not, this would be reported to the Governing Body, which would take appropriate measures.²

The Monitoring Body could be the Secretariat, which now reviews national communications and leads in-country reviews. The Governing Body might also be the Secretariat but probably would be a new organization, because the mandates of the Secretariat and the subsidiary bodies to the FCCC (SBSTA, SBI, etc.) do not provide for an enforcement role. The Trading Body would be new and independent, because existing organizations do not possess the expertise needed to regulate market activity.

The success of the trading system in bringing about low-cost compliance with GHG emissions commitments ultimately will depend on ensuring that members of the system have confidence that all allowances traded represent real reductions beyond required levels. If this integrity is not maintained, then some countries may believe that others are meeting their commitments by buying cheap but illegitimate reductions. Trading might then come to be viewed as a means of evading commitments rather than a tool for achieving low-cost compliance.

Two key factors in ensuring compliance will be 1) requiring the establishment of strong domestic compliance systems; and 2) the development of appropriate international regulatory infrastructure.

III. In-Country Monitoring and Enforcement

Because domestic monitoring and enforcement systems will directly regulate GHG sources, the most important step in ensuring compliance in a GHG cap-and-trade system would be to ***limit participation in trading to countries with strong national compliance systems***. These systems would ensure the buyers of allowances that reductions they purchase represent reductions below allowed levels, while the international community would be sure that trading countries and the world as a whole were moving towards their GHG reduction targets.

Minimum preconditions for participation in the trading system should include:

1. Commitment to GHG emissions **targets and timetables** under the FCCC.
2. Enactment of **enabling legislation** that would establish a domestic regulatory program, designate a specific agency to administer the program and appropriate adequate budget resources to that agency. The establishment of national compliance and enforcement

² In Stewart et al., 1996, the three international bodies are known as the Council, Monitor and International Emissions Trading Organization (IETO), respectively.

programs as a precondition for trading is now provided for in the U.S. protocol proposal.

3. **Adoption of minimum standards for monitoring and reporting**, which would be developed by the international Monitoring Body. This requirement also is included in the U.S. proposal. Government agencies would monitor emissions by examining emissions and fuel use records. This effort would be supplemented by some site inspection and the use of independent data to confirm reported information.
4. **Submission to international law**: Agreement to submit to both the monitoring activities of the Monitoring Body and any sanctions imposed by the Governing Body.

In addition, two other rules would apply to countries adopting cap-and-trade systems. These are:

1. **Adoption and enforcement of strict domestic penalties for non-compliance**. These could include financial penalties on companies in non-compliance and a reduction in allowances. The U.S. experience with acid rain regulation has demonstrated that such measures are an effective means of bringing about compliance. To accommodate local norms countries would be able to choose from a menu of enforcement options or perhaps free to tailor the standards according to their unique circumstances, subject to approval of the Monitoring Body.
2. **Seller Responsibility**: Establishment of laws and/or financial mechanisms that would make sellers rather than buyers responsible for ensuring that allowances are of high quality. If sellers have a financial incentive to create high-quality allowances, fewer violations will occur. Therefore they should bear the legal burden of proof that their allowances are legitimate and transferable. One possibility here is that sellers could be required by domestic law to insure their allowances.

Putting the onus on sellers would be preferable to a "buyer beware" system, under which buyers of allowances would have to take steps to ensure the allowances they bought represented real reductions below the sellers' commitments. The two main objections to this approach are that 1) investors would have to incur high transactions costs, which would dampen market activity; and 2) buyers would have difficulty ascertaining whether or not allowances were backed by real reductions below required levels. In effect, application of the "buyer beware" principle would introduce uncertainty as to whether or not targets were being met.

These additional rules would mean that the allowances sold by these countries would be especially secure, because the emissions sources in these countries will have been directly regulated. This will not be the case in countries adopting policies and measures.

Theoretically, it would be possible to have an international trading system that included countries that did not adopt tough domestic monitoring and enforcement provisions. This would lead to a two-tier system in which allowances from countries with strong infrastructure and tough laws would represent "the gold standard" and allowances from other countries might be viewed as "junk bonds." (A third tier, credits from joint implementation projects undertaken in countries not in the trading system, might also exist.) Buyers would pay less for allowances from countries that had less stringent mechanisms. The problem with this approach is that it would essentially inject a "buyer beware" dynamic into international carbon trading, thereby introducing uncertainty about the quality of allowances and whether or not global GHG reduction targets were being met. Ultimately, the best way to ensure the integrity of the system would be to avoid the development of a two-tier system and require the adoption of strong in-country compliance systems.

In sum, tough in-country monitoring and enforcement provisions represent the primary means of ensuring that the international cap-and-trading system is producing legitimate tradable allowances and that the participating countries are in compliance with their emissions targets. The language about trading in the protocol adopted in Kyoto should allow trading countries to establish strict domestic compliance measures as a precondition for participation in the system. The establishment and use of domestic financial penalties on firms in non-compliance would be an especially important precondition.

IV. International Monitoring and Enforcement

A companion measure for ensuring compliance in an international GHG trading system would be to establish a ***strong international monitoring and inspection regime*** supported by tough enforcement mechanisms.

An important first principle in thinking about international compliance is that most countries will be inclined to comply with their GHG caps. Countries do not make treaties lightly; they expend considerable resources in analyzing, negotiating and ratifying treaties. In the case of the FCCC it is fair to say that countries have signed and ratified the treaty because they believe that doing so serves their long-term interests. The same could be said for countries that choose to participate in an international GHG trading system.

This principle notwithstanding, and even given the establishment of strong national regulatory programs, it would be necessary to adopt international mechanisms for ensuring compliance. This would be especially true if emissions caps were ratcheted down and allowance prices were to rise, because the rewards for non-compliance would be greater under these circumstances.

Features of the international trading infrastructure that would help ensure compliance include annual reporting accompanied by regular in-depth reviews; strict rules regarding company participation in international trading; seller responsibility for delivering real reductions; and sanctions.

A. Annual Monitoring and Enforcement

One feature of the GHG trading system that would complicate international compliance is the budget period, under which all Annex I countries would commit to making reductions over a multiyear period rather than year by year. Budget periods would give countries flexibility in the timing of GHG reductions; a country expecting an economic downturn or the penetration of clean technologies could wait on making reductions, thereby lowering its cost of compliance. The issue raised by a multiyear approach is whether monitoring and enforcement should take place only at the end of the budget period or whether interim monitoring and enforcement should take place as well.

A major difficulty associated with interim monitoring and enforcement would be the definition of non-compliance. At the end of a budget period non-compliance may be said with certainty to either have occurred or not: It would occur when actual emissions exceeded allowances, adjusted for purchases and sales. In contrast, an interim finding of non-compliance would require the Governing Body to make a subjective judgment, because it would not know with certainty that at the end of the budget period the country's emissions for the entire period will exceed its allowances. Even in the case where a country has used up its initial allowances in the middle of the budget period and yet is attempting to sell allowances, it could be argued that the country could make up its deficit by buying allowances before the end of the budget period.

We believe that the Governing Body and the Monitoring Body should be empowered to address potential non-compliance during the budget period. Emissions reporting should take place annually (as called for in the U.S. proposal); in addition, the Monitoring Body should conduct in-depth reviews during the budget period to assess whether or not the administrative systems of trading countries are satisfactory. (International reviews are also provided for in the U.S. proposal, though their frequency is not specified.) If domestic monitoring, reporting and enforcement systems were found to be unsatisfactory, then interim enforcement measures could be applied. These would be less forceful than end-of-period sanctions and might consist of inclusion on a "Greenhouse Watch List", loss of trading rights or a reduction of allowances. These options are discussed further below.

Publicizing probable emissions violations could lead to shame and public outcry, which in turn could lead to diplomatic pressure. Thus even if the Governing Body did not apply

formal sanctions, interim measures might enable it to martial the weight of international diplomacy.³

Finally, it is worth keeping in mind that the importance of interim monitoring and enforcement would be reduced by the shortening of budget periods. In determining the length of these periods, delegates will need to weigh the economic benefits of longer periods against the attendant increase in the difficulty of ensuring compliance.

B. Rules Governing Company Trading

Another matter that complicates the design of an international compliance system is the fact that countries in the trading system will use different domestic regulatory systems to meet their targets. Some will use cap-and-trade systems, others will adopt national policies and measures, and yet others will use a combination of the two. The difficulty comes in trying to go below the country level to include companies in international trading.

Countries that adopt cap-and-trade systems would fit neatly into an international trading system that allowed for company-to-company trading. This would be especially true if the companies in the domestic trading system were responsible for the country's entire commitment. In this case, the allocation of international trading allowances would be identical to the allocation of domestic allowances. A company reducing GHG emissions below allowed levels could sell the allowances on either the domestic or the international market. If it chose the international market, both the company's emissions budget and the country's emissions budget would be reduced by the amount of allowances sold. The integrity of both the domestic and international systems would be maintained: Because the seller was participating in a domestic cap-and-trade system, the buyer would know that the allowance purchased was backed by reductions that fit into an overall national reduction strategy.

Allowing trading by companies from countries adopting national policies and measures such as carbon taxes and building efficiency standards would be more problematic, because these measures do not assign responsibility for emissions reductions to specific domestic parties.⁴ In this case, it is possible that the emissions reduction credits offered by the company were backed by real reductions but that the country as a whole was substantially out of compliance.

³ For a deeper discussion of the importance of diplomatic pressure in international law, see Chayes and Chayes 1995.

⁴ Companies from these countries would trade "emissions reduction credits" ("ERCs") rather than allowances. Each ERC would represent a reduction below a baseline level of emissions. This is the joint implementation now works.

One solution to this problem would be to require that only the government of a country using policies and measures could hold the country's allowances and engage in international trading. Under this approach, companies would not be able to profit directly by trading; however, they might be able to make side arrangements with their governments to receive (some or all of) the proceeds from the sale of allowances. In this situation, the government would essentially act as a broker on the company's behalf.

C. Seller Liability for Allowances

A third important feature of the international trading system would be to make sellers rather than buyers liable for the delivery of the reductions backing allowances, just as with domestic trading systems. Again, establishment of this dynamic rather than "buyer beware" will reduce buyers' transaction costs, provide sellers with an incentive to make required reductions and reduce uncertainty as to the legitimacy of allowances sold.

There are a variety of ways that seller responsibility could be established. One way would be for the Governing Body to require countries to create (together or separately) a reserve pool of allowances that could be drawn on as insurance. Costa Rica has discussed such a pool that would rely on the carbon sequestered in its national parks.

A major difficulty with the insurance pool concept is the fact that countries would have to overcomply to fund the pool. For example, if a country needed to reduce emissions by one hundred million tons per year and was required to contribute ten percent of its reduction requirement to the reserve pool, it could sell allowances only after it had made 110 million tons of reductions. Given that countries are now having difficulty meeting their stabilization targets, this could prove to be a formidable barrier. On the other hand, third party brokers would likely step in and create such pools based on emission reduction option purchases and other hedging techniques.

An alternative approach would be to let a private insurance market develop. Under this model private insurers would agree to provide GHG emissions reductions in the event that allowances sold were not backed by reductions below commitments; in exchange sellers of allowances would pay premiums, which would be set by insurers based on the probability of non-delivery.

D. Sanctions

Even given the appropriate design of the international trading system, the use of sanctions to deter country GHG exceedances would be important in ensuring compliance. Possible sanctions include:

1. **Loss of vote** in the Governing Body or the COP.

2. **International disapproval.** One option here is the inclusion of countries in non-compliance on a "Greenhouse Watch List", which would be similar to the lists used to call attention to countries violating human rights. Another, more severe option is the issuance of a formal condemnation.
3. **Loss of the right to sell allowances.** This enforcement mechanism is contained in the current U.S. proposal.
4. **Reduction of allowances.** This sanction, which is also contained in the U.S. proposal, would reduce the allowances granted to the country in non-compliance in a future budget period. The ratio of exceedances to allowances removed would have to be determined; a ratio of 1:1 would require the country to simply make up for prior exceedances, while a higher ratio would impose a penalty by reducing the country's total allowances. A 1:1 reduction provision is included in the U.S. acid rain law; coupled with financial penalties, it has been very effective.
5. **Devaluation of Allowances.** Under this sanction, the allowances of the country in non-compliance would be devalued by a certain percentage upon their sale. For example, the buyer of ten allowances from a country in non-compliance would have fewer than ten allowances added to its emissions budget. This would reduce the payments received by the host country, making the country less competitive with other sellers.
6. **Trade sanctions** tied to GHG-emitting industries. These could include duties on the imports of countries in non-compliance, import bans, quotas and other forms of retaliation. The World Trade Organization (WTO) has not taken a position as to whether it would have jurisdiction over the trading of carbon allowances, so it is not now clear whether trade sanctions would be imposed under WTO auspices. This topic is discussed in greater detail below.
7. Imposition of **financial penalties** by the Governing Body on the country in non-compliance. The penalty could be assessed on a per-ton basis; for instance, the penalty might be \$100 per ton of carbon dioxide-equivalent of exceedance. A penalty of this size would act as a significant deterrent to non-compliance because it is likely to far exceed the cost of compliance.

Financial penalties would be paid into a fund, perhaps the Global Environment Facility (GEF), which would then purchase GHG reductions. To ensure payment of penalties, countries might be required to offer a bond or other form of assurance. A variation on this sanction would be withdrawal of the ability to draw on the GEF, though this would not affect most participating countries, which at least initially would include Annex I countries only.

8. **Loss of multilateral development funds.** This also would not affect most participating countries.

These options may be judged on several criteria. These include certainty of compliance (i.e., environmental effectiveness), transaction costs, political feasibility, and flexibility in implementation (i.e., the ability to issue various gradations of penalties.)

1. Certainty of Compliance

The effectiveness of the various options in ensuring compliance would be a function of the perceived impact that they would impose, unless they were so strict that they were seen as unenforceable.

In general, stiff financial penalties and trade sanctions represent the most powerful deterrents of non-compliance. Financial penalties probably pose the most immediate and tangible threat; they would be especially effective if they triggered immediately upon a finding of non-compliance rather than after negotiation, and if they were designed to be greater than the penalties imposed by the countries on their companies in non-compliance. This would give countries an additional incentive to enforce domestic laws. An important strength of the use of financial penalties in ensuring compliance is that it would create funding for the purchase of reductions to cover the shortfall of the country in non-compliance. The international community thus could be sure that the GHG exceedance by the country in violation did not cause the trading community as a whole to fail to meet targets.

Measures that tie to trading (a loss of selling rights, devaluation) would be effective only to the extent that a country would achieve large cost savings or earn significant revenues through trading. This will vary by country, meaning that the penalty will work better in some cases than others. Similarly, the pain associated with a reduction in allowances would be a function of the cost of making further reductions. A reduction in allowances and loss of the right to sell would provide a greater deterrent than devaluation.

The options that appear to be strictly diplomatic (loss of voting rights in the COP and international disapproval) probably would be less effective than other options. One reason is that it may be more difficult to mobilize public opinion around global climate change than around the subjects of other international treaties, such as human rights and nuclear proliferation. In addition, as already mentioned, the need for significant cuts in emissions would drive allowance prices up, further increasing the benefits of buying and selling illegitimate allowances. It is important to note, though, that a seemingly diplomatic sanction such as inclusion on a Greenhouse Watch List would have a financial component,

in that it would send a negative signal to potential allowance buyers. This would result in a drop in the value of a country's allowances.

Sanctions would be most effective if applied in tandem. For instance, enforcement provisions could call both for payment of penalties and the loss of allowances, as is the case with the acid rain law. Another possibility is that penalties could be applied sequentially, with tougher measures imposed only after lesser ones have been tried. As an example, loss of selling rights could serve as an interim sanction, applied only during the budget period, with financial penalties applied at the end of the budget period.

2. Political Feasibility

International environmental agreements typically rely on peer pressure and public outcry to bring about compliance. In contrast, there has been very little use of financial sanctions, which are seen as threats to national sovereignty, burdensome and simply not the norm.⁵ Loss of voting rights in the COP and international disapproval probably are the most politically feasible options, because they fit best with the accepted practices of international diplomacy.

This does not mean that financial measures (options 3 through 8) could not be used. Options such as the loss of trading rights, devaluation and reduction of allowances probably would be more acceptable than financial penalties and trade sanctions because they "fit the crime", that is, they are tied to the trading system.

The imposition of fines probably would be most politically difficult, primarily because requiring the payment of fines to an international body might be viewed as an infringement upon national sovereignty. In addition, fines might be resisted simply because they are tough and because they might require the posting of a bond. The latter feature might be opposed by country treasuries, which would not want to incur an extra obligation. One way financial penalties could be made more palatable would be to impose them only as end-of-budget period measures, after a process of dispute resolution, and/or after other options had been exhausted. For instance, one strategy would be to employ a less severe measure such as loss of the right to sell allowances as an interim sanction and financial penalties only at the end of budget periods.

Shadowing the discussion of political feasibility is the issue of WTO treatment of GHG allowances. WTO is the organizational foundation of the international trading system. It is the successor to GATT and is "the platform on which trade relations among countries

⁵ The Montreal Protocol is the only international environmental agreement that calls for financial penalties. To date these penalties have not been applied. Stewart et al., 1996; Vaughan, 1997.

evolve.”⁶ All Annex I countries are WTO members. If WTO were to consider allowances to be a good or service regulated under its agreements, then trading would be subject to WTO rules. If this were the case, then any of the sanctions discussed might be found to be inconsistent with the WTO agreements. Trade sanctions for GHG exceedances would be especially problematic, because generally, the WTO allows for trade sanctions only in retaliation against dumping (the sale of goods at predatory prices) and the use of subsidies to protect domestic industries. On the other hand, WTO jurisdiction over allowance trading may improve the political feasibility of applying sanctions: If trade sanctions could be applied under WTO auspices, then there would be no question as to their legitimacy.

The WTO has not yet taken a stand on GHG trading.⁷ Given, though, that the WTO has never taken up an investigation of an international environmental agreement,⁸ there is no reason to presume that WTO regulation would preclude the use of penalties in the governance of the trading system.

3. Transaction Costs

The level of technical and organizational complexity associated with an enforcement mechanism determines the level of transaction costs. When transaction costs are lower implementation becomes more feasible.

The level of transaction costs associated with particular options would depend to a large extent on the events deemed to trigger sanctions. A sanction might be imposed immediately upon a finding of non-compliance by the Monitoring Body, in which case transaction costs would be relatively low. Alternatively, sanctions might be imposed after a process of investigation and negotiation – perhaps by a tribunal, as is the case under the Montreal Protocol, or through a dispute resolution process such as that employed by the WTO. If this were the case, then the transaction costs associated with any of the sanction alternatives presented would be high.

Under either scenario, some measures would be more costly to implement than others. Measures such as loss of vote in the COP, loss of trading rights and reduction of allowances would be relatively simple to administer, once the Governing Body had decided upon them. In contrast, the imposition of options such as trade sanctions and reductions in foreign aid would require further investigation, analysis and coordination and therefore would entail higher costs. Devaluation of allowances might or might not be costly to impose, depending on whether the devaluation rates were predetermined or assessed on a case-by-case basis.

⁶ WTO Internet web site, as of April 3, 1997.

⁷ Stewart et. al., 1996; personal communication with Scott Vaughan, WTO Secretariat, April 7, 1997.

⁸ Vaughan 1997.

The imposition of financial penalties would be made more complex by the need to guarantee payment in the event of non-compliance. This guarantee could come in the form of a bond, a reserve pool of allowances or some other form of insurance. The creation and implementation of any of these mechanisms would demand substantial time and resources.

The application of trade sanctions might be particularly complicated if GHG trading were regulated by the WTO, in which case sanctions could be imposed only after the WTO dispute resolution process had been undertaken. This would involve consultations under WTO auspices between the accusing and accused countries and then as necessary, examination of the complaint by a WTO panel, appeal by either party, and finally, imposition of a retaliatory measure.

4. Flexibility in Implementation

It is important that the Governing Body be able to design penalties commensurate with the level of exceedances and take consideration of the reasons for non-compliance. To the extent that the enforcement of penalties took place after a process of diplomacy, then the application of any of the penalties mentioned would take place in a flexible way. If instead penalties were triggered immediately upon a finding of non-compliance, then penalties would be less flexible.

Even in this case, however, some of the measures would provide for more flexibility than others. International disapproval, reduction of allowances and trade sanctions all could be imposed in a measured way, giving the international community the opportunity to express itself carefully. In contrast, loss of vote in the COP and loss of trading rights are discrete, all-or-nothing measures that afford little flexibility. Devaluation and financial penalties both could either be specified in advance, in which case they would be inflexible, or imposed upon the judgment of the Governing Body.

5. Conclusions

Table 1 presents the ranking of the international sanction options across the four criteria mentioned. The ideal enforcement mechanism would combine environmental effectiveness with political feasibility and low transaction costs. It also would provide the international community with the opportunity to tailor penalties according to circumstances.

None of the measures reviewed represents this combination, primarily because there is a tradeoff between environmental effectiveness and political feasibility. Tough financial penalties would be the most effective deterrent of GHG exceedances, especially if imposed by the Governing Body immediately upon finding of a violation. Such penalties would be

difficult to implement, however, because they are strict and because they are contrary to the norms of international diplomacy.

Table 1 Evaluation of International Sanction Alternatives				
Measure and Measure Type	<i>Environmental Effectiveness</i>	<i>Political Feasibility</i>	<i>Feasibility of Implementation</i>	<i>Flexibility</i>
Loss of Vote in the COP	Weak	Easy	Easy/Moderate	Inflexible
International Disapproval	Weak/ Moderate	Easy	Moderate/ Difficult	Flexible
Loss of Trading Rights	Moderate	Moderate	Easy/Moderate	Inflexible
Reduction of Allowances	Moderate	Moderate	Easy/ Moderate	Flexible
Devaluation of Allowances	Moderate	Moderate	Easy/Moderate	Moderate
Trade Sanctions	Strong	Difficult	Difficult	Flexible
Financial Penalties	Strong	Difficult	Moderate	Moderate
Loss of Development Funds	Strong	Difficult	Difficult	Flexible

Trade sanctions also would provide an effective deterrent to non-compliance. They might also meet political resistance, however, unless they were imposed under WTO jurisdiction. Trade sanctions would come with high transaction costs, especially if the international GHG trading system fell under WTO rules.

Loss of trading rights and a reduction of allowances also could be effective measures, and might be more agreeable to potential trading countries because they relate directly to GHG exceedances. The reduction of allowances appears especially attractive because required reductions could be tailored according to specific circumstances. Inclusion of countries exceeding their allowances on a Greenhouse Watch List also could be an effective interim enforcement mechanism, in that it would carry diplomatic weight and also send a signal to markets.

V. Summary

This paper has described two options for ensuring compliance with GHG emissions caps, as embodied in an international GHG allowance trading system. The most critical component of the overall GHG trading structure would be the requirement of strong national monitoring and enforcement mechanisms. This is the first line of defense in ensuring that allowances are real and countries are meeting their targets.

The second critical component is the establishment of the appropriate international trading and compliance structure. Monitoring and reporting should occur annually, while in-depth reviews should take place both during and at the end of budget periods. If these reviews were to uncover major weaknesses in domestic compliance systems, then measures such as loss of trading rights and inclusion on a Greenhouse Watch List could be applied. If politically viable, tougher sanctions such as trade sanctions and financial penalties should be imposed at the ends of budget periods. If these are not feasible, then options such as a reduction of future allowances and loss of trading rights should be considered.

The protocol signed in Kyoto should authorize international GHG trading and should establish strict rules for participation in trading. These preconditions should include many features now contained in the U.S. proposal, including the adoption of international measurement standards and submission to international review and sanctions. In addition, countries employing domestic cap-and-trade systems should be required to establish and impose strict enforcement measures against companies exceeding their caps. These conditions would ensure that the allowances traded represent real reductions below allowed levels, thereby guaranteeing that trading is a tool that helps countries to meet their targets.

References

- Chayes, Abram, and A.H. Chayes. 1995. *The New Sovereignty: Compliance with International Regulatory Agreements*. Harvard University Press, Cambridge MA.
- Stewart, Richard B., Jonathan B. Wiener and Philippe Sands. 1996. *Legal Issues Presented by a Pilot International Greenhouse Gas Trading System*. United Nations Conference on Trade and Development (UNCTAD), New York, NY.
- Tietenberg, Tom, and David G. Victor. 1994. *Possible Administrative Structures and Procedures*. In: *Combating Global Warming: Possible Rules, Regulations and Administrative Arrangements for a Global Market in CO₂ Emission Entitlements*. United Nations Conference on Trade and Development (UNCTAD), New York, NY.
- U.S. General Accounting Office. 1992. *International Environment: International Agreements are not Well Monitored*. USGAO, Washington DC.
- Vaughan, Scott, World Trade Organization. Personal communication, April 7, 1997.
- World Trade Organization. 1997. Internet home page, April 3, 1997. WTO, Geneva, Switzerland.

Clinton Presidential Records Digital Records Marker

This is not a presidential record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

This marker identifies the place of a publication.

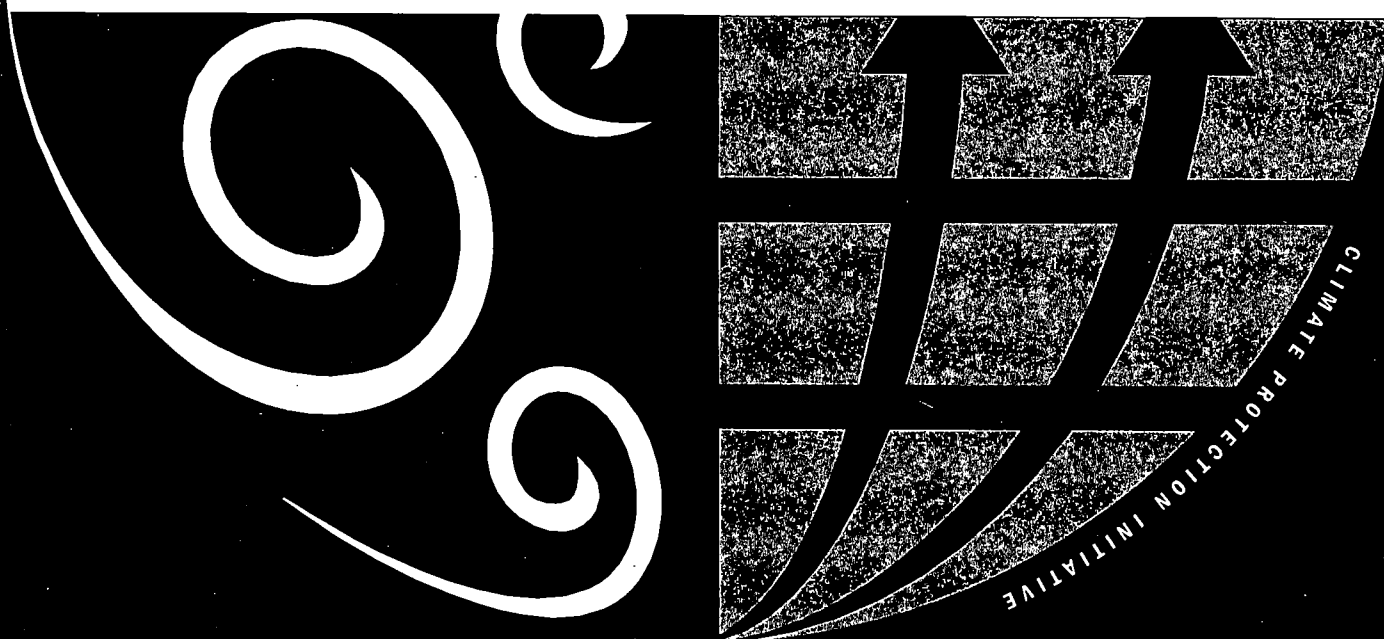
Publications have not been scanned in their entirety for the purpose of digitization. To see the full publication please search online or visit the Clinton Presidential Library's Research Room.

WORLD RESOURCES INSTITUTE



THE COSTS OF CLIMATE PROTECTION:

A GUIDE FOR THE PERPLEXED



ROBERT REPETTO AND DUNCAN AUSTIN

Corrections from
Janet Yellen / CEA

JY

6/23/97 9:00 p.m.

**PRESIDENT WILLIAM JEFFERSON CLINTON
ADDRESS TO THE UN SESSION ON ENVIRONMENT AND DEVELOPMENT
NEW YORK CITY
JUNE 26, 1997**

Acknowledgments: Mr. President, Mr. Secretary General, Distinguished Leaders.

Five years ago, the nations of the world joined together in Rio de Janeiro around a simple but revolutionary proposition: that today's advances should not come at the expense of future generations -- that the earth we leave to our children and grandchildren must be as rich with promise and beauty as the one we inherited.

At Rio, the world embraced a compelling reality: our responsibilities to build a brighter future for our people and to protect the environment are linked together. Today, we know that we must keep our forests healthy and whole, our rivers pure and oceans clean...that preserving the resources we share is crucial to stability and peace, within nations and among them...and that what comes out of a smokestack or goes into the water within one nation's borders can do grievous harm to others. Just as our nations must work together to promote economic growth, good jobs and social progress, we must join together in safeguarding the natural resources on which growth, jobs and progress[!] depend.

In the years since Rio, our shared resolve has led to real progress. The United States is proud to have led the effort to ban ocean dumping of radioactive wastes...and reduce land-based sources of marine pollution. With others, we are working to protect the coral reefs... conserve threatened fish stocks...and stop ozone depletion, which threatens life in the ocean and on land. We are

taking part in the effort to stop the advance of deserts. And we helped forge a consensus at the Cairo Population Conference that recognizes individuals' right to make family planning choices.

Here in America, we are also making important strides. We have cleaned up a record number of toxic waste dumps -- though we have many more to clean. We passed tough new laws to better protect our water, created new national parks and monuments and prevented mining in Yellowstone and oil and gas development in the Arctic National Wildlife refuge. Our efforts for environmental protection, economic growth and social improvement are increasingly united -- and I am proud of the work my Council on Sustainable Development is doing to strengthen that unity.

But in the last five years, we have all learned a hard lesson: achieving the goals we set for ourselves in Rio will be more difficult than we thought. The father of American conservation, John Muir, said, "When we try to pick anything out by itself, we find it hitched to everything else in the universe." That is the glory of nature -- which we see in the rainforest's web of life or Muir's beloved California woodlands -- it is also the hurdle before mankind as we try to manage the complex relationship between human society and the natural world. As Vice President Gore said on Monday, "Sustainable development requires sustained commitment."

Nowhere is this more true than on the critical issue of climate change. The scientific debate is over: Concentrations of greenhouse gases in the atmosphere are at their highest level in more than 400,000 years and climbing sharply. If the trend is not changed, the seas will rise more than three feet in the next century. In America, that means 9000 square miles [ck] of Florida, Louisiana and other coastal areas will be flooded...in Asia, 17% of Bangladesh, now home to 6

*overstated.
This should
be toned
down --
these
catastrophes
are possible
but not
certain, even
if the trend
is not changed.*

million people, will be lost...islands such as the Maldives will disappear from the map. The changed climate will disrupt agriculture, cause severe droughts and floods...and the spread of infectious diseases, including 50 million or more cases a year of malaria.

Just as no nation is immune from this danger, no nation can evade its responsibility to confront it. We must all do our part -- developing nations and the developed nations of the world that emit the largest quantities of greenhouse gases. My own country's responsibility is clear. The United States represents only 4% of the world's population, yet we emit more than 20% of the world's greenhouse gases. That must change. That will change -- starting with a strong agreement in Kyoto in December on emissions targets. The United States supports realistic, achievable and binding limits that return emissions to 1990 levels and then reduce them.

Let us be clear: This effort will not be easy. It will carry significant costs. And it will demand sustained effort over many decades. Governments and industries will have to make significant investments to create new technologies and curtail pollution. Meeting our goals will require that we innovate...distribute the burden fairly in our societies...and above all, use common sense to reduce our emissions at the lowest possible cost and achieve maximum protection of the environment.

Possible changes: (1) It will entail costs. (2) It will entail changes in energy prices and use. (3) It will entail significant structural shifts in the economy. (4) Not too easy and it will not be costless.

To make good on our commitment, we must make our people full partners in this challenge. Ultimately, their ingenuity and determination -- as well as that of people around the world -- will decide our success. Our immediate task is to galvanize our people -- and in the coming months, I will work to do exactly that. I and my cabinet will speak to the American people about every aspect of climate change, and I will chair a White House conference on climate change this fall.

We will ^{lay out} ~~give them~~ the scientific facts so that they understand why we must act... and the economic facts so that they understand ^{both benefits and} the costs.

We also must hear from those who recognize in this global problem a global opportunity -- to develop essential new technologies that increase productivity and energy efficiency. Now, we must unleash more of the creative power of our people to seize these possibilities. For example, we must find ways to use the sun's energy to reduce our reliance on fossil fuels. To advance that effort, I am announcing that the United States will put up 1 million solar roofs around our nation by the year 2010. By capturing the sun's warmth, we can help turn down the earth's temperature.

Today, I want to discuss three other initiatives that will help us confront the problem of climate change and advance the sustainable development goals we share.

First: To help developing nations fulfill their responsibilities to reduce greenhouse gases, I am pleased to announce that the U.S. will provide them with \$1 billion in assistance over the next five years. These funds will go to programs that support energy efficiency and the development of alternative energy sources and better resource management to promote growth in ways that do not contribute to global warming.

Second: Aid alone cannot guarantee that sound, sustainable practices take root in the developing nations. Only when nations build thriving economies with free markets and embrace wise environmental policies can these goals be achieved. That is why the United States will work harder to encourage private investment that meets environmental standards. Starting today, the

U.S. Overseas Private Investment Corporation will require that its projects adhere to new and strengthened environmental guidelines. In our era, trade and investment -- not aid -- are the primary engine of economic change. This effort can pave the way to common guidelines for responsible investment -- and greatly strengthen sustainable growth in developing countries.

Third: All our nations must do better at safeguarding forests, which are vital for maintaining life on our shared planet. There has been much helpful discussion, but now nations must act more effectively. The United States will work to eliminate subsidies and incentives that encourage destructive logging practices...protect large, ecologically important roadless areas in our national forests...establish an independent committee of scientists to improve management of those forests.

Distinguished leaders: In all of our cultures, the thought has been handed down that, as Scripture says, "One generation passes away and another comes, but the earth abides forever." We know the earth will abide forever. But we must fulfill our obligations so that when this generation passes, it will be the earth we know that the coming generation inherits.

We must act wisely with our environment -- so we can we build a 21st century in which people live in harmony and not at war...so that today's growth does not threaten tomorrow's survival. We have much work to do. Let us strengthen our resolve -- and let us turn to it.

###



9709923 XR 9709240
United States Department of State

Washington, D.C. 20520

June 2, 1997

JLY
AHM
JAF
JS

UNCLASSIFIED

MEMORANDUM TO:

MS. JULIETTE FALKNER
Special Assistant to the Secretary and
Director, Executive Secretariat
Department of the Interior

MR. WILLIAM NITZE
Assistant Administrator
for International Activities
Environmental Protection Agency

MS. BETTIE BACA
Director
Executive Secretariat
Department of Interior

MS. LYNNE F. FINNERTY
Executive Secretary
Department of Agriculture

MR. T. MICHAEL KERR
Executive Secretary
Department of Labor

MR. BRUCE N. REED
Assistant to the President for Domestic
Policy
Domestic Policy Council

MR. JAMES N. SOLIT
Director
Office of the Executive Secretariat
Department of Energy

MS. ANNA-MARIE KILMADE GATONS
Director, Executive Secretariat
Department of Justice

MR. J. BENJAMIN NYE
Executive Secretary
Department of the Treasury

MS. JUDITH BURRELL
Director, Executive Secretariat
Department of Transportation

MS. RYAN CONROY
Executive Secretary
Agency for International Development

MS. MICHELE JOLIN
Chief of Staff
Council of Economic Advisors

MR. FREDERICK MONTGOMERY
Assistant US Trade Representative
for Policy Coordination
Office of the US Trade Representative

MR. GLYN T. DAVIES
Executive Secretary
National Security Council

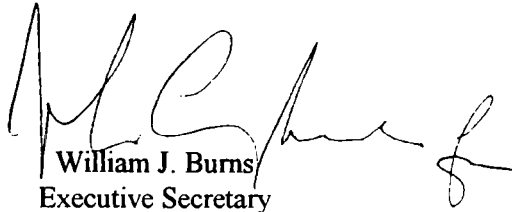
LEON FUERTH
Assistant to the Vice President for
National Security Affairs
Office of the Vice President

MS. SUSANNE BACHTEL
Special Assistant to the Director
Office of Science and Technology
Policy

DR. GORDON ADAMS
Associate Director for
National Security and International
Affairs
Office of Management and Budget

Subject: Climate Change

The staff of the Vice President has suggested that the attached memorandum be distributed to principals of the Interagency Working Group on Climate.


William J. Burns
Executive Secretary

Attachment:

As stated.

ORIG CENT TO OVP
COPIES TO:
S
D
G
S/S
RF/CWA

S/S 9709240

THE SECRETARY OF STATE
WASHINGTON

'97 MAY 24 P1:55

May 23, 1997

UNCLASSIFIED

MEMORANDUM FOR THE VICE PRESIDENT

FROM: Madeleine K. Albright *MKA*

SUBJECT: Climate Change

I am writing to express my strong view that we must reach closure very soon on how to proceed on the issue of climate change. As you know, the State Department is actively engaged in negotiations to secure an agreement in Kyoto this December. These negotiations are critical if the world is to address climate change in a serious and effective way. Our ability to reach a successful conclusion depends on a set of policy decisions that must be made by you and the President. I am concerned that if some of these decisions are not made and publicly announced in time for the Summit in Denver and the Special Session of the United Nations General Assembly in June, the negotiations are in danger of falling apart. Specifically, I feel we must provide a strong signal on where we stand on the three following issues, so that others with differing views will understand the strength of our commitment to an agreement that is successful for our environment as well as our economy.

1. EMISSIONS REDUCTION TARGET

We have made clear, beginning in Geneva last July, that we believe the developed world must negotiate a serious, realistic, legally binding emissions reduction target. But we have given no sign of what kind of target would be appropriate. In fact, the only clear target that has been submitted recently has come from the European Union (a proposed reduction of 15% below 1990 emission levels by the year 2010). This is not a target that we find either realistic or achievable. While we have stressed the importance of other issues in the negotiations, our ability to negotiate a package of requirements is highly dependent

UNCLASSIFIED

UNCLASSIFIED

- 2 -

on the kind of target that we are willing to accept. I am not suggesting that we announce a proposed target over the next several months. But I believe we must provide a sense of what might be possible for the United States; in other words, a statement of intent to negotiate a target in Kyoto that would begin to take us below 1990 emission levels. Were we to reach such a conclusion, and then have this conclusion announced this summer, I believe our ability to deal with other critical issues would be greatly strengthened.

2. FLEXIBILITY

We have repeatedly made clear that one of our major objectives in the climate negotiations is to establish a system that is sufficiently flexible so as to allow for maximum cost effectiveness in achieving our targets. Our analysis shows that there will be significant economic costs associated with our effort to protect the climate system, and it is in the world's interest to minimize those costs wherever possible. We have specifically urged the adoption of multi-year targets, a global emissions trading system, and programs to allow for projects that can be implemented jointly with other nations. We must reiterate the importance we attach to these provisions, since they will significantly affect not only our own costs, but also those of others. And the more we can reduce our costs, the more ambitious our targets can become.

3. DEVELOPING COUNTRY PARTICIPATION

This is the most difficult issue we are facing in this negotiation. We cannot avert major environmental impacts from climate change unless all nations participate in this effort. Certainly, we in the developed world have been responsible for most of the emissions to date, and we must play a leadership role in finding alternative technologies and significantly reducing our emissions. But if emissions from developing countries simply grow unabated, our efforts will be for naught. On the other hand, we cannot expect countries whose per capita emissions are from one tenth to one twentieth of ours to take the same steps as we do. What is important is that we strike the right balance - by bringing these countries into the process and insisting that

UNCLASSIFIED

UNCLASSIFIED

- 3 -

they take some steps now, and making it clear that their obligations will grow over time. Reiterating this view and insisting on its inclusion in the final agreement, is crucial if we are to have an outcome that we can sign on to in Kyoto.

Our position on climate change is a true test of our seriousness on global environmental issues. We must move forward to make the necessary policy decisions as soon as possible so that we can have an opportunity to achieve our objectives in December.

UNCLASSIFIED

THE WHITE HOUSE
WASHINGTON
February 6, 1997

Copy
JES
JAF
MM

MEMORANDUM FOR DISTRIBUTION

FROM: Kristen Panerali
National Economic Council

SUBJECT: Climate Change Deputies Meeting

The Climate Change Deputies meeting scheduled for Tuesday, February 11 is canceled.

There will still be a Climate Change Deputies meeting on Monday, February 24 at 2:00 pm in 231 OEOB. Deputies plus one are invited to attend. An agenda will be sent to you before the meeting. Please call Kristen Panerali at 456-5353 with your clearance information (date of birth and social security number) by COB February 21.

Distribution:

Charles Curtis, DoE
Mort Downey, DOT
Ev Ehrlic, Commerce
Leon Fuerth, OVP
John Garamendi, DOI
Jack Gibbons, OSTP
Jamie Gorelick, DOJ
David Hales, AID
Fred Hanson, EPA
Jeff Lang, USTR
Jack Lew, OMB
Ira Magaziner, DPC
Cynthia Metzler, Labor
Richard Rominger, USDA
Alicia Munnell, CEA
Nancy Soderberg, NSC
Larry Summers, Treasury
Tim Wirth, State

Economic Effects of Global Climate Change Policies

Results of the Research Efforts of the
Interagency Analytical Team

June 1997

Introduction

In June 1996, the Department of Energy (DOE) and the Environmental Protection Agency (EPA) sponsored a joint workshop where more than 50 experts from inside and outside the government made presentations on technical issues associated with our emissions trends and capability to reduce emissions trends in the next century. As a part of that workshop, the Interagency Analytical Team (IAT), released what were then preliminary results on the economic effects of emissions reduction proposals.

Since that June 1996 workshop, the IAT has reviewed its work, selected new modeling instruments and improved its approach to old ones, and developed a new set of modeling runs that lead to a better understanding of the economic dimensions of the climate change policy problem. This paper describes those efforts. It first summarizes the IAT model selection process. Second, it discusses the (pre-policy) base case used to measure the effects of various policy options. Third, it discusses the IAT's core emissions reduction scenario. Finally, the bulk of this paper discusses the results of the IAT's analysis.

The modeling work performed for this analysis was done by economists at the DOE and the Environmental Protection Agency EPA. The IAT also included members from the Departments of Commerce, Treasury, Labor, and State, as well as members of the White House staff. The majority of the IAT members are still primarily from DOE and EPA --the agencies that have the primary responsibility for the Administration's energy and environmental policies.

Model Selection

The first task that the IAT confronted was to review the analytic "toolbox" to assure that it had all the tools necessary to specify the economic effects of a broad range of climate change proposals. At the time, the IAT relied primarily on the Data Resources, Inc. (DRI) macro model to measure economic effects. After this reevaluation of our modeling needs, it was readily apparent that the complexity of the analysis would require a broader range of analytical tools.

At a public meeting last November, the IAT announced the selection of three models for its analysis. It decided to continue to use the DRI model, but also included two additional models. The Second Generation Model (SGM) and the Markal-Macro model. Each of these three models met the criteria of being available in the public sphere; being well documented; having a track

record of analysis in the climate change area; being widely understood within the energy-environment community; and of bringing a unique capability to the IAT's work. Used separately, but in concert with each other, they provide the broad analytical capability needed to examine the many complex economic effects of potential global climate change policies.

The DRI model is a large disequilibrium model of the domestic economy that is particularly well suited to identify transition issues based on short-run behavior embedded into a long-run model. The DRI macroeconomic model is linked to energy, regional, and industry sub-models so that macroeconomic effects of policies are translated into the effects on specific industries and regions of the country. The link to energy sub-models provides specific detailed information about the interaction of the energy sector with the rest of the economy. The DRI model also includes the interaction of the financial markets with markets for goods and services and enables the analysis of the interaction of fiscal and monetary policy with the rest of the economy.

The SGM model is a computable general equilibrium good at identifying an economy's long-term trends in response to climate policies. As such, it is particularly good at describing the economy's long-term path while not as good at describing short-term transition issues. In this sense, its strengths and weaknesses are counterpoised to those of DRI. International in scope, SGM also provides detail for 12 global regions that allows us to examine the effects of permit trading and joint implementation. The SGM model assesses the impacts of greenhouse gas emissions policies on economic growth, consumption, and energy.

The DRI and SGM models can be thought of as lying at opposite ends of an axis that measures time horizons. A second dimension of the climate change problem concerns the role of technology. Both DRI and SGM allow technological progress to move forward in response to the parameters of their models. But given the unpredictable character of innovation, the IAT concluded that a second approach would be helpful. The Markal-Macro model consists of an integrated energy supply and demand modeling system (Markal) and a macroeconomic model (Macro) useful for translating technological assumptions into economic outcomes. Thus, the Markal-Macro model is particularly useful in answering the question, "How do we get there from here?" Markal-Macro allows the user to control technology innovation and diffusion and its cost to the user in order to determine the levels of energy efficiencies that might be expected from a long-term policy announcement. This model also allows us to understand the implications of technology and its interaction with the economy, and helps us determine whether expected energy efficient technologies hold the key to continued economic growth.

The DRI model and the SGM model in some sense provide notional brackets for estimates of the economic effects of carbon-limiting policies. The DRI model is focused on short-term transitions and measures the economy in quarters. In some sectors, the DRI model has forward-looking behavior, but it is structured to examine the effects of short-term changes in the economy, and is often held to overstate the transitions created by broad, secular changes in the economy (and, as will be discussed below, might overstates subsequent economic improvements as well). The SGM model focuses on these long-term transitions and measures the economy in five-year intervals. Thus, it risks racing past short-term transition issues, while identifying the economy's ultimate destination.

The Base Case

The domestic energy and emissions baseline forecasts were taken from the Energy Information Administration's 1997 Annual Energy Outlook (AEO97) while the international baseline forecast was taken from the International Energy Agency's World Energy Outlook, except for the baseline forecast of the Former Soviet Union (FSU), which came from World Bank projections. The IAT then imposed, as best possible, consistency across the models with regard to projections of baseline GDP, total energy consumption, and carbon emissions. Once these were calibrated into the 3 models, the models solved for energy prices by fuel type. Thus, the baselines of the three models are consistent, but not identical.

Tables 1 and 2 summarize the IAT baseline. In the baseline, U.S. economic growth is projected to slow over the next several decades, as the retirement of "baby boom" workers slows labor force growth and reduces the economy's potential growth rate. Energy demand therefore grows somewhat more slowly than it now does. Energy intensity, measured as energy use per dollar of GDP (the E/GDP ratio), is a key ingredient in the AEO97 forecast, because it measures the growing efficiency with which the economy uses energy. In the 1970s and 1980s, the E/GDP rate of decline averaged almost 2 percent annually. Moderate price increases and the growth of more energy-intensive industries in the late 1980s lead to a slower decline of energy intensity--about 0.9 percent annually. The baseline projection used for this study incorporates a 1.0 percent annual reduction in energy consumption per unit of real output, which is taken from the EIA's Annual Energy Outlook. With these improvements included, energy demand grows at an annual rate of about 0.8 percent over the period from 1995 to 2020, tailing off at the end of the period as does economic growth.

Carbon emissions in the baseline are projected to increase by about 1.2 percent a year through 2010, and by 0.6 percent annually from 2010 to 2020, reaching 1805 million metric tons in 2020. In 1990, the year most frequently used in the negotiating process as the level of carbon to stabilize at, carbon emissions were 1,340 million metric tons, 22 percent below EIA's projection for 2010 and 21 percent below DRI projection for 2020.

Table 1: IAT Domestic Baseline

	Year						Average Annual Growth Rate (percent) ¹						
	1990	1995	2000	2005	2010	2015	2020	90-95	95-00	00-05	05-10	10-15	15-20
Population													
DRI-DRI Energy	250	263	276	287	299	311	323	1.0	0.9	0.8	0.8	0.8	0.7
AEO97 (NEMS) ²	250	264	276	287	299	311	n/a	1.0	0.9	0.8	0.8	0.8	n/a
SGM	250	263	276	287	299	311	323	1.0	0.9	0.8	0.8	0.8	0.7
Markal-Macro	250	263	276	287	299	311	323	1.0	1.0	0.8	0.8	0.8	0.8
GDP (\$Billion 1992)													
DRI-DRI Energy	\$6,139	\$6,743	\$7,515	\$8,320	\$9,163	\$9,996	\$10,670	1.9	2.2	2.1	1.9	1.8	1.3
AEO97 (NEMS)	\$6,139	\$6,739	\$7,544	\$8,390	\$9,185	\$9,880	n/a	1.9	2.3	2.1	1.8	1.5	n/a
SGM	\$6,139	\$6,739	\$7,544	\$8,390	\$9,185	\$9,880	\$10,591	1.9	2.3	2.1	1.8	1.5	1.4
Markal-Macro	\$6,139	\$6,739	\$7,549	\$8,384	\$9,198	\$9,880	\$10,498	1.9	2.3	2.1	1.9	1.4	1.2
OMB ³	\$6,142	\$6,721	\$7,470	\$8,343	\$9,225	\$9,929	\$10,581	1.8	2.1	2.2	2.0	1.5	1.3
Total Energy Consumption (Quads) ⁴													
DRI-DRI Energy	82.6	88.9	95.9	101.0	105.3	107.4	108.9	1.5	1.5	1.0	0.8	0.4	0.3
AEO97 (NEMS)	83.7	90.0	97.9	103.4	107.9	110.9	n/a	1.5	1.7	1.1	0.9	0.5	n/a
SGM	81.2	90.6	96.0	102.0	107.0	110.3	113.0	2.2	1.2	1.2	1.0	0.6	0.5
Markal-Macro	83.7	90.9	98.0	103.7	107.8	110.7	115.3	1.7	1.5	1.1	0.8	0.5	0.8
Energy Intensity (TBtu/\$92GDP)													
DRI-DRI Energy	13.5	13.2	12.8	12.1	11.5	10.7	10.2	-0.4	-0.7	-1.0	-1.1	-1.3	-1.0
AEO97 (NEMS)	13.6	13.4	13.0	12.3	11.7	11.2	n/a	-0.4	-0.6	-1.0	-1.0	-0.9	n/a
SGM	13.2	13.5	12.8	12.2	11.6	11.2	10.7	0.4	-1.0	-1.0	-1.0	-0.9	-0.9
Markal-Macro	13.6	13.5	13.0	12.4	11.7	11.2	11.0	-0.2	-0.8	-1.0	-1.1	-0.9	-0.4
Minemouth Coal Price (\$95/ton)													
DRI-DRI Energy	\$23.92	\$18.45	\$15.28	\$14.41	\$13.76	\$13.16	\$12.70	-5.1	-3.7	-1.2	-0.9	-0.9	-0.7
AEO97 (NEMS)	\$19.88	\$18.83	\$18.38	\$17.47	\$16.92	\$15.46	n/a	-1.1	-0.5	-1.0	-0.6	-1.8	n/a
SGM	\$19.88	\$19.45	\$18.48	\$17.30	\$16.47	\$15.73	\$14.96	-0.4	-1.0	-1.3	-1.0	-0.9	-1.0
Markal-Macro	\$19.88	\$18.83	\$17.37	\$16.39	\$15.90	\$16.39	\$16.14	-1.1	-1.6	-1.2	-0.6	0.6	-0.3
World Oil Price (\$95/Barrel)													
DRI-DRI Energy	\$25.23	\$17.14	\$16.18	\$18.93	\$21.24	\$22.86	\$23.95	-7.4	-1.1	3.2	2.3	1.5	0.9
AEO97 (NEMS)	\$24.87	\$17.26	\$18.20	\$19.72	\$20.41	\$20.98	n/a	-7.0	1.1	1.6	0.7	0.6	n/a
SGM	\$24.87	\$17.26	\$18.20	\$19.72	\$20.41	\$20.98	\$21.57	-7.0	1.1	1.6	0.7	0.6	0.6
Markal-Macro	\$24.87	\$17.26	\$18.59	\$19.75	\$20.29	\$21.05	\$22.20	-7.0	1.5	1.2	0.5	0.7	1.1
Natural Gas Price (wellhead \$95/Mcf)													
DRI-DRI Energy	\$1.81	\$1.46	\$1.87	\$2.15	\$2.42	\$2.54	\$2.65	-4.2	5.1	2.8	2.4	1.0	0.9
AEO97 (NEMS)	\$1.97	\$1.61	\$1.82	\$1.94	\$2.01	\$2.13	n/a	-4.0	2.5	1.3	0.7	1.2	n/a
SGM	\$1.97	\$1.99	\$2.07	\$2.10	\$2.16	\$2.11	\$1.97	0.2	0.9	0.2	0.6	-0.5	-1.4
Markal-Macro	\$1.71	\$1.55	\$2.22	\$2.28	\$2.46	\$2.77	\$2.97	-1.9	7.4	0.5	1.6	2.4	1.4
Gasoline Prices (\$95/Gal) ⁵													
DRI-DRI Energy	\$1.40	\$1.21	\$1.20	\$1.26	\$1.31	\$1.37	\$1.40	-2.9	-0.1	1.0	0.8	0.8	0.4
AEO97 (NEMS)	\$1.34	\$1.15	\$1.19	\$1.21	\$1.22	\$1.17	n/a	-3.1	0.8	0.3	0.1	-0.7	n/a
SGM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Markal-Macro	\$1.34	\$1.15	\$1.34	\$1.39	\$1.40	\$1.41	\$1.44	-3.0	3.1	0.7	0.1	0.1	0.4
Carbon Emissions (MMTC) – Total													
DRI-DRI Energy	1338	1413	1516	1612	1693	1767	1805	1.1	1.4	1.2	1.0	0.9	0.4
AEO97 (NEMS)	1339	1424	1543	1639	1722	1799	n/a	1.2	1.6	1.2	1.0	0.9	n/a
SGM	1350	1480	1550	1637	1729	1808	1871	1.9	0.9	1.1	1.1	0.9	0.7
Markal-Macro	1338	1459	1574	1674	1741	1806	1914	1.7	1.5	1.2	0.8	0.7	1.2

¹ Growth rates are calculated from non-rounded levels. ² AEO97 projections extend only to 2015. ³ Office of Management and Budget fiscal year 1998 assumptions. ⁴ SGM projections do not include geothermal, wind, biomass waste, and other municipal waste. ⁵ The SGM model does include gasoline.

Table 2: IAT International Baseline

	Real Economic Growth (Annual)			Energy Growth (Quads)			Emissions Growth (MMTC)		
	1990-00	2000-10	2010-20	1990-00	2000-10	2010-20	1990-00	2000-10	2010-20
Australia	2.8	2.8	2.6	2.1	1.5	0.9	1.7	1.2	0.7
Canada	2.6	2.5	1.2	1.7	1.0	0.4	2.2	1.5	0.7
China	8.4	7.5	5.8	3.9	2.8	2.1	3.8	2.8	2.2
Former Soviet Union	-3.5	4.6	4.2	-3.5	1.8	1.2	-4.0	1.6	1.1
Eastern Europe	-4.5	4.2	4.3	-3.0	1.3	1.2	-3.5	1.3	1.2
India	4.1	4.4	3.5	3.9	1.3	3.1	4.7	2.0	2.9
Japan	2.1	1.7	0.9	2.2	0.9	0.1	2.1	0.9	0.1
Korea	5.0	5.9	4.4	4.0	3.1	2.4	2.6	3.3	2.9
Mexico	4.0	4.0	3.2	4.2	2.9	2.3	4.2	2.9	2.4
Western Europe	2.3	2.5	2.4	1.5	1.4	0.6	1.2	1.4	0.6
United States	2.1	2.2	1.4	1.7	1.1	0.6	1.4	1.1	0.8
Rest-Of-World	3.6	3.4	3.0	3.0	2.0	2.0	3.0	2.2	2.2

The "Plain Vanilla" Scenario

The IAT began its analysis of emissions reductions policies by examining one core emissions reduction scenario. Then we explored the economic effect of changes to this scenario. The central policy modeled -- the "plain vanilla" scenario -- is aimed at reducing carbon and other greenhouse gas emissions by freezing them at 1990 levels. (Reductions in non-carbon emissions, such as methane, are solved for outside the model.) The "plain vanilla" scenario pursues those reductions by issuing tradable emission permits at the earliest point of energy production. The policy is announced in 2000 and its restrictions are phased-in over a ten year period, so that the policy would take effect in 2010. The permits are initially auctioned, in a way that is revenue neutral, i.e., all revenues generated through permits would be recycled back through the economy through deficit reduction. The "Plain vanilla" scenario assumes no international cooperation, although this option is discussed later in the paper along with other alternatives and sensitivities.

Industry and regional effects, as presented here, show only the effects of the climate change policy on the industry's output (shipments plus inventory change). We considered this our first step in understanding the likely consequences of emissions reductions on industry. As the year goes on, the IAT hopes to provide further detail to the industrial analysis by examining jobs, international trade, industries comparisons between countries, and the possibility that domestic industries might relocate overseas due to increased costs.

The "plain vanilla" scenario incorporates a slight improvement in energy intensity (E/GDP) over the EIA/AEO baseline, which declines by 1.0 percent per year. This improvement comes about

because of "announcement effects" -- that is, the actions that take place because the climate change policy undertaken produces anticipatable increases in the future price of energy. The "announcement effect," therefore, is what allows the model to distinguish between a change in future policy regarding carbon emissions and an exogenous shock, such as the two oil price increases in the 1970's. This leads to somewhat faster rate of diffusion of energy efficient technologies and a higher rate of innovation through R&D in anticipation of future higher energy prices. The IAT assumes an improvement in energy-intensity of 0.25 percent so that the total annual change in the ratio of energy to GDP is 1.25 percent per year. A faster technology alternative is also investigated. (More detail on energy-efficient technology improvement is provided later in this paper.)

Core Results

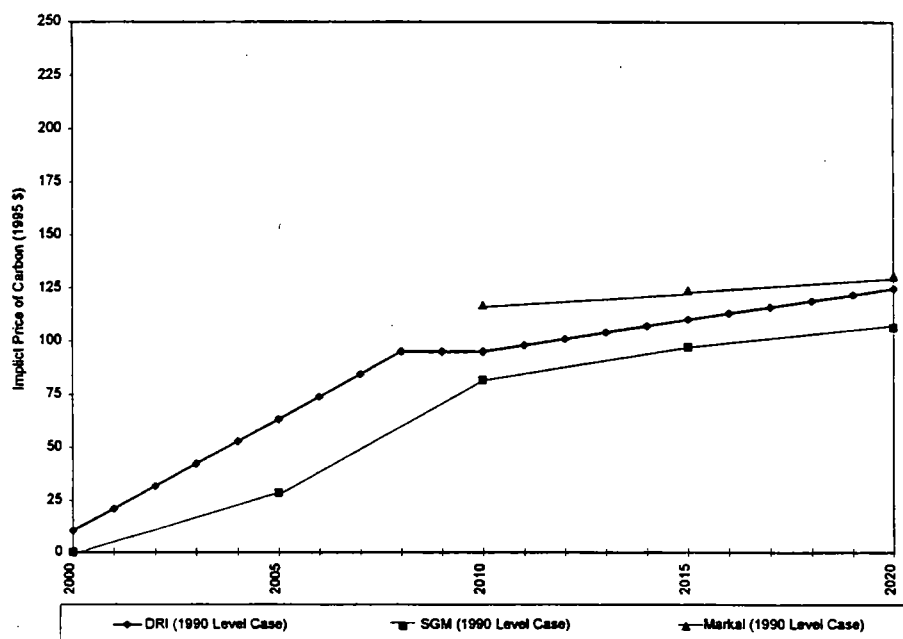
Estimates of permit prices are around \$100 in 2010 and rising slightly thereafter, and are consistent across models. While the three models used for this analysis vary in structure and often in terms of macroeconomic outcomes, they generate fairly consistent results as to the implicit price of carbon in the economy. Table 3 presents the results obtained by the three models for the value of any permit to emit carbon. Figure 1 shows the path for the value of carbon in these models. All of these estimates pertain to the "plain vanilla" option in which emissions are frozen at their 1990 level in 2010 and thereafter.

Table 3: The Implicit Price of Carbon (1995 \$) in 2010 and 2020

1990 Level Case		
	2010	2020
DRI-DRI Energy	95	125
SGM	82	107
Markal-Macro	130	122

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP. SGM and Markal-Macro permit prices are calculated using the rate of change in Carbon to GDP (C/GDP), which incorporate emission rates by the different fuel types.

**Figure 1 : Price Path of the Implicit Price of Carbon (1995 \$)
2010 to 2020**



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP. SGM and Markal-Macro permit prices are calculated using the rate of change in C/GDP. SGM and Markal-Macro models use data and generates results in five year intervals.

The DRI model concludes that an implicit price of \$95 (1995\$) per ton of carbon in 2010 would result in stabilization. The Markal-Macro model estimated \$130 (1995\$) while the SGM model predicted about \$82 (1995\$), in 2010. A carbon tax of \$100 per ton is the equivalent of a price increase of 26 cents per gallon of refined petroleum product, of \$1.49 per thousand cubic feet of natural gas, of \$52.52 per ton of coal, and of 2 cents per kilowatt hour of electricity produced.

These models also agree that this implicit price of carbon grows somewhat over time. This reflects the fact that the 1990 emission ceiling becomes a progressively more binding constraint over time given projected growth in base case emissions. By the year 2020, the implicit price of carbon rises, in 1995 dollars, to \$125, \$107, and \$131 per ton in the DRI, SGM, and Markal-Macro respectively.

Sensitivity to the Emissions Target. The DRI model was used to analyze how changes in the level of emissions level allowed affect the implicit price of carbon. If the emission target for the year 2010 and beyond is raised (made less severe) to a level equal to 110 percent of the 1990 emissions level (that is, to a target of 1,472 million tons as opposed to 1,338 million tons), then permit prices drop almost by half -- to about \$50 per ton of carbon. The very large decline in the implicit price of carbon reflects the fact that additional emissions reductions are progressively

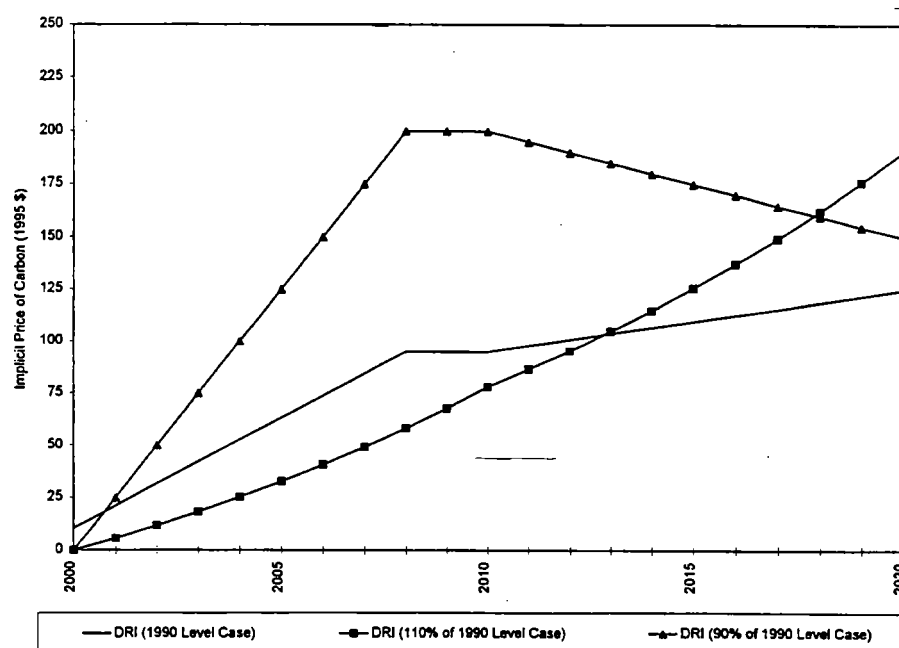
harder to find. On the other hand, a more stringent target, one that freezes emissions at 90 percent of their 1990 level in the year 2010 and beyond, leads to an implicit price of carbon of \$200 per ton in 2010 and \$150 per ton in 2020. Table 4 and Figure 2 describe the sensitivity of these results using DRI and SGM.

**Table 4: Sensitivity of the Implicit Price of Carbon
to the Stringency of the Emissions Target**

	2010	2020
DRI-DRI Energy		
Carbon Emissions 90% of 1990 Level Case	200	150
Carbon Emissions 110% of 1990 Level Case	50	85
SGM		
Carbon Emissions 90% of 1990 Level Case	n/a	n/a
Carbon Emissions 110% of 1990 Level Case	n/a	n/a

Note: 10 year phase-in with revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP. SGM and Markal-Macro permit prices are calculated using the rate of change in C/GDP.

**Figure 2 : Sensitivity of the DRI Implicit Price of Carbon
to the Stringency of the Emissions Target --2010 to 2020**

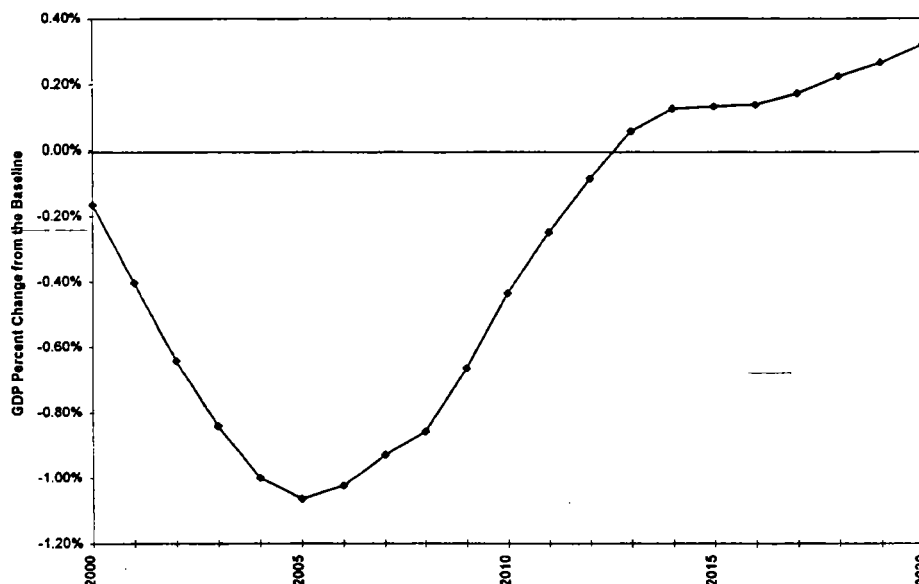


Note: 10 year phase-in with revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Emissions reductions lead to small reductions in short-term economic growth (GDP), but growth later appears to recover The burden of reducing carbon and other greenhouse gas emissions leads to short-term reductions in economic growth as measured by GDP. These reductions, however, are not large and, in many instances, are recovered in later years.

Results from the DRI model are presented in Figure 3. The results indicate that there is an initial GDP loss as the emission-limiting policy begins to be phased in. These losses cumulate to a peak loss of 1.0 percent of total economic output in the year 2005 -- that is, the economy's growth slows until the size of the economy is, at worst, 1.0 percent smaller in that year. After 2005, the economy actually grows faster than it would have absent climate change policy and starts to make up the lost ground. By the year 2013, the economy is back to the point at which it would have been had no policy been enacted. In subsequent years, the economy is actually slightly improved -- this differential reaches 0.3 percent by 2020, the last year of the model run.

Figure 3: DRI 1990 Level Case--Gross Domestic Product



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

This improvement occurs in the DRI model because emissions reduction policies have some effects that favor savings and investment at the expense of consumption. If the government auctions off emissions permits, it acquires the wherewithal to reduce the deficit (or retire debt) and, in effect, increase the nation's savings. This allows the cost of capital to fall and favors investment. The marginal profitability of investment also rises under these policies because new investment allows firms to neutralize higher energy costs. In effect, capital is a long-term

substitute for energy and is favored after a transition period. Thus, the cost of investment falls and the incentive to invest is strengthened. This faster rate of investment (discussed in greater detail below) gives the economy a newer and larger capital stock: as a result the economy's ability to grow improves until it actually reaches a modestly higher growth path in the years following the transition.

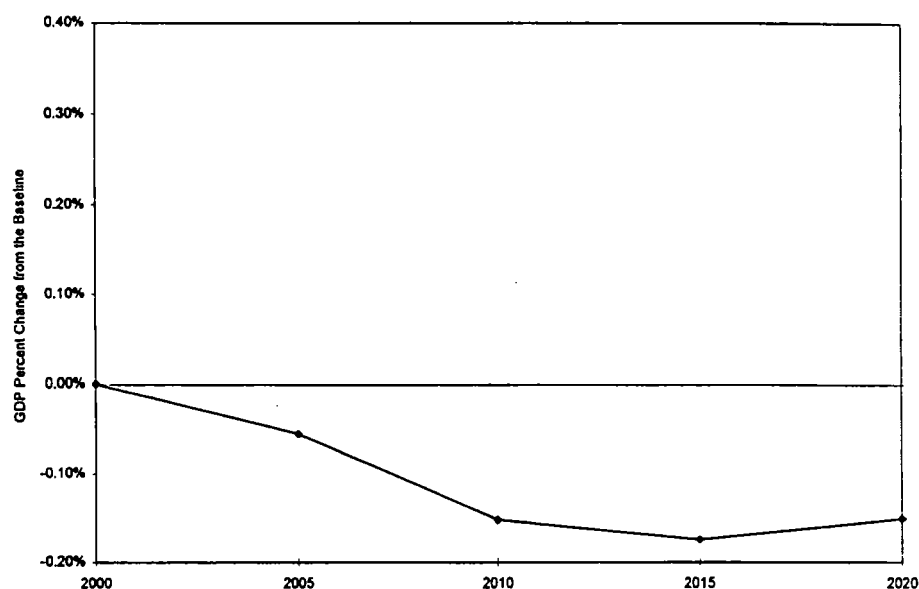
Figure 4 shows comparable results from the SGM model. Just as the DRI model focuses on short-term transition issues and may therefore tend to produce larger estimates of GDP losses, the SGM model moves quickly through these issues and focuses on longer-term prospects. The SGM model estimates peak losses for the economy of 0.17 percent in 2015, but the economy then stabilizes through 2020.

The two models offer a similar picture in some regards -- both show initial losses that are not very large (even the DRI peak loss is spread over five years). But they also differ in predictable ways, given their structure. Disequilibrium macro models, such as DRI, tend to identify deeper transitional losses and steeper transitional rebounds. Computable general equilibrium models, such as SGM, see more sanguine short-term effects and see the economy stabilizing after a more frictionless adjustment. A recent analysis by Dr. Robert Repetto and Dr. Dunkin Austin of the World Resources Institute examined about 162 analyses of climate change policy and found that this difference in structure can account for two-thirds of the difference in results, if environmental benefits are ignored.¹

Which, then, is right? The likely answer is somewhere in between the two. DRI's transitional losses may be overstated, but so would be the rebound and the shift to a higher growth path it estimates for later years. SGM probably understates the transitional problem, but also avoids the later-year growth surge that DRI sees as driven by higher levels of investment. The two model probably serve as brackets for the range of reasonable estimates of the economic effects of an emissions freeze at 1990 levels in 2010 and thereafter.

¹ Repetto, Robert and Dunkin Austin. "The Cost of Controlling CO2 Emissions: A Guide for the Perplexed." *World Resources Institute*, June 1997 (Forthcoming).

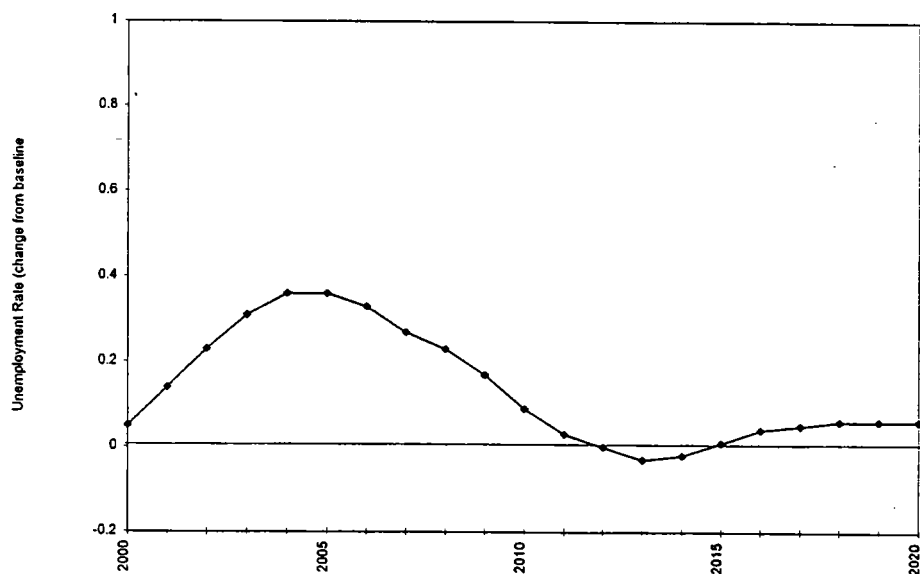
Figure 4: SGM 1990 Level Case—Gross Domestic Product



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in C/GDP.

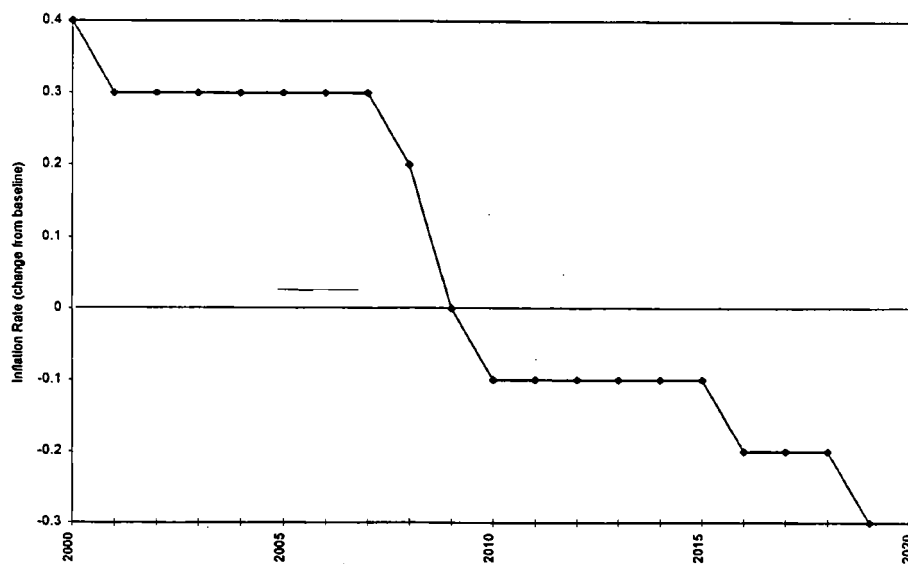
Unemployment and Inflation. The effect of the stabilization policy results in approximately a 0.2 percentage point increase in the unemployment rate from 2001 through 2011, as estimated using the DRI model. The unemployment rate first rises as GDP falls, but then returns to its pre-policy level by 2012, as shown in Figure 5. The inflation rate increases by about 0.3 percentage points until 2009, measured by the annual rate of change in the Consumer Price Index (CPI). The annual rate of change in the CPI reduces by about 0.1 to 0.2 percentage points per year through 2020, as shown in Figure 6.

Figure 5: DRI 1990 Level Case -- Unemployment Rate



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Figure 6: DRI 1990 Level Case -- Inflation Rate

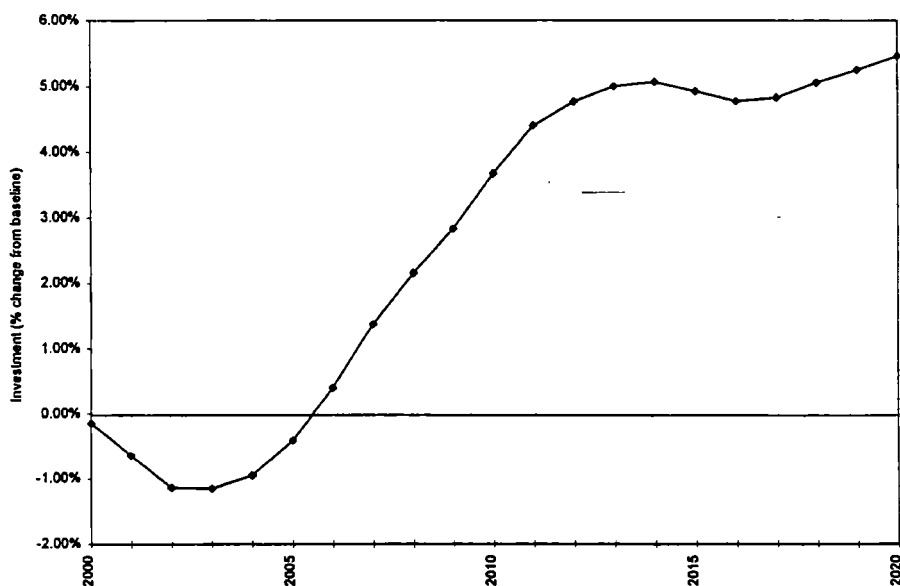


Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Investment policies are key to getting the economy back on track. In the baseline forecast, slow labor force growth of 0.8% per year yields slow potential GDP growth, which results in slow capital stock turnover. The slower rate at which the capital stock is renewed is of direct consequence to mitigating carbon and other related emissions, since improvements in energy-using or carbon-abating technologies generally must be embodied in the capital stock in order to be effective. Thus, any global climate change policy, to be effective, must focus on investment at the expense of consumption to have any chance of success. The policy must convert less efficient to more efficient energy-efficient capital. The deficit reduction policy option, one of the several revenue recycling options examined, promotes savings, which boosts this investment.

The DRI model suggests that investment under a climate change policy scenario begins to exceed investment in the baseline by 2006, as seen in Figure 7. By the time the policy is fully implemented in 2010, investment exceeds the baseline by about \$50 billion (1992\$), with this difference rising to about \$100 billion in 2020. Personal Consumption Expenditures (PCE), on the other hand, remain below the baseline throughout the forecast period, so that PCE drops by about \$80 billion in 2008, as seen in Figure 8. After the trough in 2008, PCE gradually moves toward baseline by 2020.

Figure 7: DRI 1990 Level Case—Investment

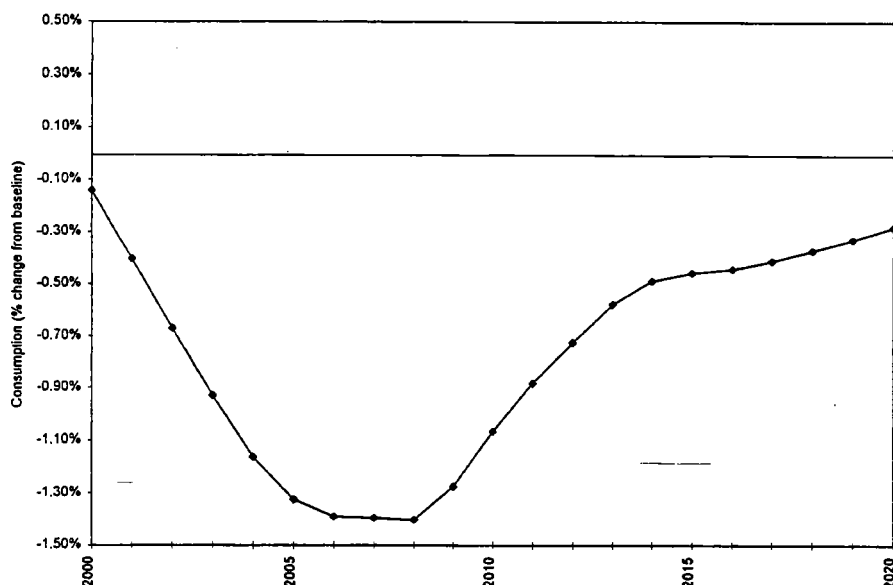


Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

The faster rate of investment drives the rebounding of real economic growth in the later years of the model simulation. But it should be noted that consumption does not rebound in the same

manner, although it does recover from its peak losses, as seen in Figure 8. But consumption can be taken as the measure of economic activity that is closer to consumer “welfare” than total GDP, which includes investment, because consumption includes all activities that are of direct consequence to households. Thus, while increases in investment drive the economy’s growth path back to and perhaps even above its original trend, it does so by diverting resources away from uses that allow consumers to enjoy them directly in the short term.

Figure 8: DRI 1990 Level Case—Consumption



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

The paths of consumption and investment following the imposition of a climate change policy depend critically on assumptions regarding the manner in which revenue flows related to the allocation of emissions permits are managed and the conduct of Federal Reserve policy. These sensitivities are discussed in a later section.

Among fuels, demand for coal bears the brunt of greenhouse gas stabilization. Table 5 presents the effects of carbon-limiting policies on the economy’s energy consumption and fuel mix. Using the DRI model, total energy consumption falls from 105 quadrillion Btus (quads) in the base case in 2010 to a level of 88 quads under the policy, a reduction of 16 percent in that year. By 2020, energy consumption in the economy has declined by 20 percent when compared to the base case for that year, from 109 quads to 87 quads. The table also shows comparable results using the Markal model, when the 1990-level emissions freeze produces a decline in projected energy consumption of 14 percent in 2010 and 20 percent in 2020.

**Table 5: Effects of Carbon Stabilization on
Energy Consumption and Fuel Mix (quadrillion Btus)**

	2010		2020	
	Base case	1990 Level Case	Base case	1990 Level Case
DRI-DRI Energy				
Total US Energy Consumption	105.3	88.2	108.9	86.7
Natural Gas	25.1	22.9	26.7	24.9
Oil	40.4	35.6	43.3	37.4
Coal	22.7	17.2	23.7	15.2
Markal-Macro				
Total US Energy Consumption	107.8	97.1	115.6	100.9
Natural Gas	29.0	22.8	35.1	25.8
Oil	43.4	36.2	45.0	35.8
Coal	22.5	16.0	24.6	11.1

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP. Markal-Macro permit prices are calculated using the rate of change in C/GDP.

Both DRI and Markal demonstrate that dampened energy consumption and reduced carbon emissions are concentrated in coal use. As seen in Table 6, DRI results show that about 57 percent of the total emissions reductions in 2010 result from reduced demand for coal, 30 percent from oil, and 13 percent from natural gas. By 2020, 65 percent of emission reductions are generated from reductions in demand for coal. This translates to a 25 percent total emission reduction for coal in 2010 and a 36 percent reduction in 2020. Markal produces somewhat different results; it shows that about 42 percent of total emissions reductions in 2020 occur due to reduced coal use and 29 percent due to reduced oil use, and 29 percent due to reduced natural gas consumption. By 2020, coal begins to grow in importance.

The different spread of percent of total emissions reductions by fuel occurs because renewable energy sources play a more important role in the Markal model. It is also true because DRI's model sees strong transportation demands and more limited technological prospects for serving it, while transportation choices do not take into account price expectations. This is in contrast to DRI's treatment of the utility sector, which is relatively forward looking when examining fuel choices.

Table 6: 1990 Level Case -- Percent of Total Emissions Reduction by Fuel

	2010	2020
DRI-DRI Energy		
Natural Gas	13	8
Oil	30	28
Coal	57	65
Markal-Macro		
Natural Gas	31	29
Oil	36	29
Coal	33	42

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP. Markal-Macro permit prices are calculated using the rate of change in C/GDP.

On the demand side, according to DRI, about 46 percent of total emission reductions in 2010 result from reduced demand for electricity, 26 percent from reduced demand for transportation and 19 percent from reduced demand from the industrial sector, as shown in Table 7. The commercial and residential sectors contribute a combined 8 percent to the total of emissions reductions. The corresponding estimates obtained from the Markal model show that electricity uses account for [FORTHCOMING] percent of total reduction in emissions, and transportation, industrial, and residential and commercial uses for [FORTHCOMING] percent, [FORTHCOMING] percent, and [FORTHCOMING] percent, respectively.

Table 7: 1990 Level Case -- Percent of Total Emissions Reduction by Demand Sector

	2010	2020
DRI-DRI Energy		
Residential	5	4
Commercial	3	2
Industrial	19	21
Transportation	27	25
Electricity	46	47
Markal-Macro		
Residential	n/a	n/a
Commercial	n/a	n/a
Industrial	n/a	n/a
Transportation	n/a	n/a
Electricity	n/a	n/a

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP. Markal-Macro permit prices are calculated using the rate of change in C/GDP.

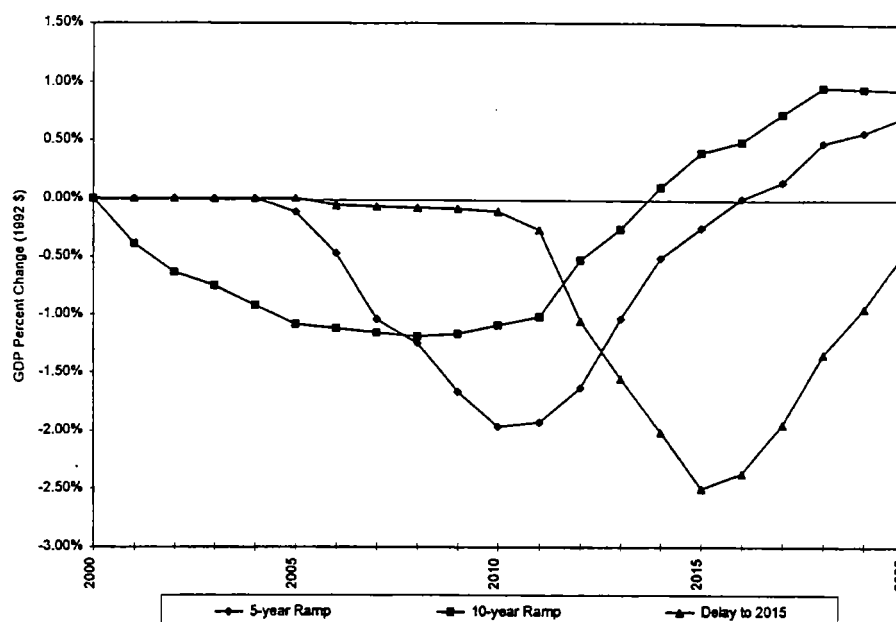
Thus, across models and when viewed from different perspectives, the center of the reductions in emissions obtained under the broadest strategies moves toward reducing utility consumption of coal. Reducing coal use under utility boilers is generally the largest, cheapest option to reduce carbon emissions in the economy. This is accomplished through better operating rates and through the substitution of gas-fired combined-cycle units for coal-fired units. The implicit price of carbon obtained in most model runs is usually the one that accomplishes this transition in electricity baseload. The range of carbon values -- generally about \$100 per ton -- is as high as it is because most coal-fired units are fairly old and already fully amortized. Thus, their costs consist of fuel and operating and maintenance expenses but not capital costs. The price of coal, therefore, must rise considerably to make coal-fired electricity more expensive than electricity generated by a new gas-fired plant that entails new capital costs.

Important Sensitivities

The following represents a number of variations from the "plain vanilla" scenario that the IAT analysts examined to address a number of factors that negotiators are likely to face in the global climate change policy process. These include the effects of: (1) timing, including different transition periods to full implementation and delaying implementation; (2) lower or higher emission level targets (the effects to permit prices were already discussed in a previous section); (3) revenue recycling options, including a comparing the deficit reduction case with revenues returned to consumers, returned to business, and a combination of returned to both consumers and investors; (4) the effects of the Federal Reserve Board reaction function on interest rates and the effect of the Price Expectation assumptions in the DRI model, (5) the effects of a policy announcement on technology innovation and diffusion as well as the steps needed to achieve a higher level of innovation and diffusion; (6) Annex I permit trading; (7) Joint Implementation with developing countries; (8) other collateral environmental benefits; and (9) effects on international trade.

A longer period for implementation, from 5 to 10 years in the 1990 level stabilization case in 2010, dampens negative effects to GDP while delaying implementation does little to improve GDP effects. The IAT examined differing effects on GDP of a 5-year and a 10-year implementation period for the stabilization "plain vanilla" scenario. These results are shown in Figure 9. A 10-year implementation or "ramp-up" period between 2000 and 2010 results in a maximum GDP loss of 1.19 percent in 2008 and a return to above the baseline in 2014. On the other hand, a 5-year ramp-up between 2005 and 2010 results in a maximum of a 1.96 percent loss in 2010 and a return to the baseline in 2016. Thus, shorter transition periods result in a more pronounced economic cycle in response to policy--a sharper downturn and deferred recovery.

Figure 9 : 1990 Level Case--Sensitivity to the Length of the Implementation Period and to Implementation Timing



Note: These simulations were conducted using DRI and the NEMs Energy Model and they do not conform in detail to those conducted using DRI and the DRI Energy Model. 5-Year and 10-Year Ramp to 1990 Levels in 2010; 1990 Levels in 2015 using a 5-Year ramp-up.

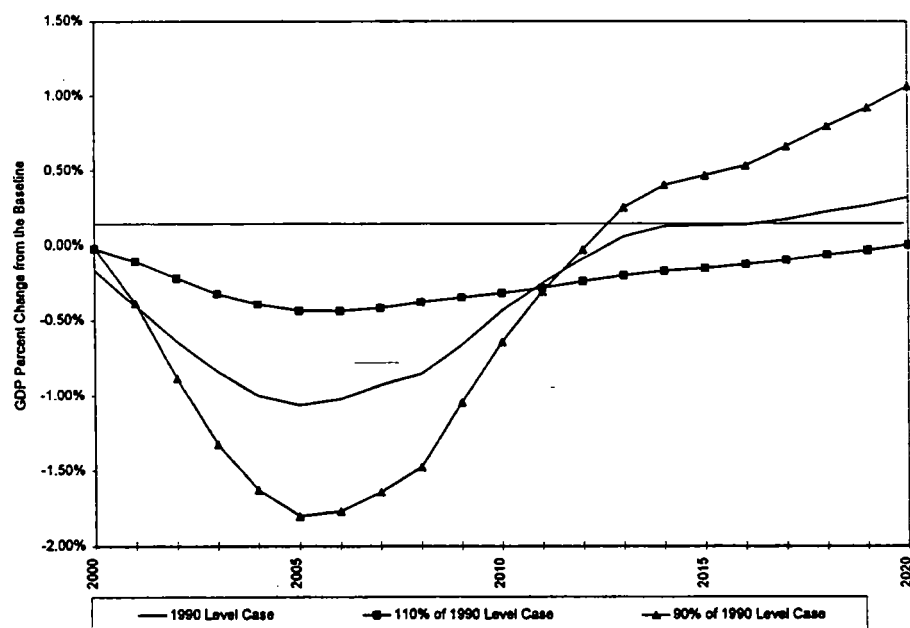
Figure 9 also shows the result of delaying the implementation by 5 years, to 2015 combines with the shorter 5-year ramp-up period. GDP effects for the delayed case are less severe in the initial period, but become greater than either the 5-year or 10-year ramp-up to stabilization in 2010 reaching a maximum of 2.5 percent in 2015 and never regaining the baseline GDP throughout the period.

Raising or lowering emission targets lead to obvious results --more stringent emission targets lead to greater economic losses while less stringent ones result in less severe impacts. As discussed briefly above, the IAT examined emissions targets that were both 10 percent above and 10 percent below the emissions levels of 1990. The implicit carbon prices in 2010 of the 110 percent of 1990 level case in 2010 are \$50, or approximately half the "plain vanilla" stabilization permit price. In 2020, permit prices rise to about \$85 compared with the \$125 permit price under stabilization. Alternatively, an emissions target of 90 percent of 1990 level results in an implicit price of carbon of \$200 per ton in 2010 and \$150 in 2020. Unlike in the other cases, the implicit price of carbon falls after 2010. This is because the initial price increase is large enough to set in motion a series of capital stock improvements, particularly in utilities, that reduce the ongoing level of emissions by enough to allow the implicit price to fall. Thus, this result is predicated on the idea that future price expectations could be wrong. In fact, if decision makers had perfect price expectations, the implicit price of carbon would lie somewhere between these two values over the period.

It is no surprise that the 90 percent of 1990 emissions case results in a more severe decline of GDP in the transition period. But what is surprising, and questionable, is that this scenario also has a greater long-term potential for economic recovery. As shown in Figure 10, GDP declines to a peak loss of 1.9 percent below the base case in 2005. It recovers to the base case level in 2013 and increases to 1.0 percent above the base case in 2020. The long-term rebound effect results from a greater amount of revenue recycled to deficit reduction (or debt retirement), which pushes interest rates down substantially and drives up investment.

This result is questionable. The DRI model, as discussed, is prone to depicting large effects of interest rates on investment. Thus, when confronted with a very large implicit price of carbon and, in turn, large amounts of forced saving, either through deficit reduction or by grandfathering these new property rights to firms, it produces much higher levels of investment and a higher long-term growth path. The reality is probably more moderate at both ends. In essence, this case appears to tax the ability of the model to manage these revenue flows.

Figure 10: Sensitivity of GDP to the Stringency of the Emissions Target



Note: 10 year phase-in with revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

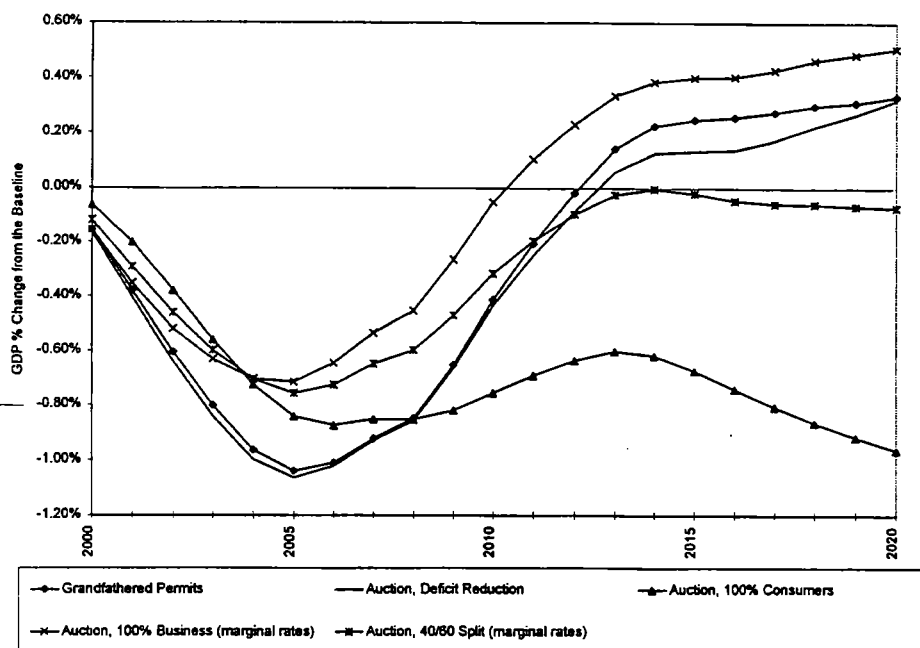
The portion of total emission reductions from coal and oil in both the 90 percent and 110 percent of 1990 Level Case, increases only slightly--about 5 percentage points--while total emission reductions from natural gas change significantly. In 2010, under stabilization, about 13 percent of total emission reductions are from natural gas. Under a 10 percent increase in the target (that is, a target of 90 percent of 1990 emissions), about 24 percent of total emission reductions are from natural gas. This occurs because the substitution of gas for coal in electric utilities is not

enough to achieve the bulk of the 90 percent (more stringent) target. Additional emissions reductions must be found, which forces the burden to be spread more evenly among fuel types and sectors.

Adopting a revenue recycling option that leads to investment in energy efficient capital leads to less impact on the economy during the transition and greater returns to the economy in the long term. The IAT looked at a number of revenue recycling policies in addition to the deficit reduction case. These options are depicted in Figure 11. These include:

- “grandfathering” permits to producers, meaning that every carbon-emitter would be allowed to pollute at their 1990 level. The permits allowing them to do so would then be traded freely, allowing a least-cost response to the problem to emerge;
- a 100 percent recycling of any revenues from permit auctions to consumers through a reduction in the personal income tax;
- a 100 percent return to business through a reduction in the marginal rates of the corporate income tax or through lump-sum rebates; or
- a 40/60 split to consumers and businesses, in proportion to their shares of energy use, either through a tax rate reduction or a lump-sum return.

**Figure 11: DRI 1990 Level Case --
GDP Sensitivity to Revenue Recycling Options**



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Assuming a 1.25 percent annual decrease in E/GDP.

According to the IAT analysis, the revenues generated from the implementation of this policy have the most positive effect when returned through either the deficit reduction plan, grandfathered permits, or returns to business. Revenue recycled to consumers, in either case, result in a greater and longer-term reductions in GDP, when measured against the baseline.

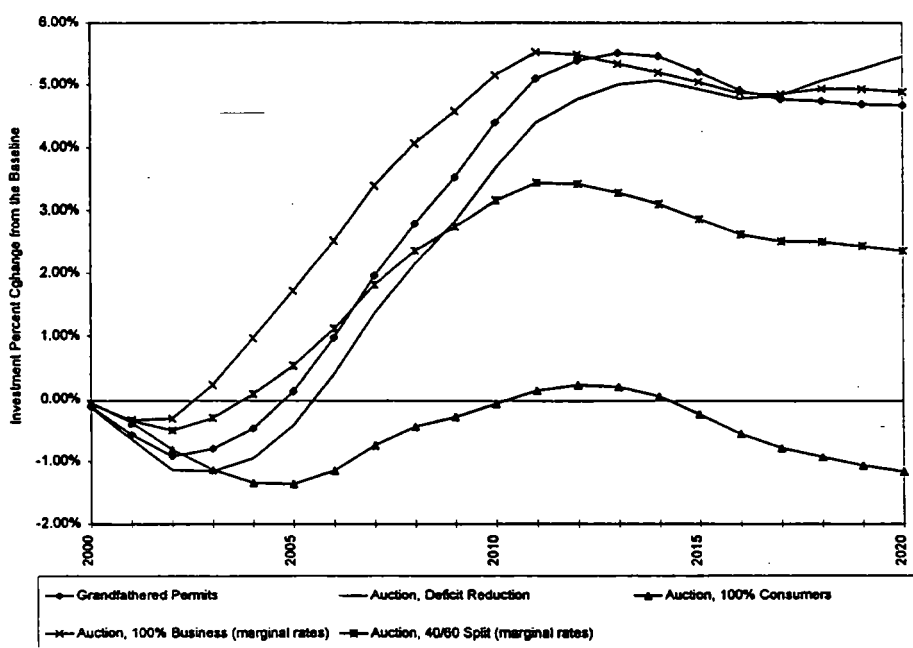
The revenue recycling options that lead to better economic outcomes are all those associated with greater investment and capital formation. Deficit reduction leads to lower interest rates, which lowers the cost of capital and facilitates investment. Recycling revenues to companies has the effect of increasing savings through apparent profits and provides the wherewithal for greater investment spending. Similarly, grandfathering permits to producers allows them to "assetize" their right to pollute. This allows firms to realize gains and again provides the wherewithal to invest.

Peak GDP losses during the transition period are less severe for the 100 percent to business and 40/60 split when accomplished through reductions in the marginal tax rates, (about 0.7 percent in 2005), compared with the other recycling options, (between 0.8 and 1.0 percent in that year).

Figures 12 and 13 demonstrate the effects of revenue recycling on investment and consumption, in relation to the effect on GDP, as shown in the previous figure. As these figures show, the key to economic recovery among the revenue recycling options is to improve investment in the economy.

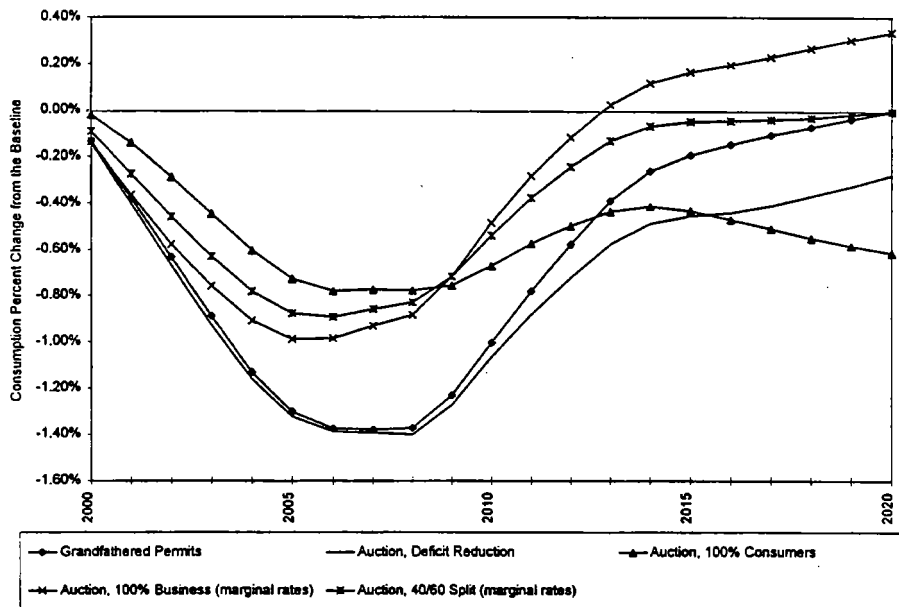
Figure 12: DRI 1990 Level Case

Investment Sensitivity to Revenue Recycling Options



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Assuming a 1.25 percent annual decrease in E/GDP.

Figure 13: DRI 1990 Level Case
Consumption Sensitivity to Revenue Recycling Options

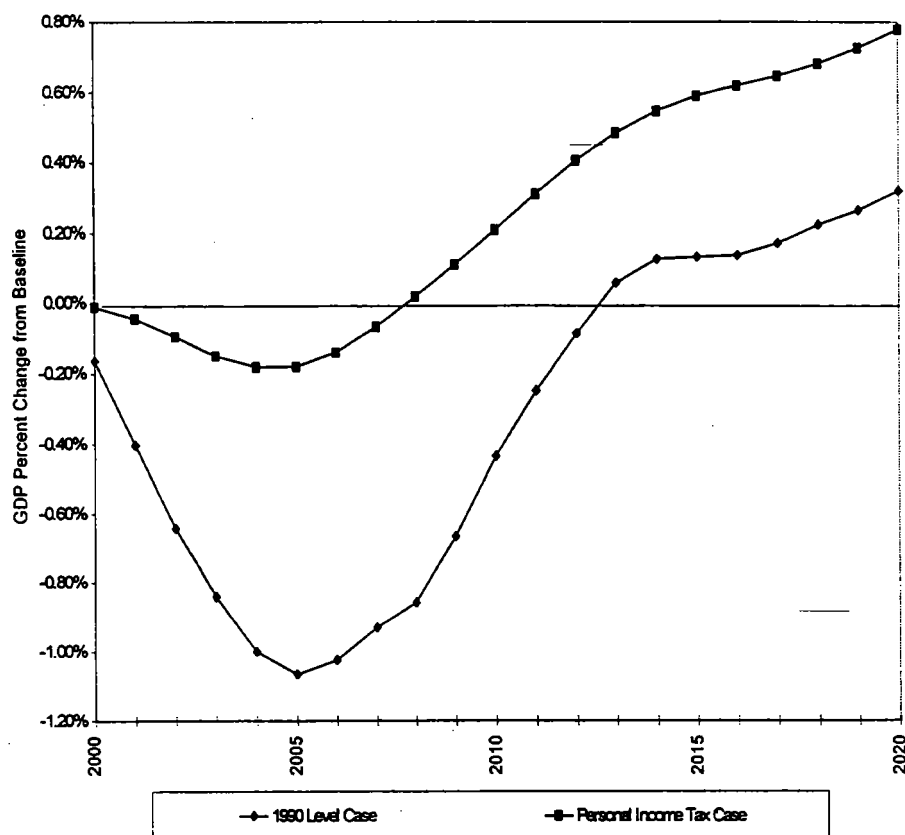


Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Assuming a 1.25 percent annual decrease in E/GDP.

But the economic effects of these recycling options must be separated from the economic effects of carbon limitations *per se*. That is, economic analysis can make the case -- and models are often structured to demonstrate -- that capital-favoring taxes could improve long-term economic performance. In order to separate these effects, the 1990 emissions freeze accompanied by the use of any permit auction revenues to reduce the deficit was compared to a conventional increase in the personal income tax to achieve a comparable level of deficit reduction.

An increase in the personal income tax results in smaller economic losses and a more prompt economic rebound than a "deficit-equivalent" carbon reduction policy, as shown in Figure 14. Thus, while revenue recycling options can affect significantly the outcome of a carbon-reduction policy, the gains they create are unrelated to carbon reduction itself.

**Figure 14: Comparison of Deficit Reduction to Personal Tax Increase:
Effects to GDP**



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Assuming a 1.25 percent annual decrease in E/GDP.

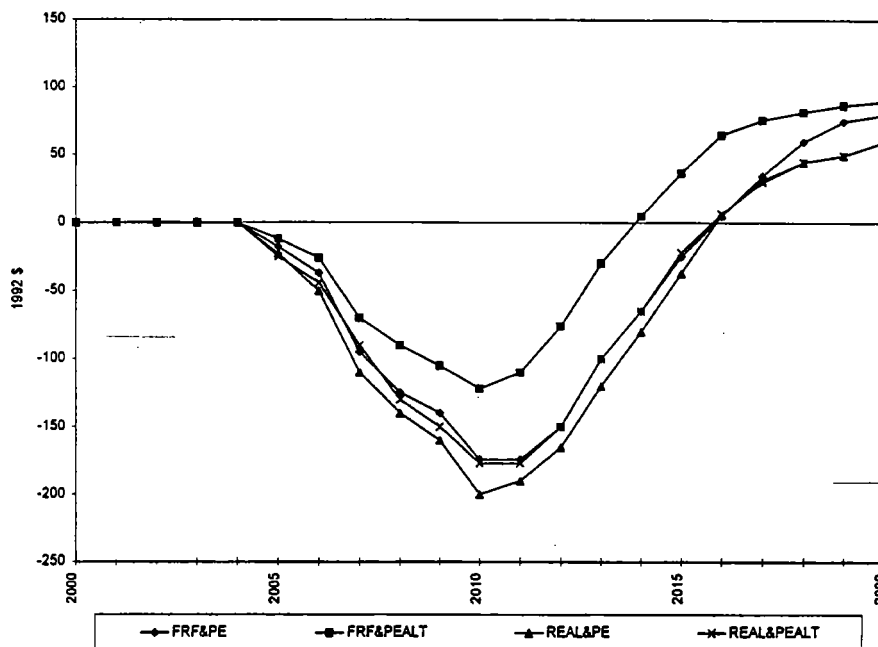
The IAT decided to maintain the DRI assumptions about the reaction of the Federal Reserve Board (Fed) to price inflation, while excluding DRI's price expectation function for consumers, business and the Fed. The Federal Reserve reaction function in the DRI model is an empirically derived estimation of likely Federal Reserve policy responses to changes in price inflation and the unemployment rate, among other variables. This reaction function was used in the analysis. The price expectation equation in the DRI model presumes that three agents in the economy--business, consumers and the Fed -- have adaptive expectations, that is, they believe that future levels of inflation can be guessed by extrapolating current levels of inflation. This price expectations equation was *not* used in the analysis, because it seemed a poor way to model a widely-known and anticipated one-time policy event that would affect prices as would, in some sense, a sales tax. Nonetheless, the IAT ran sensitivity analyses to discover what the differences in the economic effects there would be under a carbon policy scenario if these assumptions were altered.

As can be seen from Figure 15, the effects of the DRI reaction function are very similar to those obtained when the Fed's target is assumed to be constant real non-borrowed reserves, itself a

fairly accommodating policy (depicted in Figure 15 as "REAL"). The alteration of price expectations is also important. When all three agents--business, consumers, and the Fed --view expected inflation as unchanged as a result of the imposition of a carbon permit policy, GDP losses are smaller (depicted in Figure 15 as "PEALT").

Thus, alternative views of price expectations appear to have as large an impact on the ultimate results as do alternative monetary policy reactions: when consumers, businesses, and the Fed all see a carbon-limiting policy as inseparable from an increase in underlying inflation fundamentals, and while their doing so would be myopic in the extreme, the economic results are worse. Moreover, should they do so, they force the Fed into an even more output-limiting policy posture and the combined results are far worse.

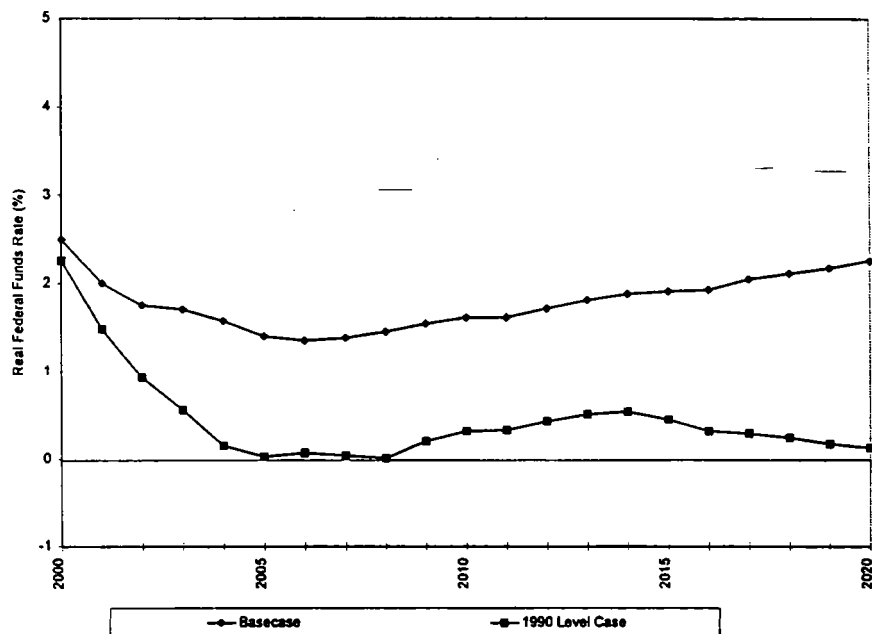
Figure 15: 1990 Level Case--Sensitivity of GDP to Assumptions about Federal Reserve Policy and Price Expectation



Note: These simulations were conducted using DRI and the NEMs Energy Model and they do not conform in detail to those conducted using DRI and the DRI Energy Model. FRF&PE means DRI's Federal Reaction Function and Price Expectation equations are both left on. FRF&PEALT means DRI's Federal Reaction Function equation is left on while the price expectation equation is switched off. REAL&PE means that the Federal Reaction Function equation is switched off and constant real non-borrowed reserves are used instead and the Price Expectation equation is left off. REAL&PEALT means that the Federal Reaction Function and the Price Expectation are switched off.

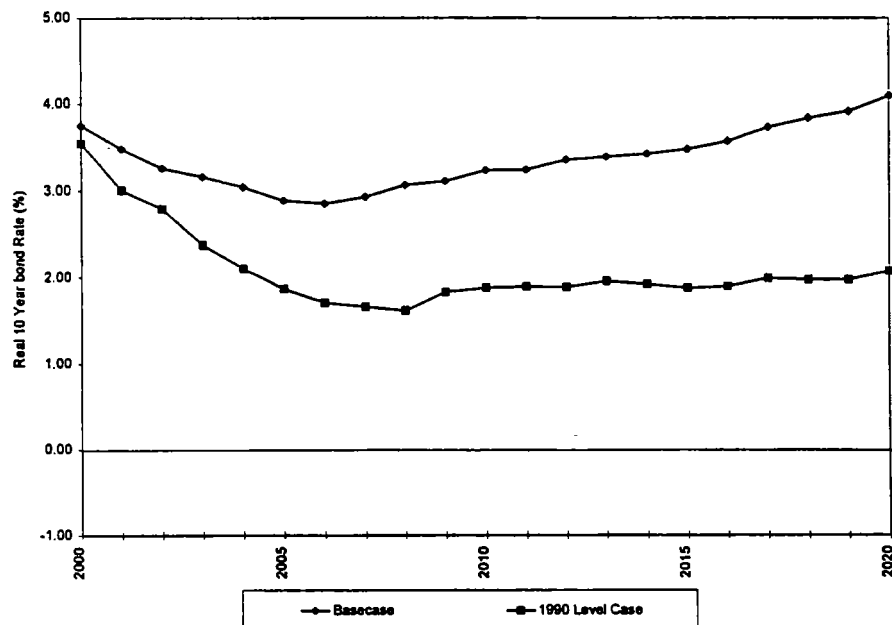
Figures 16, 17, and 18 show projections of the Federal Funds Rate, the 10-year Long Term Bond Rate, and the Federal Deficit/Surplus, respectively, from the DRI model while both the Federal Reaction Function and the Price Expectation equations are used in the analysis of the 1990 Level Case ("plain vanilla"). These results show how important the treatment of revenue flows is in the DRI model. Substantial declines in the deficit (these runs were produced before the agreement to balance the budget in 2002 was achieved in May) allow interest rates to fall, which is the key to the economy's investment response.

Figure 16: DRI 1990 Level Case--Real Federal Funds Rate



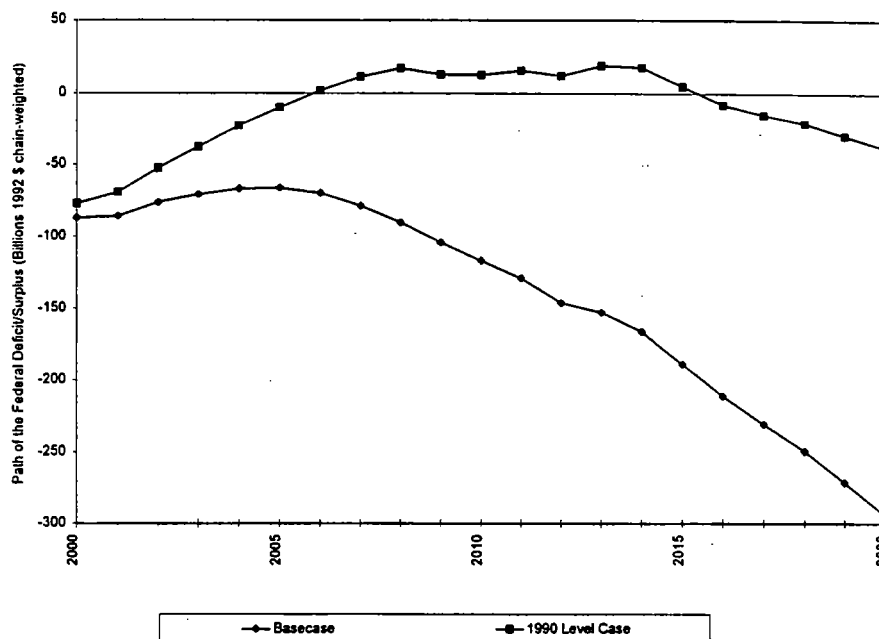
Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Figure 17: DRI 1990 Level Case--Real 10-Year Long-Term Bond Rate



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Figure 18: DRI 1990 Level Case--Path of the Federal Deficit/Surplus



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Technological progress can be very helpful, but in the long term. In its analysis of technology, the Markal-Macro model was used to determine whether higher levels of energy to GDP (E/GDP) savings are realistic. This analysis assumed two benchmarks for technological progress. In the first, the steady-state improvement in the economy's efficient use of energy was increased from the level of 1.0 percent found in the EIA/AEO projections (found in the "no policy" base case) to a level of 1.25 percent. In the second case, this improvement in energy efficiency was increased to 1.75 percent. These two benchmark levels were obtained by examining the historical record and engineering estimates of potential technical progress. The point of the analysis was then to determine not only what effect technical progress might have on the economic effects of climate change policy, but also whether these rates were themselves technically feasible.

According to results from the Markal-Macro model, an improvement in the energy intensity of 0.25 percent annually, or a total annual decline of 1.25 in energy per unit of real output, can be achieved without great difficulty. For example, such an improvement can be produced if the "hurdle rates" -- that is, the premium that households and firms appear to place in their discount rate when considering energy-efficiency investments -- declines by 21 percent. (For example, the discount rate households use when considering installing better insulation would have to fall from [FORTHCOMING] percent to [FORTHCOMING] percent). Thus, this improvement can

be achieved through diffusion practices alone, rather than requiring a higher rate of innovation and technological progress.

In fact, some analysts believe that the enactment of the Climate Change Action Plan gets us to the 1.25 annual reduction. DRI achieved a 1.25 percent annual rate of improvement in E/GDP using the latest estimates of energy savings from CCAP, as seen in Table 8. The model then takes these savings and computes carbon emission reductions based on the energy savings profile.

**Table 8: CCAP Emission Reduction Estimates by Sector
in DRI Energy Model (MMTC)**

	2000	2010	2020
Residential	-1.5	-6.1	-9.9
Commercial	0	0	0
Industrial	-11.2	-19.8	-20.8
Transportation	-4.8	-8.3	-9.1
Electricity	-15.5	-53.2	-76.3
Total	-33.0	-87.4	-116.1

But the Markal model demonstrates that the higher technological case -- an increase in the annual rate of improvement in energy-efficiency of 1.75 percent -- is more difficult to achieve. Specifically, this higher level of energy savings cannot be achieved through better diffusion of best technical practices alone. Thus, new innovation must occur if we are to move beyond the 1.25 case. To achieve the 1.75 case, a new set of advanced energy efficiency technologies was added to the pool of technologies. Many of these are aggressive in their scope: for example, the average fuel efficiency of the vehicle fleet in the year 2020 is 33 miles per gallon in the 1.25 case, but rises to 55 miles per gallon in the 1.75 case. The IAT will be circulating the technological assumptions necessary to achieve this 1.75 benchmark in a separate paper.

Rather than use the specific technological assumptions developed in Markal, the IAT represented technological progress in the DRI model by targeting a 1.75 percent annual rate of energy improvement in the economy for supply and end-use technologies in all sectors. For residential and commercial sector space heating/cooling and water heating, DRI assumed improved performance and cost characteristics for various heating and cooling equipment types and allowed the model to choose the optimal technologies. The model selects equipment based on life-cycle cost estimates include a "first-cost bias" which weights up-front capital costs more heavily than future fuel costs: this is comparable to the higher discount rates used in Markal.

For all other residential and commercial sector energy end-uses, the DRI model uses estimates of the average efficiency of all new and retrofit equipment purchases to determine fuel use requirements. These average efficiencies were increased to reflect improvements to technology

performance and higher rates of diffusion for more efficient technologies. No changes were made to the rates of capital stock turnover and replacement.

Finally, when possible, the rate of improvement in energy-efficiency that IAT assumed was applied to the economy's carbon-efficiency for purposes of modeling. That is because carbon is the appropriate target. But not all models can be managed to this parameter. Nevertheless, the differences between the two specifications is not large.

Table 9 summarizes the effects of higher technological progress (that is, the 1.75 annual rate versus the 1.25 annual rate) on the economic effects of carbon-limiting policies. As seen, higher rates of technological progress can cut dramatically the implicit price of carbon and the associated transitional GDP losses. For example, in the IAT "plain vanilla" case (assuming 1.25 percent annual efficiency improvements), the implicit price of carbon in the two models is \$82 and \$130 per ton in 2010 and \$125 and \$122 per ton in 2020, for DRI and Markal-Macro respectively. In the more advanced technology case, the implicit price of carbon is \$88 per ton and \$95 in 2010 and \$30 and 48 per ton in 2020, for DRI and Markal-Macro respectively.

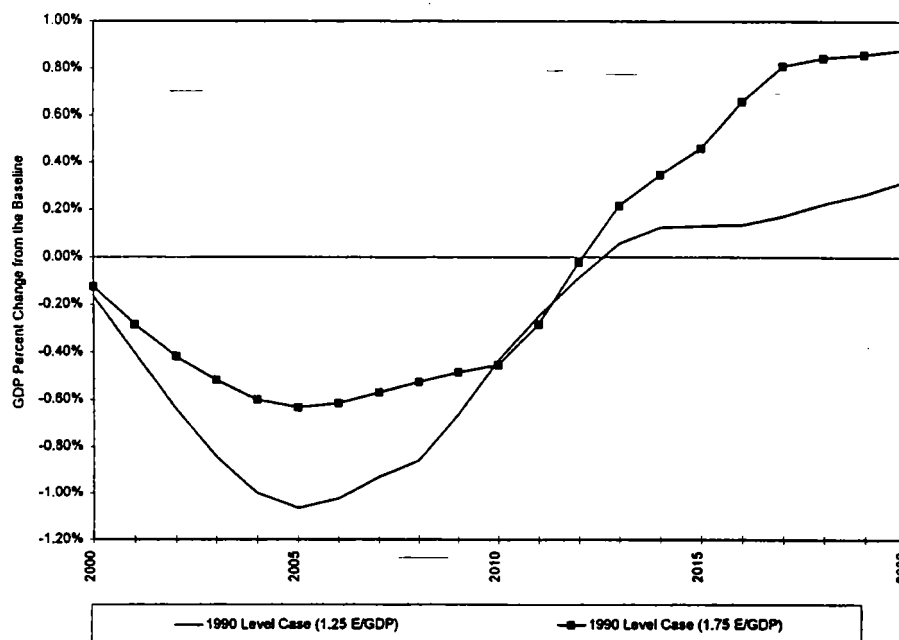
**Table 9: Sensitivity of Implicit Price of Carbon (1995 \$)
to Rate of Technological Change --1990 Level Case**

	2010		2020	
	1.25 Case	1.75 Case	1.25 Case	1.75 Case
DRI-DRI Energy	95	88	125	30
Markal-Macro	130	95	122	48

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction. DRI permit prices are generated using the annual rate of change in E/GDP. Markal-Macro permit prices are calculated using the rate of change in C/GDP.

The peak GDP losses change accordingly, as shown in Figure 19. Using the DRI model, the peak output loss of -0.6 percent occurs in 2005, and the economy reaches its pre-policy growth path by 2012. The economy's shift to a higher growth path is also more pronounced, but here the result is more believable, because it is achieved through technological progress rather than revenue recycling that raises savings and fosters investment (in fact, the level of revenue recycling falls dramatically as does the implicit price of carbon). The risk, however, is that these output gains may be somewhat overstated, because they do not account for the cost of the investments needed to reach the higher rate of technological progress. For example, firms will have to perform R&D that might distract them from other R&D tasks. If other R&D in the economy fell as energy- and carbon-related R&D was performed, overall productivity could drop and offset the economy's potential elsewhere. Alternatively, they might increase their total R&D effort, but leave the economy with fewer resources to do other things. While it is likely that these effects are second-order when compared to the effects of the improvement in carbon-related efficiency, they are still absent from the analysis.

Figure 19 : Sensitivity of GDP to the Rate of Technological Progress
DRI 1990 Level Case



Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction.

These results indicate how important technological progress is in the long term. A substantially higher rate of technological progress does not affect short-term results in a striking fashion. But it is capable of moving the analysis significantly once its effects are allowed to accumulate.

International trading of carbon permits among the Annex I countries leads to sizable reductions in costs needed to stabilize emissions. The discussion so far has centered on the how the U.S. economy reacts when the United States independently reduces emissions, however allowing an international market to trade emissions permits is an alternative to unilateral action. The purpose of such a market would be to increase the efficiency and reduce the cost of reducing global emissions by taking giving all polluters the incentive to search for least-cost solutions across national boundaries.

In brief, under a system of tradable permits, a country could either reduce emissions or purchase additional emissions "rights" (i.e., permits) from other countries. Countries with opportunities to reduce emissions that cost less than the going permit price would have an incentive to reduce emissions and sell their "right to emit" for cash. Countries that had only high cost options to reduce emissions (that is, reduction options that cost more than the permit prices) could purchase emission permits. The forces of supply and demand would set the permit price and the market incentives would push the trading group, as a whole, to institute the least cost emissions

reductions first. As a result, it costs less for the trading group, as a whole, to reach the target emissions levels, than it would for each country to unilaterally reduce its emissions to the target levels. Such a policy, of course, raises a variety of legal and institutional questions regarding how it would be implemented with certainty. These issues are not addressed here: instead, the simple assumption is made that the policy works as intended and least-cost approaches to abating carbon are identified and traded.

Using the SGM model, the IAT modeled two international trading scenarios. In the first, it examined the affects of establishing a permit market among the United States, Canada, Western Europe, Eastern Europe, Japan, the Former Soviet Union (FSU), and Australia (collectively known as Annex I countries). In the second scenario, we examined the effects of Joint Implementation, that is, establishing a wider permit market that includes the rest of the world. These scenarios are compared to a scenario in which each of the Annex I countries independently implemented our "plain vanilla" scenario for stabilizing carbon emissions ; that is, stabilizing CO2 emissions at 1990 levels in 2010 with a ten year phase in, where revenues are used to reduce the deficit, and under the assumption of moderate technological change (i.e., a .25 percent additional reduction over the baseline in the annual increase in energy or carbon efficiency).

The results obtained using the SGM model appear in Table 9. Under the "Annex I trading" scenario, the United States, Canada, Western Europe, Japan, and Australia each bear real costs for CO2 emissions reduction. The losses experienced by he different nations reflect the economic assumptions made for them (which are presented earlier in this report, in Table x) and their energy policies to date. Japan, for example, is projected to have relatively slow economic growth and already has relatively high energy prices and an extensive nuclear program. Thus, it is not projected to have strong growth in emissions over the next few decades and the implicit price of carbon in the presence of a 1990-level freeze is relatively low. Western Europe fares somewhat worse, since its economic growth is projected to be stronger, and its energy policies have been biased towards coal. Absent trading, the implicit price of carbon in the Annex I regions ranges from a low of \$82 per ton to a high of \$268 per ton in 2010.

Table 9: GDP Impacts to Annex I Countries, No Trading v. Annex I Trading
SGM 1990 Level Case

	No Trading					Annex I Trading				
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020
Australia	0.00%	-0.17%	-0.49%	-0.37%	-0.21%	0.00%	0.00%	-0.14%	-0.15%	-0.14%
Canada	0.00%	-0.42%	-1.06%	-1.08%	-1.10%	0.00%	0.00%	-0.16%	-0.20%	-0.19%
Eastern Europe	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.72%	0.68%	0.49%
Former Soviet Union	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.39%	0.50%	0.46%
Japan	0.00%	-0.23%	-0.63%	-0.43%	-0.29%	0.00%	0.00%	-0.08%	-0.08%	-0.06%
Western Europe	0.00%	-0.19%	-0.67%	-0.43%	-0.17%	0.00%	0.00%	-0.16%	-0.15%	-0.09%
United States	0.00%	-0.06%	-0.15%	-0.17%	-0.15%	0.00%	0.00%	-0.08%	-0.10%	-0.10%

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in C/GDP.

In addition to a high permit price, near term GDP losses in Canada are the most severe in Annex I. This occurs because Canada is already less carbon intensive, but not as energy intensive as the United States. The carbon to population ratios in Canada are about 17 percent below that of the U.S. levels throughout the baseline projection period, while its energy to GDP ratio is about 46% higher. Canada relies more heavily on non-carbon sources of energy, such as hydro electrical generation.

Table 10 shows the implicit price of carbon by country without trading, trading with Annex I countries, and with Joint implementation with the developing countries.

Table 10: Implicit Price of Carbon (1995 \$) Under Annex I Trading and Joint implementation--SGM 1990 Level Case

	2010			2020		
	No Trading	Annex I Trading	Joint Implementation	No Trading	Annex I Trading	Joint Implementation
Australia	132	23	15	126	35	20
Canada	222	23	15	252	35	20
China	*	n/a	15	*	n/a	20
Former Soviet Union	0	23	15	0	35	20
Eastern Europe	0	23	15	0	35	20
India	*	n/a	15	*	n/a	20
Japan	268	23	15	257	35	20
Korea	*	n/a	15	*	n/a	20
Mexico	*	n/a	15	*	n/a	20
Western Europe	130	23	15	139	35	20
United States	82	23	15	107	35	20
Rest of World	*	n/a	15	*	n/a	20

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in C/GDP. * indicates the cell is blank because the country is a non-Annex I country.

The United States shows smaller output losses than Japan or Western Europe predominantly because it has more “cheap” carbon-abating opportunities. Its energy prices are lower than these regions’ and its has yet to take a variety of steps to promote energy conservation and reduced fossil fuels use that are more commonplace elsewhere. Thus, it is somewhat easier for the United States to reach emission targets than other regions, which have “picked the low fruit.”

Under Annex I trading, the implicit price of carbon falls dramatically -- permit prices start at \$23 in 2010 and slowly climb to \$35 in 2020. All countries gain through these lower permit prices, because as a whole they achieve stabilization at 1990 levels more cheaply. The source of these cheap emissions is the former Soviet Union and the Eastern European nations. Carbon values fall because it is cheaper for all of the industrialized nations to pay for carbon abatements in those nations (due to lax environmental standards and slow economic growth) than to pursue domestic options only. These nations gain as they become emissions permit sellers under Annex I trading.

Joint Implementation with developing countries reduce the costs of permit prices even further. Joint implementation -- emissions trading on a global scale -- reduces the permit price further, to \$15 in 2010 and \$20 in 2020. Under this broader market for tradeable emissions permits, however, the FSU and Eastern Europe lose their monopoly on permit sales. Specifically, Joint

Implementation encourages China and India to reduce their use of coal and enter the market as emissions permit sellers.

NOTE TO READERS: IAT is still in the process of taking the lower implicit carbon prices calculated by SGM and using them as input to simulate macroeconomic conditions under DRI. Note, however, that the implicit price involved are less than those of the "110 percent case" above, and the economic losses, therefore, should be anticipated to be smaller.

Reducing carbon emissions would also lead to reductions in other pollutants of direct economic benefit.

NOTE TO READERS: The IAT is still in the process of estimating collateral environmental benefits.

The losses experienced to the U.S. by handicapping energy-intensive industries in international trade need not be large. There is widespread and legitimate concern that forcing an implicit energy price increase on U.S. producers will disadvantage them substantially through trade, particularly with those countries outside of "Annex I" that might not be subject to the same emissions limits. While the IAT is still examining these questions on an industry-by-industry basis, it used the DRI model to examine the overall trade implications of such a possible energy price differential.

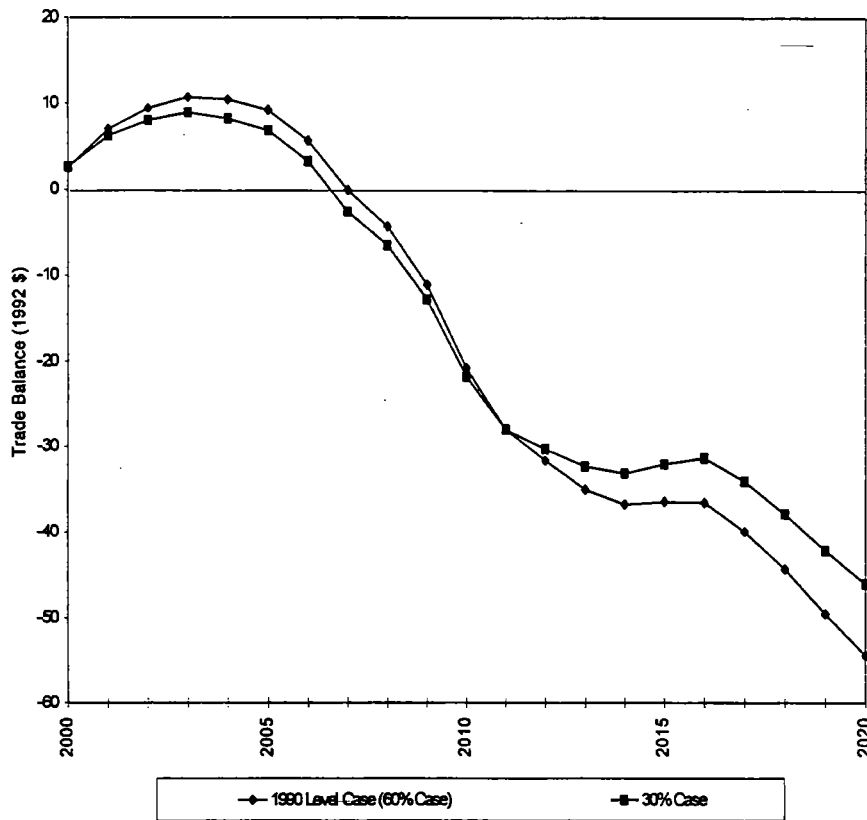
The DRI model examines overall trade effects by assuming a rate at which producers who export to the U.S. experience cost increases. In the aggregate, about 60 percent of imports of manufactured goods come from Annex I countries that will also experience higher implicit carbon prices (and, therefore, energy prices). The DRI model, therefore, assumes that manufactured imports, in general rise by an average of 60 percent of the full cost increase experienced by U.S. manufacturers.

This assumption, however, can be criticized as being too favorable to U.S. producers. If exporters from non-Annex I countries do not experience the cost increase that Annex I producers do, then they will no doubt substitute their production for Annex I production. Given this likely switching of export sources, the DRI model was also run with the assumption that foreign producers experience a cost increase equal to, on average, a 30 percent as opposed to 60 percent of the U.S. cost increase.

Figure 20 presents the results under these two cases. The effect of the carbon-limiting policy on trade is depicted in these runs as surprisingly small. Some of the change in trade flows is reconciled in the DRI model by allowing the exchange rate to move, but as seen in Figure 21, the anticipated changes in the exchange rate themselves are not large and do not vary between the two assumptions. The small differences are not necessarily counterintuitive. There are already

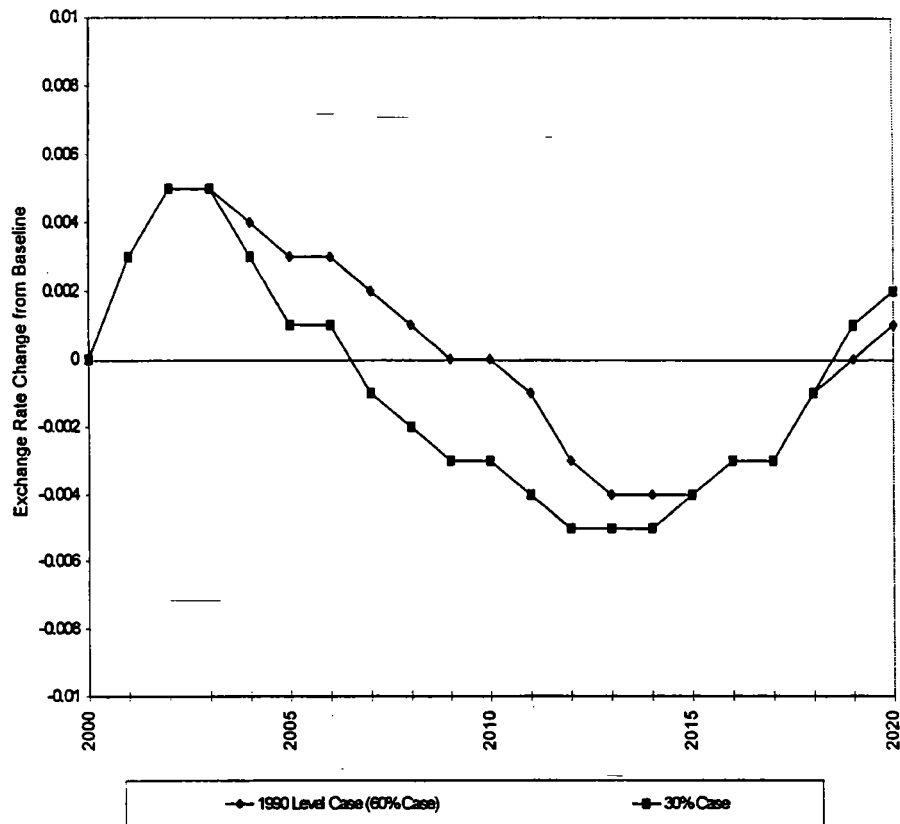
substantial energy price differences and differing environmental restrictions among trading nations that are larger than the price increase that results from the policies considered here.

Figure 20: Sensitivity of the Trade Balance to International Price Ratio Assumptions



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Figure 21: Sensitivity of the Exchange Rate to International Price Ratio Assumptions



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Regional and Sectoral Detail

Using the DRI model, the LAT examined issues regarding regional and industry detail associated with carbon-limiting policies. A summary of this detail for industry effects is given in Table 11.

Table 11: DRI 1990 Level Case--Industry Impacts
Output (Percent Change from Base case)

	2010	2020
Energy Producers		
Electric Utilities	-11.6%	-17.7%
Petroleum Refining	-8.8%	-9.3%
Coal Mining	-25.9%	-39.3%
Natural Gas	-19.9%	-18.2%
Gas Utilities	-11.4%	-10.9%
Crude Petroleum	-11.8%	-12.4%
Fuel Oil	-13.6%	-16.7%
"Pipelines, ex. Natural Gas"	-7.8%	-8.0%
Energy Intensive Industries		
Food and Kindred Products	-1.0%	-0.6%
Chemical and Allied Products	-0.8%	-0.3%
Petroleum and Coal Products	-9.2%	-10.0%
Stone Glass Clay Products	1.5%	2.9%
Paper and Allied Products	-0.4%	3.0%
Primary Metals	0.8%	1.5%

Note: Emissions stabilized at 1990 levels in 2010 with a 10 year phase-in. Assuming a 1.25 percent annual decrease in E/GDP.

Energy-intensive industries are put at a disadvantage by higher implicit prices for carbon following the imposition of policy. This occurs because they are displaced through trade -- an effect that DRI depicts as relatively minor -- or because the composition of the economy's output changes in favor of less energy-intensive goods and services. These composition shifts drive the industry results. For some industries, however, composition may shift in favor of energy intensive industries because the economy's composition shifts from consumption to investment, which calls up a different mix of goods itself.

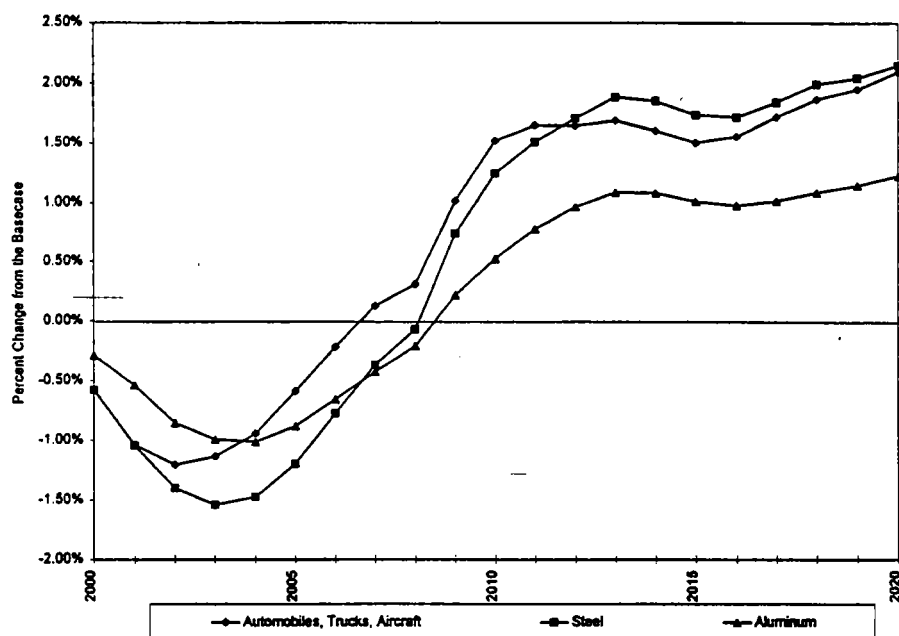
For example, a number of energy intensive manufacturing and construction sectors benefit in the long-term by the stimulus to investment created by the reduction of the deficit. For example, output of the construction, steel, aluminum, lumber and wood products, and motor vehicles are 1.0 to 4.0 percent above the baseline in 2010. Figures 22 and 23 show the transitional output losses and the long-term output gains of a number of basic energy intensive industries that produce final or intermediate products for investment.

On the other hand, industries whose production is used primarily for consumption, particularly energy products such as petroleum and coal, but also including paper, chemicals, and food and kindred products, continue to show losses in annual output, from about 0.5 to 1.0 percent, even after the economy has recovered through 2010. In the longer-term, other than the energy

producers, the consumption-oriented industries are expected to just about reach their output levels in the baseline.

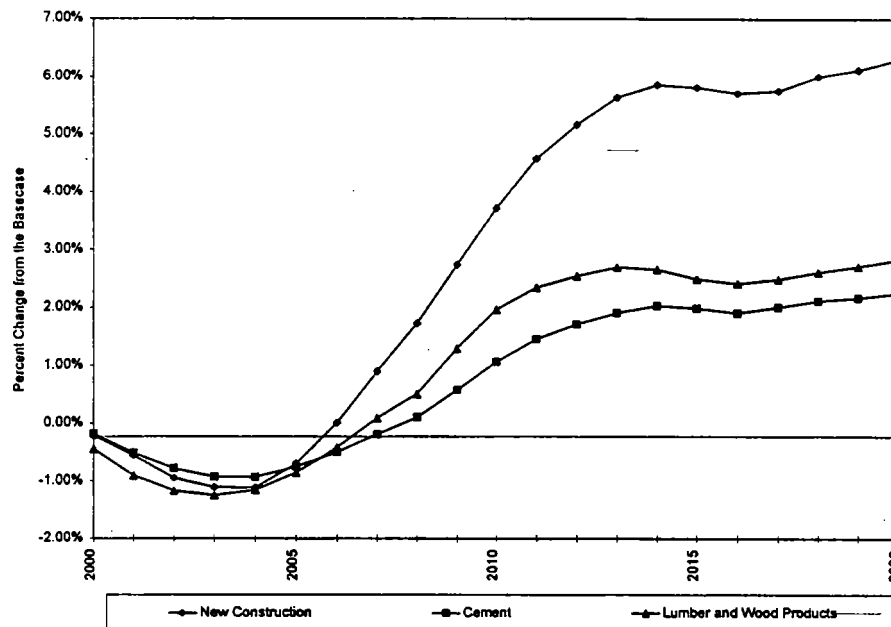
This mix effect is particularly and obviously important for energy producers. The DRI model suggests output of petroleum products will decline by 8 percent in 2010 and by 9 percent in 2020, when compared to the base case. As seen in Table 11, coal production in the U.S. will be 26 percent lower in 2010 and 39 percent lower in 2020 when compared to its projected levels in the base case.

Figure 22: DRI 1990 Level Case--Output in Key Industries--New Construction, Cement, and Lumber and Wood Products



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

**Figure 23: DRI 1990 Level Case--Output in Key Industries--
Automobiles, Trucks and Aircraft, Steel, and Aluminum**



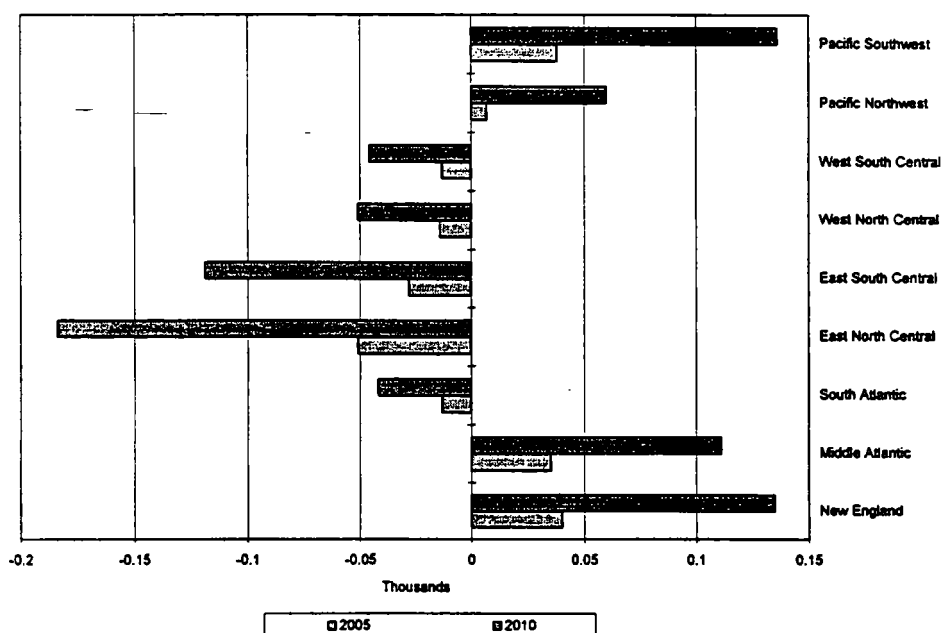
Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

Coal employment would be [FORTHCOMING] percent and [FORTHCOMING] percent lower, respectively, in those years: these declines are lower than output losses because productivity in the industry is generally anticipated to improve and the nation's coal mix is projected to shift to more productive coal reserves. These employment losses are particularly severe in the east and west south central regions. Total coal employment in the U.S. would be [FORTHCOMING] lower by 2020.

Electric utilities experience smaller percentage reductions in output, but their losses are larger in dollar terms. Utility output declines by about \$30 billion in 2010 and \$52 billion in 2020 when compared to the base case. Petroleum refining and coal mining also experience larger losses than other energy-related industries on a dollar basis.

Regional Effects The effects of climate change policy on the various regions of the country are shown in Table 12. In general, states in the East North, East South, and West North Central regions will have proportionally greater losses in population, 150-, 125-, and 75-thousand, respectively, and employment, 210-, 165-, and 125-thousand, respectively, than the other regions of the country. See Figures 24 and 25. The New England, Middle Atlantic, and the Pacific Southwest are expected to show long-term gains in population of 125-, 110-, and 130 thousand, respectively, and in employment of 125-, 45-, and 65-thousand, respectively, because of climate change policy implementation.

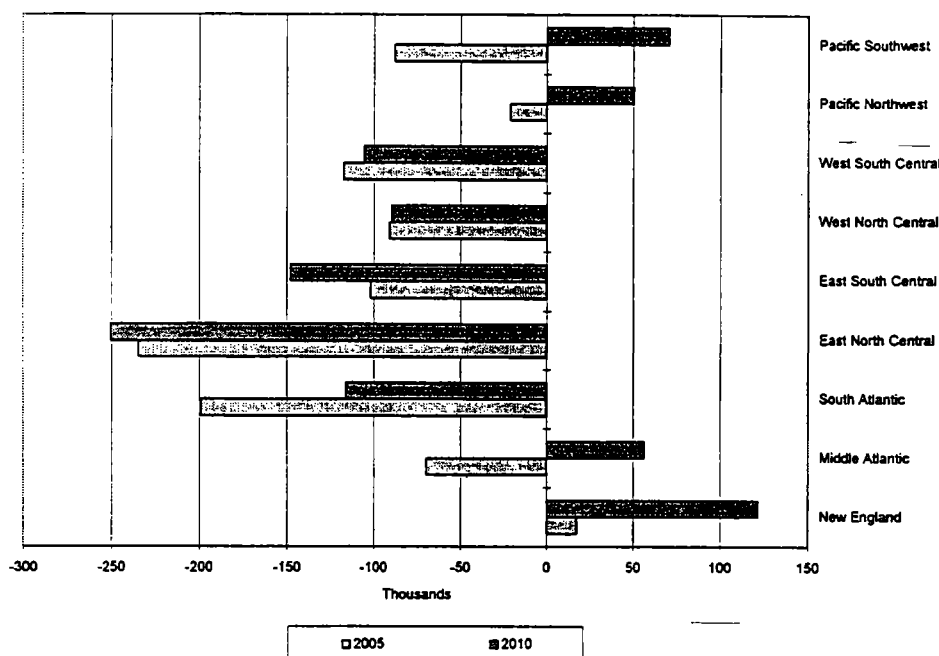
Figure 24 : DRI 1990 Level Case--Population
(change from the base case)



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

The key to the regional effects relies on how the revenue is recycled back to the economy. In the policy reviewed for regional effects, revenues are used to reduce the deficit which supports savings, and, thus, increases investment. The climate change policy favors those states where production in industries support investment in structures and capital goods equipment, and of course, those areas of the country that are not as proportionally dependent on mining. The climate change policy's effects are mitigated in those regions whose mix of industries favor investment goods industries and where the levels of industry production are large and can absorb the losses in production in industries that produce consumer goods.

Figure 25: DRI 1990 Level Case--Total Non-Farm Employment change from the base case



Note: Emissions stabilized at 1990 levels in 2010. Revenues recycled back into the economy through deficit reduction and assuming a 1.25 percent annual decrease in E/GDP.

As shown in Table 12, although the West South Central region is expected to have the greatest losses in mining employment, about 15 thousand in 2010, this represents only about 6 percent of its total mining employment in that year. On the other hand, the East South Central Region is expected to lose about 8 thousand in 2010, but this represents about 22 percent of its total mining employment in the same year.

Table 12: DRI 1990 Level Case

Regional Impacts

Year	New England	Middle Atlantic	South Atlantic	East North Central	East South Central	West North Central	West South Central	Pacific Northwest	Pacific South*west
Disposable Income, % change from base case									
2005	0.85%	0.38%	-0.08%	-0.44%	-0.45%	-0.73%	-0.15%	0.34%	0.27%
2010	1.89%	0.74%	-0.12%	-1.07%	-1.33%	-1.24%	-0.39%	1.10%	0.60%
2020	2.85%	0.91%	0.06%	-1.37%	-1.45%	-1.89%	-0.66%	1.35%	0.70%
Total Non-farm employment, % change from base case									
2005	0.25%	-0.38%	-0.78%	-1.03%	-1.29%	-0.89%	-0.81%	-0.35%	-0.39%
2010	1.65%	0.30%	-0.42%	-1.06%	-1.80%	-0.84%	-0.68%	0.78%	0.29%
2020	2.66%	0.51%	-0.20%	-1.10%	-1.71%	-0.94%	-0.76%	1.12%	0.49%
Mining Employment, % change from base case									
2005	0.43%	-8.52%	-8.33%	-5.92%	-10.87%	-0.75%	-1.43%	-2.11%	-0.89%
2010	4.40%	-10.85%	-11.62%	-7.78%	-20.54%	1.02%	-6.44%	-1.08%	0.79%
2020	9.03%	-14.04%	-15.57%	-6.22%	-27.84%	4.25%	-4.78%	-8.34%	0.56%
Population, change from base case									
2005	0.04	0.04	-0.01	-0.05	-0.03	-0.01	-0.01	0.01	0.04
2010	0.14	0.11	-0.04	-0.18	-0.12	-0.05	-0.05	0.06	0.14
2020	0.25	0.18	-0.04	-0.30	-0.17	-0.11	-0.12	0.11	0.19
Manufacturing Employment, change from base case									
2005	9.61	1.67	-32.48	-77.07	-24.65	-19.50	-21.51	-0.95	-0.56
2010	26.48	21.72	-28.41	-116.07	-32.47	-28.33	-28.50	6.74	17.34
2020	36.92	13.90	-33.80	-142.48	-32.69	-35.25	-41.78	7.28	23.91
Transportation, Communication & Utilities, change from base case									
2005	1.74	-4.06	-12.10	-15.53	-4.90	-8.08	-8.70	-1.55	-6.49
2010	5.70	-2.94	-16.52	-25.93	-9.36	-13.46	-14.91	0.30	-5.52
2020	8.39	-4.83	-18.14	-31.18	-10.03	-16.07	-17.89	0.35	-5.35



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

Janet Yellen
314 OEOR

February 4, 1997

MEMORANDUM TO THE VICE PRESIDENT
SECRETARY MADELEINE ALBRIGHT
SECRETARY BRUCE BABBITT
ADMINISTRATOR CAROL BROWNER
ACTING SECRETARY CHARLES CURTIS
SECRETARY DAN GLICKMAN
SECRETARY FEDERICO PENA
SECRETARY ROBERT REICH
ATTORNEY GENERAL JANET RENO
SECRETARY ROBERT RUBIN
AMBASSADOR CHARLENE BARSHEFSKY

FROM: KATHLEEN A. McGINTY *KMG*
DANIEL TARULLO *DT*

CC: JOHN GIBBONS
KATHRYN HIGGINS
SYLVIA MATHEWS
FRANKLIN RAINES
JANET YELLEN ✓

SUBJECT: CLIMATE CHANGE

This year represents a critical stage in our efforts to develop and implement an effective policy to address the risks of climate change. Key international negotiations are now well underway with upcoming sessions scheduled for late February, August, and October. These treaty negotiations are scheduled to conclude at the Third Meeting of the Parties to the Climate Convention in December of this year.

We have recently taken steps to improve organizationally our ability to manage this issue. We have established a Deputies Committee on Climate Change. We have also established an interagency analytical group that is being led by Undersecretary Everett Ehrlich at the Department of Commerce. In addition, working groups at the Assistant Secretary level continue to contribute valuable coordination related to the international process, led by Assistant Secretary Eileen Claussen at State, and to issues related to domestic implementation led by the National Economic Council and the Council on Environmental Quality (Elgie Holstein and David Sandalow).

One final organizational piece, that we are now establishing, is a task force on outreach. The goal of the White House Climate Change Task Force will be to work with involved agencies and White House offices to educate and build support for the Administration's position in the climate change negotiations. It will focus on enhancing outreach activities to Congress, state and local governments, industry and farm organizations, environmental groups, labor and the media. The task force will be located in the White House reporting to us and will consist of a Chair with several professional staff. We are pleased to announce that Dirk Forrister, who has served as Assistant Secretary of Energy for Congressional, Public and Intergovernmental Affairs, has agreed to serve as Chair of this task force.

We will be calling on you in the very near future for your financial and staffing assistance in support of this important initiative. We appreciate your cooperation and support.