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THE WHITE HOUSE

WASHINGTON

October 18, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: **GENE SPERLING**
KATHLEEN McGINTY
DANIEL TARULLO
JIM STEINBERG
TODD STERN

SUBJECT: **Climate change decision memorandum**

This memorandum follows up on our earlier climate change memoranda and meetings with you. It requests specific decisions from you on various elements of our overall climate change policy. We are not looking for final decisions on the precise details of all the elements, but rather for key decisions that could form the basis for a five-point or ten-point plan. Your responses will allow us to put together a climate change policy package that you are scheduled to announce on Wednesday, October 22, while the penultimate negotiations take place in Bonn.

The decisions identified in this memo may be some of the most important and difficult of your Presidency. There does not appear to be any way fully to reconcile four constraints we have previously identified to you -- the environmental imperative, diplomatic realities, economic costs, and political opposition from business, labor and the Hill.

We think it is imperative to think beyond next week's announcement, to the management of this issue for Kyoto and beyond. In the short-term, any decision you make will draw more censure than praise. We can modulate the criticism from different quarters by moving to different points on the policy spectrum, but there is no package that wins universal acclaim. It is important, therefore, to sketch a vision of how your policy will play out in the months and years ahead.

The package we present to you today rests on several premises. First, we understand that you wish to position the United States as a leader on this issue. We present a set of policies that show that the United States is taking this problem seriously and that you are working to build the domestic consensus necessary to address this problem. Second, we recommend that an agreement in Kyoto, while desirable, should not become the measure of success of our policy. The concessions required to reach agreement there could endanger the long-term management of this issue at home. Finally, we believe that our policy can unfold with time. We should advance

a framework that is sufficiently supple to adjust to political, diplomatic, economic, and scientific developments as they occur.

I. Confirmation of your instructions on several elements

Based on your reactions to our previous memos and our meetings with you, we understand that you support the following items as components of an overall climate change policy. The purpose of this section is to confirm that our understanding is correct.

- **Tax cuts and R&D:** We held a very productive meeting on Thursday with Secretary Rubin, Director Raines, Deputy Secretary Summers, Chair Yellen, and others to discuss the budget and our climate change proposal. The focus of the meeting was how to structure a package of carbon-reducing tax incentives and other programs that would amount to perhaps $5 billion over 5 years. Given the constraints on discretionary spending, we decided to explore how to move as many of the initiatives as possible on to the tax side. Treasury is working intensively with DOE, EPA, and other agencies on this front. Some of the *preliminary* ideas include: a tax credit for the purchase of certain highly efficient equipment for buildings; a tax credit for high fuel economy vehicles; a tax credit for photovoltaic rooftop systems; a tax credit for retiring inefficient electric generating capacity; and a tax credit for industrial cogeneration. The specific proposals could be more fully developed, and final decisions about which activities to encourage through spending or which through tax incentives, as part of the budget process. The offsets for the tax cuts could take the form of reducing current tax preferences for fossil fuels; such offsets would ensure that both the tax cuts and their "pay-fors" advance the effort to reduce carbon emissions.

- **Federal energy efficiency:** The federal government spends more than $7 billion per year on energy. A Federal government energy efficiency initiative is being developed by DOE staff, in conjunction with Defense and other relevant agencies. It would include expanding the use of Energy Savings Performance Contracts, reinventing federal procurement, taking a "sustainable design" approach to federal facilities, and developing more efficient military propulsion systems. The effort would also include a review of existing Executive Orders on purchases, preparation of a new Executive Order to fill any gaps, a directive to federal agencies to prepare greenhouse gas reductions plans and a requirement that all federal agencies assess the greenhouse gas impacts of major federal actions.

- **Industry out-reach:** Although we are committed to a binding, rather than voluntary target, it would still make sense to encourage businesses, on an industry by industry basis, to prepare plans in which they tell us what reductions they believe they could achieve on their own and how they could best achieve them. We would ask each relevant industry to prepare a plan over the next 6-12 months and would work cooperatively with industries where appropriate. (For example, the cement industry claims it could reduce CO2

emissions by 10 million tons/year -- over 2 percent of the total national reduction needed to reach 1990 levels by 2010 -- with a regulatory change in how the industry is permitted to mix cement. We would work with the industry to facilitate such a change, if it proved to be appropriate.)

- **Credit for early action:** We would declare that it was crucial that there be no discrimination against firms that take early action to reduce emissions (e.g., that any baseline that might be established would be set prior to any early action -- so that they would not suffer from taking early action and then seeing the baseline moved). Furthermore, we would declare that we would strongly favor appropriately rewarding those who promptly take early action. The details of how such an early credit system would operate, however, are complex and can't be fully articulated until the details of an overall permit trading system are worked out. We should state our support for early action and indicate that early actors will be appropriately rewarded.

- **5-year science reviews:** Under the existing climate treaty, the Intergovernmental Panel on Climate Change is charged with reviewing the state of the science every five years. Several corporate and Congressional leaders have suggested supplementing these reviews with additional studies by the National Academy of Sciences or your Committee of Advisors on Science and Technology (PCAST), on a similar 5-year cycle.

- **Emphasize long-term goal of stabilizing concentrations.** The goal of the existing climate treaty is "to stabilize concentrations of greenhouse gases in the atmosphere at levels that avoid dangerous anthropogenic interference with the climate system." However, the Parties to the climate treaty have never defined precisely what levels are dangerous. Your advisers believe the United States should announce support for developing a specific, long-term goal. The U.S. would urge the Intergovernmental Panel on Climate Change, as well as the National Academy of Sciences, to undertake this task.

- **Global Environmental Facility.** The United States is significantly in arrears to the Global Environmental Facility, which assists developing countries in reducing greenhouse gas emissions. (Of the $430 million pledged for FY93-FY97, we have been able to contribute roughly $185 million.) These arrears reduce our leverage with developing countries in negotiations under the climate treaty. Your advisers recommend you reemphasize your strong commitment to the Global Environment Facility and support clearing U.S. arrears at the earliest practical date. Funding for the Global Environment Facility should be pursued as a top priority.

- **International Financial Institutions.** We would work with the international financial institutions (e.g., World Bank and IMF) to boost the importance of carbon reduction efforts in the context of both concessional and non-concessional lending decisions. The purpose would be to ensure that the activities of the international financial institutions provide the proper incentives for countries to undertake efforts to address climate

change. Elim. fossil fuel subsidies.

- **Bilateral Dialogues.** We are pursuing bilateral dialogues with key developing countries (including China, Brazil and India) to promote clean energy. Often, interest in energy efficiency and renewable energy is greater in these settings than in the politicized, multilateral setting of the Climate Convention. Discussions focus on regulatory structures for clean energy development, technical assistance, export credit and related items. Work is underway in this area in connection with the Jiang Zemin state visit later this month. Your advisers recommend that we pursue these dialogues with increased effort in the years ahead.

- **Transition Assistance.** While we should not dwell on transition assistance as a major focus of your plan, you should nonetheless state as one of your principles that we will work cooperatively with labor and Congress to insure that we give proper assistance to any workers who are dislocated by the changes in energy usage inherent in any climate change plan. This both makes sense and is very important to labor.

_____ Approve the above components

_____ Do not approve

_____ Discuss further

II. Overall policy approach, including targets and timetables

The most difficult decisions you must make involve targets and timetables under the climate treaty, and how explicit to make the protections against excessive economic costs as part of your announcement. You have already heard the pros and cons of different courses of action.

To put the target, timetable, and safety valve discussions in context, it may be helpful to examine the overall vision that we have for your policy package. The sections below then describe possible variations on this basic package.

The plan involves three stages. Only after we had accumulated experience during the first stage (of tax cuts, R&D, and industry out-reach) and accumulated more experience during the second stage (of a trial trading program), would we enter the period under which we would be bound by the international treaty to reaching 1990 levels. Possible budget periods are explored below.

Our approach recognizes the novelty of the task that we are undertaking, and the uncertainty surrounding its potential impact, by creating regular reviews of how effectively the economy was responding to the carbon emissions reduction effort, and how effectively other

countries were responding. Such a review would include the impact of the effort on overall energy prices, an analysis of how technology was developing to meet the need for low-cost carbon reductions, an evaluation of progress toward an international permit trading regime, an assessment of the Federal government's own efforts to conserve energy, an evaluation of the efforts undertaken by other countries to meet their targets, and a recommendation on how best to proceed. The review could be conducted every four years, starting with one in 2004 and another in 2008.

In addition to these regular reviews, the basic vision involves three stages:

- Beginning as soon as possible: Tax cuts, R&D, and industry outreach. Before 2005, we would start with the policies that we have outlined above: tax cuts, R&D, federal energy efficiency, industry out-reach, and a commitment to rewarding early action.

- 2005-2008 or 2005-2010: Trial emissions trading program. The emissions trading system would start in 2005, as a trial project that would allow us to learn how the system operates before entering the period in which our binding international obligations would hold. Gene would prefer that we include an explicit ceiling in this period, to ensure that the permit price does not rise above $25 per ton. Katie opposes naming a specific ceiling price. This issue is explored in more detail below.

- 2008-2014 or 2010-2015: Return to 1990 emissions levels. Only after we had accumulated experience during the first stage (of tax cuts, R&D, and industry out-reach) and accumulated more experience during the second stage (of a trial trading program), would we enter the period under which we would be bound by the international treaty to reaching 1990 levels. Possible budget periods are explored below. We would also commit to further reductions, to levels below 1990, after the end of the first budget period.

This structure is designed to phase-in implementation of the program, thereby minimizing costs. We thus start with two periods -- amounting to a decade's worth of experience -- in which the pain is relatively low, and the economy has a chance to adapt to some of the new constraints being imposed on it. Only after reviewing our experience under these two periods would we determine precisely how we would make adjustments in the binding international period.

But it is crucial to recognize that even with this strategy, we are still very exposed to attacks about the credibility of our plan or the potential costs involved in meeting the target and timetable. The vast majority of outside, credible *economists* will predict that reaching 1990 levels by the 2010 or 2015 timeframe will involve significant economic costs -- making it awkward for top Administration economists to simultaneously argue that we will meet our target and avoid significant economic costs. Other experts, such as those who look at the unused technological potential in many sectors, will be prepared to support these claims. We

will be forced to face very difficult questions about whether we are willing to accept the costs that most credible outside analysts believe will be necessary to reduce emissions to 1990 levels by the 2010 or 2015 timeframe. But if we try to protect ourselves against such attacks, we will expose ourselves to attacks that the target is not truly binding. Gene's view is that our best hope is to argue that future Congresses and Presidents will decide how best to proceed at the relevant point (see further discussion below).

At the same time, we will also face strong attacks from the environmental and international community on the ground that our target and timetable are too weak. Two weeks ago, Japan proposed 0-5 percent reductions from 1990 levels by 2008-2012, and was harshly criticized. The vast majority of the environmental community expressed outrage when press reports indicated that you were not even considering reductions below 1990 levels in the 2010 timeframe.

Within this overall framework, there are several possible variations:

A. Trial emissions trading program (2005-2008 or 2005-2010)

The framework delineated above would start a domestic emissions trading system in 2005. The first few years of the system -- before any internationally binding obligation would take hold -- would involve a relatively mild constraint (i.e, only a small reduction off the business-as-usual emissions path).

The benefit of an early start is that it allows time for the system to become operational in the run-up to the internationally binding goal, and begins to deflect emissions from the business-as-usual path. The cost is that in order to affect emissions, it moves forward the time at which energy prices will rise from their business-as-usual path.

Gene would prefer to impose a ceiling price on the permit system during this trial period, to ensure that the constraint was mild. The principal benefits of this specificity are that it builds credibility and provides a way to beat back the $200 per ton (50 cents per gallon) attack. In response to such attacks, we could argue that the price increase would be limited until after the trial budget period (at least 2008) and, that after that date, we would not expect a future President or Congress to impose excessive costs on the economy. To environmental groups, we would argue that the $25 ceiling applies only to the trial trading period, before the first internationally binding period.

Katie opposes naming a ceiling price. The cost of the $25 ceiling approach is that it gives opponents a specific, Administration-approved figure to attack. Specifying the ceiling price for the trial period allows opponents to attack on that basis ($25 per ton of carbon translates into approximately almost $40 billion per year), and these figures would continue to be identified with the Administration's climate change program even if there is no agreement in Kyoto. We could argue that the figures would explicitly be a *ceiling* and that the prices

could be lower. A specific price would also be opposed by some in the moderate business community at least in part because they think such a price would interfere with their ability to do lucrative joint implementation projects in developing countries. Some in the business community are already arguing that any price of this kind would, whether correctly or not, be perceived as a *floor*.

During the last several days, opposition to a trial program has begun to emerge from utilities and others. We are consulting and will pass along further information as soon as we receive it.

_____ Approve starting the permit system in 2005

_____ With $25 ceiling on permit price

_____ Without specific ceiling on permit price

_____ Do not approve

_____ Discuss further

B. Targets and timetables under the climate treaty

It is vital to keep in mind that we should discuss targets and timetables as only one part of a three-piece international agreement that must also include provisions for international emissions trading and joint implementation, as well as clear obligations for developing countries. Arguing for this three-part framework allows you to take the high ground by calling for a truly global approach to the problem.

The integrity of this framework is also critical to the economic and political defense of our position. For one, the flexibility for low-cost reductions that trading and JI afford is key to our ability to defend as achievable any target that seeks to reduce emissions to 1990 levels in the 2010 timeframe. As for developing countries, insisting on their meaningful participation deflects the criticism that U.S. competitiveness is at risk and also makes the strong environmental point that the problem cannot be solved without all major greenhouse gas emitters doing their fair share.

The targets and timetables will inevitably remain the focus of enormous attention at home and abroad. Constituencies and other countries will pay more attention to this piece of our policy package than to any other. Based on our meeting with you, we understand that you would like to support a position within the current international mainstream, that you are inclined toward a first target of 1990 levels by roughly 2010 or 2015, and that you would support additional reductions in roughly the 2020 or 2025 timeframe. Based on this understanding, we suggest two possible approaches. (There are, of course, many variations that would accomplish similar goals.) Both

approaches reflect the U.S. position in support of multi-year targets, intended to smooth out annual variations in emissions caused by weather, business cycle, and other factors.

- 1990 levels by 2008-2014; reductions below 1990 levels in the next budget period
- 1990 levels by 2010-2015; reductions below 1990 levels in the next budget period

The basic dynamic is that an earlier timetable would please the environmental and international communities more, while a more gradual timetable would be less opposed by business and labor. Neither of these approaches is likely to win actual praise from the environmental groups or your negotiating partners.

Internationally, the EU and much of the rest of the world will criticize either of these options, since neither calls for reductions below 1990 in the first budget period. (The Japanese were criticized for their plan by much of the international community; we could expect even stronger criticism.) 2008-2014 would be received better than 2010-2015. Similarly, environmentalists will be very disappointed by the absence of reductions below 1990 in the first budget. The commitment to reductions below 1990 levels during the second budget period could help somewhat.

Most business and labor will not be happy with either of these options. The hard-core business opposition will attack either of them with great vigor, but more moderate companies and utilities, of the kind you hosted in the Cabinet Room in August, would feel much better about a more gradual approach (e.g., 2010-2020), but could probably live with 2010-2015 -- *if* we made clear that we were insisting on a full international package as part of the deal: joint implementation, international trading and developing country participation. The AFL-CIO has argued for a 2020 timetable.

Some of your advisers -- including Gene, Dan, and Todd -- would prefer to see a target and timetable more in the 2015 or 2020 range, and the economic agencies would prefer something beyond that. Others -- including Katie, Jim Steinberg, Jack Gibbons and Madeleine Albright -- are inclined toward an earlier target, closer to the 2010 timeframe. It is our understanding that you would prefer something closer to 2010. We have therefore presented two options in that range. Not surprisingly, those who favor something in the 2015-2020 range or beyond would prefer the option below that is less stringent.

Over the weekend, Katie has been engaged in intensive efforts to shape a coalition of business and environmental concerns that might stand up to support your policy next week. Key players are BP, several utilities, and the Environmental Defense Fund. The key components of a policy that might win support from these groups and companies appears to be: (1) 1990 levels by 2008-2014; 1990 levels minus 5 percent by 2015-2021; (2) strong commitment to credits for early action (i.e., before 2008); (3) strong support for existing elements of the U.S. position (flexibility in meeting targets and participation of developing countries), (4) no "safety valve" or

"escape clause", and (5) no trial permit period as above. At this writing, the results are uncertain. We will keep you closely apprised.

Gene notes that while initial validation is important, we must carefully weigh any possible benefits from policy changes intended to capture initial validation against possible cons from those changes if they might expose us to attacks in a larger political arena.

_____ 1990 levels by 2008-2014; reductions below 1990 levels in the next budget period

_____ 1990 levels by 2010-2015; reductions below 1990 levels in the next budget period

_____ Discuss further

C. Protecting against excessive costs during the international target period

At a minimum, we would announce a general principle that it would be unreasonable to expect you or any future President to impose excessive costs on the economy in implementing this program. The question is whether we go beyond a statement of principle, by announcing some mechanism for protecting the economy against significant damage. *The fundamental tension involved is how to balance the need for protection against charges of high economic costs against the "binding" nature of the international target.* The statement of principle provides the least protection against charges of high economic costs, and the most protection against charges that the target is not binding. In addition to that approach, there are three different visions that build upon a simple statement of principle to provide somewhat more protection against the economic damages argument; the visions vary in trading off protection against charges of substantial costs versus protection against charges that the obligation is not truly binding. You should also keep in mind how any of these approaches influence the effectiveness of your economic team in advocating our policy package.

- Announcing support for a ceiling price in the internationally binding period (e.g., 2008-2014 or 2010-2015). The ceiling price could be defined now or decided in the future following consultation with Congress and other interested parties.

- Announce support for a discretionary safety valve, which would be invoked if costs are judged to be excessive or other countries were not meeting their obligations. This discretionary safety valve would not explicitly specify the criteria (e.g., permit price, GDP growth, unemployment, international trade in permits, other countries' performance, etc.) that would be used in evaluating the costs of the program.

- Announce support for having the Congress and the President review the program immediately before the binding international period, and decide how to proceed at that point. This approach reflects the reality that future Congresses will always have the option to protect the economy or undertake more environmental action -- and thus recognizes that

decisions about whether the United States was willing to bear the costs that could be necessary to meet the target and timetable goal will have to be made at that time.

Approach 1: Ceiling price in internationally binding period

The first approach would involve a statement to the effect that even during the internationally binding period (2008-2014, or 2010-2015), the government would stand ready to sell additional permits at some price, which could be specified now or set after appropriate consultation with Congress and other interested parties. Such a ceiling price would provide the most protection against charges that the costs involved would be excessive, but it would also provide the most ammunition for those who want to charge that the target is not truly binding.

This idea has emerged in the public dialogue on this issue very recently. Last week, due in part to a general discussion of this issue at the White House conference, there was a flood of constituency interest. Environmental groups wrote criticizing the idea in very strong terms. Several corporate leaders (including Tom Casten of Trigen, BP, and several leading utilities) voiced *opposition.* On the other hand, Gene and others believe that it is reasonable to surmise that as many business groups evaluate a specific safety valve proposal, they will be supportive to the extent that such a proposal caps overall costs.

Approach 2: Discretionary approach which would be invoked if costs are judged to be excessive or other countries are not performing

This discretionary safety valve would not explicitly specify the criteria (e.g., permit price, GDP growth, unemployment, international trade in permits, etc.) that would be used in evaluating the costs of the program. Instead, we would announce now that protective steps would be taken under either of two conditions:

- First, if the effort were imposing substantial economic damage on the country.
- Second, if some percentage of other countries were not meeting their obligations.

The principal benefit of this approach is that it would allow us to fend off the high cost estimates of our opponents, without creating a specific Administration figure to attack. In a related vein, this approach frustrates efforts to plug official Administration figures into conventional economic models, in an attempt to show that our policies are unlikely to achieve their objectives. It also offers the most protection against the concern that non-market mandates will be used to fill the gap between a specific ceiling price and the target and timetable.

On the other hand, it could allow all sides to assume the worst: Corporate groups would worry that the safety valve would never be triggered, and environmental groups (which strongly dislike the idea to begin with) would worry that it would be triggered too easily. We are also likely to be faced with a barrage of questions, from those armed with credible outside analysis,

about how we expect to meet the target for a price that was not "excessive." We could be forced into reacting to specific model results -- and thus quickly pressed into specifying the precise conditions under which the safety valve would be used. For example, we would likely face questions such as: "Is a $100 increase in carbon prices 'excessive'?" If we responded that $100 was excessive, we could soon fall into the trap of defining the boundary of "excessive."

Approach 3: Announce support for having the Congress and the President review the program immediately before the binding international period

This approach reflects the reality that future Congresses will always have the option to protect the economy -- and thus recognizes that decisions about whether the United States was willing to bear the costs that could be necessary to meet the target and timetable goal will have to be made at that time.

The benefit of this approach is that it provides some protection against the likely attacks, but still allows us to underscore our commitment to the target. But we could be criticized for avoiding the difficult choices involved, and it could allow all sides to assume the worst: Corporate groups that we had commited to the target and timetable, and that the momentum behind the internationally binding treaty would allow environmentalists to win the debate in a decade; and environmental groups that we were not truly binding the country now.

Katie supports announcing a general principle. Larry Summers supports approach 2 and Gene and Todd support approach 3.

_____ Announce general principle

_____ Approach 1: Ceiling price in internationally binding period

_____ Approach 2: Discretionary approach which would be invoked if costs are judged to be excessive or other countries were not performing

_____ Approach 3: Announce support for having the Congress and the President review the program immediately before the binding international period

_____ Discuss further

<u>How to define the safety valve</u>

Another question that you had about the safety valve was whether it could be triggered if the economic performance suffered because of the carbon emissions reduction effort. In response to this question, NEC staff have worked with Treasury and CEA to explore different possibilities. They have concluded that it is not technically possible to construct a credible safety valve that triggers

only if the carbon emissions reductions adversely affect economic growth: the baseline issues are simply too complicated. For example, suppose that such a policy reduces GDP growth by 0.25 percentage points in each year. If the economy is otherwise booming, so that growth in the absence of this policy would have been 3.5 percent, then the result of the policy will still be a 3.25 percent growth rate. Given the enormous uncertainties, even after the fact, regarding the effects of environmental regulation on the economy, CEA and Treasury believe that it would be impossible to separate out the role of climate change policies on the economy's growth rate with any degree of confidence.

Including a safety valve in the climate treaty

A final question is whether to reflect a safety valve in the climate treaty. Any attempt to do so would meet with fierce resistance and charges that the United States was backtracking from its call for "binding commitments." But if we fail to seek a safety valve under the treaty, there is a risk that our domestic mechanism would put us out of compliance with our international obligations -- thus causing business leaders to fear that we would not invoke our safety valve if necessary.

Gene, Katie, Dan, Jim, and Todd do not recommend seeking a safety valve under the treaty. The costs of doing so would be high and the need is unclear. In the event a domestic safety valve appears likely to cause the United States to exceed emissions limits under the treaty, the United States could adjust domestic programs, renegotiate the treaty or accept the treaty's non-compliance provisions (which are unlikely to be severe).

_____ Negotiate a safety valve under the climate treaty

_____ Do not negotiate a safety valve under the climate treaty

_____ Discuss further

III. Grandfathering and auctioning

Another issue related to a permit system, and one we touched upon in our meeting, is whether the permits should be auctioned or grandfathered. Your advisers suggest that we not declare at this point our position on auctioning or grandfathering. Announcing either approach could entail considerable costs, and there is little to be gained from taking a position at this time. We would state that the structure of the domestic emissions trading program is important, and that we will work with Congress and other interested parties as we developed our domestic implementing legislation.

_____ Agree: announce that we will develop approach in consultation with key constituencies.

_____ Discuss further

IV. Developing country stance

As we have noted before, your advisers favor a tougher line on developing countries than we have taken to date. In particular, your advisers favor a linkage between the United States' willingness to make commitments and the willingness of key developing countries to do the same. Under the "two-step" approach, we would make a strong statement that the United States would not assume binding obligations under the climate treaty until key developing countries assume adequate obligations in terms of their commitments. This linkage with developing country commitments might be reflected in a "Kyoto Mandate," establishing a new round of negotiations under the treaty.

The position recommended by your advisers on this issue could very well endanger an agreement being signed this December in Kyoto. Even the current U.S. position on developing countries, which seeks additional commitments but does not draw this linkage, has won little if any support abroad. State Department negotiators believe that developing countries are unlikely to agree to a "Kyoto Mandate," and that the odds of such a mandate are close to zero unless the United States accepts targets with *reductions* below 1990 levels in roughly the 2010 timeframe.

_____ Approve linkage of U.S. commitments to developing country commitments

_____ Do not approve linkage

_____ Discuss further

V. Electricity restructuring

We have held two NEC principals meetings on electricity restructuring. Our recommendation is that one of the elements of your climate change proposal should be the announcement of support for electricity restructuring, which if properly structured, could reduce carbon emissions. It is the unanimous opinion of your advisers, however, that it would not make sense to announce your entire restructuring package in the context of climate change -- because it would be drowned out by other aspects of the package, because the Hill is consumed with Fast Track, and because we have not worked out all the details of our proposal.

One remaining issue is whether you would announce some specific examples of restructuring provisions in your climate speech. There is internal consensus in support of several provisions that could help reduce emissions, such as a "renewables portfolio standard" to promote wind, solar, geothermal and biomass and "green labeling" to provide consumers with the information to evaluate the environmental consequences of various sources of electricity. The principal benefit of mentioning these specific examples is that it provides more connection to the climate change issue. However, outsiders following the electricity restructuring issue may wonder why other environmental provisions were *not* mentioned. We are working to resolve this issue.

_____ Approve statement of environmentally-friendly program for electricity restructuring

_____ Do not approve

_____ Discuss further

VI. National Security Exemption

You should be aware that the Defense Department is seeking a "national security exemption" under the climate treaty. The Pentagon puts a high priority on this issue, due to concerns that fuel reduction requirements could hamper military operations. The issue has attracted attention on the Hill.

There is consensus among your advisers that some form of "national security exemption" is warranted. However, there may be disagreement concerning the scope of the exemption. We are working to clarify issues and resolve differences, and expect to provide additional information on this issue early next week.

6713

Janet Yellen fyi

United States Department of State

Washington, D.C. 20520

OCT 16 1997

TO: NEC - Gene Sperling
NEC - Dan Tarullo
CEQ - Katie McGinty

CC: EOP - Todd Stern

FROM: Under Secretary Stuart E. Eizenstat
Under Secretary Timothy E. Wirth

SUBJECT: Economics of Climate Change Policy

As we prepare for the President's announcement of the USG proposal for Kyoto and upcoming negotiations in Kyoto, we will face difficult questions about the cost to the US economy of reducing greenhouse gas emissions. The public perception is that the Administration has dismissed the findings of the IAT's economic analysis and so we must be prepared to draw on other analyses to support the economic underpinnings of our target and timetable.

Of course, what we say about the economics of our target and timetable must be part of a larger message that the President conveys about our climate policy. The message should include several components, including a definition of the environmental goal (getting to safe concentrations of greenhouse gases) and the costs of inaction, technology initiatives and government-industry partnerships, financial instruments -- such as tradable permits -- that will lower the cost of our policy, and tax cuts if we raise revenue through permit auctions.

We have taken the liberty of drafting a "Q and A" on the underpinnings of our assessment of the economic impact of USG policy on climate change.*

Q: *What will be the cost to the US economy of reducing greenhouse gas emissions? What economic analysis has the Administration used to guide USG policy on climate change?*

A: The USG proposal calls for a target and timetable that is realistic and achievable. The USG proposal will allow us, quoting Dr. Janet Yellen, Chair of the Council of Economic Advisors, "to do it smart," thereby reducing costs and possibly producing net benefits for the US economy in the long run. The market-based mechanisms of the USG proposal will assure flexibility in the timing and location of reductions -- through multi-year emissions budgets rather than single year caps, international emissions trading and joint implementation, and expanded participation by developing countries -- and aggressively promote technological innovation. These kinds of mechanisms will minimize the cost of efforts to slow climate change.

In considering the economic impact of USG policy on climate change, the Administration has drawn on several economic analyses, including those of the World Resources Institute (WRI) and

the Energy Modeling Forum (EMF). These analyses provide valuable information, highlighting the benefits of market-based mechanisms, the need for "when" and "where" flexibility in implementing an emissions reduction program, and the importance of technological development and diffusion -- all of which are central pillars of the USG proposal for Kyoto. They indicate that a realistic and achievable policy will have only a modest impact on the US economy.

In particular, WRI assessed 16 economic models and found impacts ranging from 2.4% below to 2.4% above business-as-usual, or baseline, levels of US GDP in 2020, resulting from policies to stabilize greenhouse gas emissions at 1990 levels by 2010 and thereafter. WRI found that different models reach different conclusions because they start with substantially different assumptions. The costs of emissions reductions are lower when models assume that the US economy can adapt efficiently, that alternative non-fossil-fuel energy sources are available, that international trading and joint implementation are available, that revenues are "recycled" to cut taxes, and that greenhouse gas abatement avoids quantifiable damages from climate change or air pollution. According to EMF, costs are also lower when models include flexibility in the timing of emissions reductions.

Cost estimates at the "high end" of the WRI range arise from ~~unduly~~ pessimistic assumptions about the ability of the US economy to adapt to change, even in the long run, and opportunities for broad-based international participation, among other key factors. ~~This pessimism is unwarranted~~. By including flexibility in the timing and location of emissions reductions and promoting technological innovation, the Administration is seeking to implement a policy which will minimize costs and possibly produce net economic benefits in the long run. The USG's proposal for multi-year emissions budgets, international emissions trading and joint implementation, and expanded developing country participation will promote when and where flexibility. Further, the USG's proposal for an aggressive program to promote research, development, and investment in energy-efficient technology will reduce costs.

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* We are sending to you separately a memo regarding new developments that could further reduce the economic costs of climate change policy by redefining the calculation of the 1990 baseline, among other things. The range of economic impacts, as discussed in this memo, is without regard to the potential savings that we could gain if we chose to incorporate or otherwise build on those developments.

Drafted: EB - VAGreenfield
Cleared: EB/ESC - WRamsay
OES - MKimble
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G - RPrudencio
S/P - MIonata

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Larry and Janet and Jeff:

Attached are two documents:

1. My effort to follow Bob B.'s guidance

~~2. Janet's comments on the earlier draft.~~

I need help in the specification of policy directions.

I can be reached at home tonight starting about 8:30 at:

703-549-3865

David Wilcox

Boerstin/Wilcox

Global Climate Change: Which Way Forward?

I. Economic costs

There is no doubt that we must take action to begin to stabilize and eventually reduce our emissions of greenhouse gases. Economic evidence indicates, however, that meeting the targets and timetables for emissions reductions that are currently on the negotiating table would require severe and unpopular actions. Achieving such targets would entail greater restraint on energy consumption than resulted from the OPEC oil price increases of the 1970s. Such restraint could only be accomplished by imposing a tax — or the economic equivalent thereof — on energy that is more than five times larger than our 1993 BTU tax proposal. Advances in technology and mechanisms for international burden-sharing would help cushion this impact somewhat, but even with the most effective possible measures in place on these fronts, an aggressive program would still inflict considerable economic pain. For all these reasons, an ambitious approach would face severe Congressional opposition and have other highly adverse political consequences. Moreover, none of the lead signatories on the recent economists' letter supporting action on climate change believes that returning carbon emissions to 1990 levels by 2010 is warranted.

There is a better alternative available to the Administration: A more gradual program of emissions restraint would capture most of the environmental benefits of an ambitious program, and at only a small fraction of the economic cost.

Broadly speaking, there are three possible ways to satisfy the obligations we might sign onto in Kyoto: We can raise the price of emitting carbon; we can increase the efficiency with which we use carbon; or we can buy our way out of at least part of the obligation by paying other countries to reduce their emissions. The next several subsections consider five possible approaches to advancing one or more of these objectives: a tax on carbon emissions; a system of tradeable permits; command-and-control regulation; investment in technology; and international cost-reduction measures.

A. Carbon taxes

The most straightforward way to reduce carbon emissions is to tax them. Imposing a tax would increase the incentive to become "carbon-efficient."

The magnitude of the required tax would depend on the aggressiveness of the objective. If the objective is to return emissions to 1990 levels by 2010, then the tax would have to be between $80 per ton and $200 per ton of carbon emissions. This tax would have to be introduced within the next few years, and would ramp up to its full level by 2010,

- A tax of this magnitude would be 4-10 times larger than the BTU tax that was proposed in 1993.
- Even an $80-per-ton tax (i.e., a tax at the lower end of the estimated required range) would reduce the standard of living of the average family by about $880; this is roughly

equivalent to 1-½ week's worth of take-home pay. Furthermore, a tax of this type would be highly regressive: the burden on the lowest fifth of the population would be 6 times as great as the burden on the highest fifth.

- The impact of a tax of this magnitude would be evident in macroeconomic data as well. Conservative estimates suggest that this action would inflict the equivalent of one additional mild recession on the economy every 15 years.

Notwithstanding these severe impacts, your economic advisers believe that a tax on carbon emissions compares favorably to other methods of restraining carbon emissions. The costs to consumers and the overall economy under most other methods would exceed the costs under a direct carbon tax. (Some other methods would obscure these costs, but impose them nonetheless.) Importantly, a tax would limit the cost to the economy of the carbon program in a way that no other program is capable of doing: Once the level of the tax was set ("so many dollars per ton of emissions"), the cost could not rise. By contrast, other methods of imposing restraint on carbon emissions leave uncertainty about the eventual cost per ton of emissions.

B. Tradeable permits

Another available tool for restraining emissions is a domestic emissions trading program. At the center of this type of program is a *permit*, which entitles the holder to emit a certain amount of carbon into the atmosphere. Such a program could be implemented either by auctioning permits, or by giving them away. Many designs for the give-away are possible, but one much-discussed option would involve "grandfathering" existing emitters.

would publically be unavoidable + unfair

Grandfathering is economically ~~ludicrous~~, in part because it would publically reward polluters; for this and other reasons, we would strongly favor an auction-based approach. Either approach, however, would result in a large increase in the price of energy to consumers, and so would be perceived as essentially equivalent to an increase in taxes.

Some observers have claimed that the sulfur-dioxide program serves as a good model for how a carbon trading program would work, and in particular illustrates that carbon emissions could probably be reduced at surprisingly low cost. In fact, this is not the case. A carbon trading program would be 100 times as large as the sulfur-dioxide program, making any extrapolation extremely speculative. Moreover, a substantial portion of the acknowledged success of the sulfur-dioxide program derives from the fact that it replaced an enormously burdensome set of command-and-control regulations, and the fact that it enjoyed some good luck, notably in the form of a steep decline in freight rail rates. Neither of these factors can be expected to operate in the case of a carbon program.

C. Regulation

Reductions in emissions could be achieved by command-and-control regulation. However, because of the attendant cost to consumers and the resulting political consequences. this approach is not currently under serious consideration.

D. Technology

One alternative to raising the price of carbon is to improve the efficiency with which it is utilized. In the very long run, technology determines what can be achieved in reducing carbon emissions, so provision of major new research funding and perhaps funding for diffusing technology is important.

A recent Energy Department study (the "5 Labs Study) concludes that an ambitious program of investment in technology development and diffusion could move the nation one-third of the way toward meeting the 1990 level of emissions *at no net cost — or possibly even net benefit — to the economy*. John Deutch, your economics advisers, and many other outside reviewers believe that this conclusion is founded on unrealistic assumptions. For example, the report assumes that firms can be induced to invest $50-90 billion per year beyond current levels in energy-efficient technologies and other measures for conservation. But because such additional effort on energy conservation would force firms to redirect 7 percent of their total investment in new equipment, it could only be accomplished by offering costly incentives.

Although the potential for technology to make a positive contribution is real, it is limited. Renewable sources of energy today account for just 8 percent of all energy supplied in the US economy. Experts in energy efficiency currently estimate that these sources could account for 3 percent of total energy supply by 2010.

E. International cost-reduction measures

As you know, the United States has suggested two approaches for reducing what we would have to do domestically to lower greenhouse-gas emissions: international permit trading, and "joint implementation."

- *International emissions trading* has not been accepted by other nations. Even if it were accepted internationally, it is doubtful that Congress would appropriate the $5-10 billion annually that would be required for the US to buy emissions rights from other countries. There is currently no model that would allow corporations to buy emissions rights directly from foreign governments.

- *Joint implementation* poses similar problems. Although it has shown promise in pilot projects, there is no evidence that we can devise a scheme that developing countries will accept and that will reward us properly.

Even assuming the most optimistic scenarios for technology and successful implementation of domestic and international trading, it will still not be possible for us to achieve 1990 emissions levels without substantial increases in the price of energy — on the order of 4 to 10 times the amount of the BTU tax. Regardless of how the restraint on carbon emissions is imposed, energy users and emitters will pass the costs down to consumers. A recent EPI study warning of the loss of 2 million jobs is typical of the reaction that an aggressive proposal would elicit. Other opponents of such a proposal would include most large companies, all energy-intensive small businesses, organized labor, consumer groups, and those fearful about competitiveness. It is likely that moderate sources of analysis (e.g., Brookings, AEI, IIE, and mainstream Democratic economists such as Alan Blinder and William Nordhaus) would oppose ambitious commitments.

II. The link between the economy and the environment

There are two key questions concerning the link between the economy and the environment. First, assuming all countries faithfully executed all of the commitments contained in proposals currently on the negotiating table, would the desired environmental benefits necessarily follow? As you know, the answer to this question is "no," because developing countries would not be required to take on binding commitments under any agreement currently under consideration for approval in Kyoto.

The non-participation of developing countries is a fatal flaw for one simple reason: A ton of carbon does the same amount of damage no matter whether it is emitted in Baltimore or in Bangkok. Therefore, from an environmental perspective, it is equally important to control emissions anywhere in the world. But as you also are aware, the politics of enforcing binding commitments on developing countries is extremely difficult. (The economics is also difficult, given that a sensible policy would have to leave room for the developing countries to improve their average standard of living.)

A second question concerning the link between the economy and the environment is whether it would make more sense, economically and environmentally, to implement an accelerated program or a more gradual one. The figure at the end of this document suggests that the case for an aggressive program is weak. This figure compares projected increases in global average atmospheric temperature in three different cases: (1) a "*business as usual*" case; (2) an *ambitious* case in which industrialized countries return their emissions to 1990 levels by 2010 and developing countries stabilize their emissions at 2020 levels in 2020; and (3) a more *gradual* case in which industrialized countries stabilize their emissions in 2015 and return to 1990 levels by 2040, and developing countries stabilize in 2040 at 2040 levels.

an extremely optimistic assumption

As can be seen in the figure, even by 2100, the difference between the ambitious and gradual strategies is only 0.2 degree Celsius. This amount is small, not only in absolute terms, but also relative to the 1.7 degree increase in the global average temperature that is projected to take place over the next century even under under an ambitious policy. Furthermore, gradual strategy captures about two-thirds of the environmental benefits generated by the ambitious

the

strategy. Separate results show that the economic costs of the more gradual approach would be only *one-tenth* as great as the costs of the ambitious approach. This difference in cost reflects two main considerations: (1) retrofitting is extremely costly compared to replacing capital stock that has lived out its full life; and (2) the longer one delays before investing in new plant and equipment, the better the technology that will be available; forcing investment on to proceed on an accelerated schedule guarantees that inferior capital will be locked in place for a long period of time.

In summary, gradual approaches have nearly the same environmental benefits as ambitious approaches, at only a small fraction of the economic cost.

III. Suggested approaches

The foregoing analysis indicates that the U.S. should promote Kyoto as a "turning point" rather than a "finishing point." A constructive alternative proposal from the United States could include:

A. Domestic steps

Any domestic strategy should include a framework for future policies that maintains maximum flexibility; ~~ambitious~~ rhetoric about the seriousness of the problem and of our response to it; and a position on developing countries that delays a Byrd ~~amendment~~ resolution battle. In addition, it could include:

- Investments in R&D to help minimize the economic costs of reducing emissions;
- Incentives for the purchase and deployment of carbon-efficient technology; and
- Exploration of proposals to shift the basis of taxation away from taxing things that we like, such as income and capital gains, and toward taxing things that we don't like, such as pollution. Such exploration could be undertaken by a National Commission or through a Treasury Department report.

Beyond these initiatives, there are three possible approaches.

Need guidance here.

B. International steps

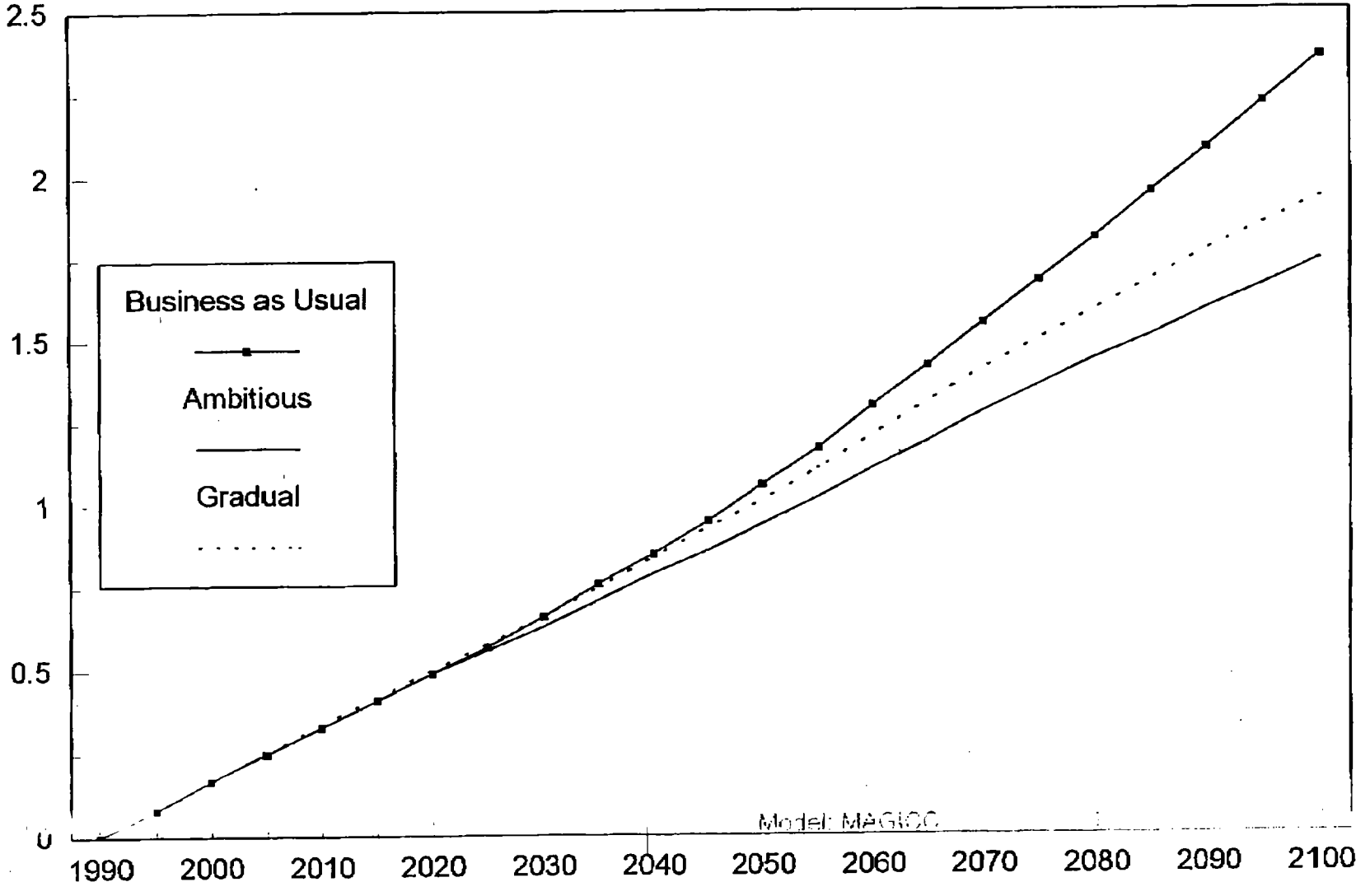
On the international front, the Administration might take the following constructive steps:

- work for the establishment of a multinational technical study group to determine the best method for obtaining a "global least-cost" approach to stabilizing greenhouse gas emissions. In addition, task this group with studying the practicality of joint implementation and international verification and enforcement. Separately, establish a global research facility to explore the application of renewables, techniques of sequestration, and methods of conservation;

- reiterate our commitment that any solution involve all nations, industrialized and developing, and press for future binding commitments on the part of developing countries that take into account the individual circumstances of each country;

- suggest new targets keyed to the ratification date of Kyoto rather than past dates.

Temperature Change (Degrees C Change from 1990)



David Wilcox 622-2633

E. *International cost-reduction measures*

in international negotiations

As you know, the United States has suggested two approaches for reducing what we would have to do domestically to lower greenhouse-gas emissions: international permit trading, and "joint implementation." But the practical difficulties of establishing such a system make it, at best, a marginal contributor in the near future. The possibilities of international trading therefore should have virtually no bearing on the preceding analysis.

- *International emissions trading* has not been accepted by other nations. It is doubtful that governments choosing to implement their own domestic emissions reductions through regulatory approaches or through energy taxes will be willing to tighten these domestic restrictions in order to profit from permit sales to the United States.

- Both international permit trading and joint implementation incur severe difficulties of both enforcement and monitoring. For example, every country in the system would be tempted to allow its firms to fraudulently sell their emissions rights into the international market, garner the resulting revenue, and exceed their allowed level of emissions.

- There is some scope for joint implementation in which emissions credits would be given for carbon savings investments in developing countries. Such an approach should be explored thoroughly but cautiously. The major difficulty in such programs is that they may entail paying for investments that would have been made even in the absence of the foreign subsidy, with no reduction in greenhouse gas emissions.

The Economics of Reducing Emissions

It will not be possible to stabilize -- let alone reduce -- carbon emissions in the United States without substantial and continuous increases in the price of carbon fuels.

The Facts

- Carbon efficiency: Rising by 0.9 percent per year
- GDP growth: 2.5 percent per year
- Carbon Emissions: Rising by 1.6 percent per year, or 16 percent over a decade
- Reducing emissions by 1 percent requires a $4-$8 per ton increase in the price of carbon

The Implications

- Holding emissions steady for a decade would require the price of carbon to rise by $64-$128 per ton
- Reducing emissions to their 1990 level from their year 2000 level would require price increases of an additional $48-$96 per ton.
- So **achieving 1990 levels of emissions by 2010 requires a carbon price of $112-$224 per ton**
- As the table shows, these costs rise as we move beyond 2010, since we must continue to hold emissions constant at 1990 levels:

1990 by:	2010	2020	2030
Price of Carbon	$112-$224	$176-$320	$240-$416

Some Relevant Comparisons

- The 1993 BTU tax was the equivalent of only a $20-per-ton carbon tax, so that this would amount to *at least 5-6 BTU taxes.*
- Even a $50-per-ton carbon tax would reduce the standard of living of the average family by about $550; this is roughly equivalent to more than one week's take-home pay. An increase in the price of carbon would also be *highly regressive* in its impact.
- Each $1 per ton increase in the price of carbon raises $1 billion in revenues, so that achieving 1990 levels by 2010 implies a tax increase of $112 to $224 billion.

Global Climate Change: Which Way Forward?

Executive Summary

There is now a compelling scientific case that the build-up of greenhouse gases poses sufficiently great risks to justify international policy action to contain their growth. This memo argues that American acceptance of the kind of ambitious targets and timetables envisioned in the Kyoto process would have deleterious economic, political, and environmental implications. In particular, adopting a strict target and timetable would require reductions in energy use much greater than those following the OPEC price shocks and requiring a tax on energy use more than six times as large as our 1993 BTU tax proposal. These costs cannot plausibly be claimed to be reduced by technology policy nor by international trading of permits.

We propose an alternative target and timetable that is more gradual and more consistent with sound economic performance, political realism, environmental protection, and previous international commitments. A much more gradual approach can provide nine-tenths of the environmental benefits at one-third to one-tenth of the economic damage. But even this much more gradual response entails meaningful action now. It will require a significant early price signal to discourage carbon emissions and the price signal must rise over time.

I. The Economics of Reducing Emissions

A central fact that should frame discussions of emissions control is this: *Between 1973 and 1985, the combination of two OPEC price shocks, a Presidential commitment that the energy issue was the moral equivalent of war, and extensive regulation, incentives and research was only sufficient to stabilize energy usage and carbon emissions.* Since 1985 and the end of the OPEC shock, energy demand has increased rapidly.

This example illustrates what virtually all economic models and reviews of historical evidence have concluded. *It will not be possible to stabilize let alone reduce carbon emissions in the United States without substantial and continuous increases in the price of carbon fuels.* Relevant rules of thumb based on optimistic estimates are:

- Carbon efficiency is expected to increase by about 0.9 percent per year if no policies are undertaken to boost it. Assuming trend GDP growth of about 2.4 percent per year, carbon emissions will therefore rise about 1.5 percent per year in the absence of policy, or about 16 percent over the course of the decade.

- A $4 to $8 per ton increase in the price of carbon fuels is required to reduce emissions by about 1 percent after a decade.

Therefore, holding emissions steady for a decade would require the price of carbon fuels to rise by the equivalent of $64 to $128 per ton of carbon emissions. Reducing emissions to their 1990 levels from their year 2000 level would require price increases of an additional $60 to $120 per ton in order to offset the 15 percent increase between 1990 and 2000.

Carbon price increases of this order of magnitude would have major economic and political implications:

- The 1993 BTU tax was the equivalent of only a $20-per-ton carbon tax.

- Even a $50-per-ton carbon tax would reduce the standard of living of the average family by about $550; this is roughly equivalent to more than one week's take-home pay. Preliminary evidence also suggests that an increase in the price of carbon would be highly regressive in its impact.

As a result of analyses like this, and environmental considerations noted below, none of the lead signatories on the recent economists' letter supporting action on climate change believes that stabilizing at 1990 levels is warranted.

Technology

In the very long run, technology determines what can be achieved in reducing carbon emissions, so major new research funding and perhaps funding for diffusing technology is important. But, it is very doubtful that even a concerted effort on technology could significantly alter the analysis just presented.

- DOE's "5 Labs Study" is regarded as indefensibly optimistic by all your economic advisers. The study invokes a host of unrealistic assumptions about technology penetration rates and ludicrously high rates of return on public R&D expenditure (roughly 1700% for transportation R&D, for example). It plans through a series of government actions to redirect firms to invest an additional $50-$90 billion per year in energy efficient technologies, beyond what they would now choose to invest. It is simply implausible to imagine that this could occur without hugely costly government incentives.

- Yet even this highly optimistic study concludes that emissions cannot be reduced by more than 30 percent of the way from their baseline 2010 level towards their 1990 level without a substantial increase in price of roughly $50/ton.

International Trading

The potential for global international trading of permits has been greatly exaggerated. If successfully implemented, permit trading amongst Annex I countries could reduce the carbon tax needed to attain 1990 emissions by 2010 by half, with further significant reductions in costs from joint implementation with developing countries. But the practical difficulties of establishing such a system make it, at best, a marginal contributor in the near future. The possibilities of international trading therefore should have virtually no bearing on the preceding analysis.

- Both international permit trading and joint implementation incur severe difficulties of both enforcement and monitoring. For example, every country in the system would be tempted to allow its firms to fraudulently sell their emissions rights into the international market,

garner the resulting revenue, and exceed their allowed level of emissions.

- It is doubtful that governments choosing to implement their own domestic emissions reductions through regulatory approaches or through energy taxes will be willing to tighten these domestic restrictions in order to profit from permit sales to the United States.

- *Larry: I think this is misleading because the government would be purchasing foreign permits on behalf of domestic entities who would pay for them. The U.S. govt. would be an intermediary.* ~~It is doubtful that other countries will let the United States buy its way out of a large share (more than one-third) of its emissions control obligation, and it is yet more doubtful that Congress would appropriate the $5-10 billion for the US to buy emissions rights from other countries. Furthermore, while it may be possible, we are not aware of any proposal that would allow firms to purchase emissions rights directly from foreign governments.~~

- There is some scope for joint implementation in which emissions credits would be given for carbon savings investments in developing countries. Such an approach should be explored thoroughly but cautiously. The major difficulty in such programs is that they may entail paying for investments that would have been made even in the absence of the foreign subsidy, with no reduction in greenhouse gas emissions.

Conclusion: Recognizing the enormous uncertainty associated with long run projections, and the likelihood of positive innovations, it will not be possible for the US to restore 1990 emissions without very large energy price increases that are many multiples of those contemplated by the BTU tax. These costs will be borne by consumers regardless of the form of implementation, although some means are better than others. For example, in the choice between an auction permit, a tax, or a "grandfathering scheme," the first two schemes make it possible to compensate consumers for these costs out of revenues, and avoid what your economic advisers regard as enormous administrative problems with an allocated permit system.

Despite the harsh economic impacts, committing to ambitious goals in Kyoto might nonetheless be justified if this would result in meaningful action in the US and abroad, and if it was necessary scientifically. We turn next to these questions.

II. The Politics of Ambitious Commitments

The effects of ambitious commitments in Kyoto depend on whether a treaty is agreed or not. We begin by considering the impact of a ratified treaty, and then the effects of ambitious commitments that are followed by a breakdown of the process.

Ratifying a Treaty

Barring radical changes in the natural or political environment, it is very unlikely that the Senate would ratify any treaty embodying ambitious commitments, especially given the absence of a fast

track mechanism to hold off amendments. The attempt would be a great gamble since a Senate rejection would risk a "League of Nations" effect of knocking serious American global warming action off the agenda for a decade.

Beyond special interest pleading about continuing scientific uncertainty, arguments that are likely to be persuasive in the political arena, though not necessarily valid, against an ambitious Kyoto treaty include:

- ***Large Economic Costs*:** This policy would immediately be recognized as six times the BTU tax. The recent EPI study warning of the loss of 2 million jobs is typical of the firestorm that would come forth. The group opposing ambitious Kyoto commitments would include most large companies, all energy using small businesses, organized labor, consumer groups, and those fearful about competitiveness. It is likely that moderate sources of analysis (e.g. Brookings, CBO, IIE, AEI, mainstream Democratic economists) would also be unfavorable to ambitious commitments.

- ***Unfair to America:*** Any "1990 by some date" goal will require far more radical action relative to the baseline in the US than in other Annex I signatories. For example a 1990 by 2010 treaty would require US actions to reduce emissions by 28 percent relative to the baseline, compared to 9 percent for the remainder of Annex I--including 19 percent for the EU, and nothing for the UK, Germany, or Russia.

- ***A Giveaway to Developing Countries:*** Even if we agree not to submit any treaty for ratification until developing countries take on binding commitments, problems will remain. It is inconceivable that they will take on obligations nearly as severe as stabilization at 1990 levels. We will be open to the charge that we sacrificed all our leverage by making our commitment before they had made any commitment at all. China in particular will stand out as a major problem.

- ***Will Others Comply?:*** Because of our openness, transparency, and legal system, America will comply with any treaty it ratifies. It will be difficult to be convincing that Russia, China or many other countries will be bound by their treaty commitment. And it is hard to see what mechanism will be used to punish countries that emit too much. In market economies, governments do not control emissions directly so it will be difficult to hold them responsible. Compliance with international fines of billions of dollars will seem problematic.

It is sobering to compare the political alignments on fast track and global warming. With an ambitious Kyoto treaty, the business support we have on fast track will largely turn out against us, and the support of elites will be divided, with economically oriented elites likely to turn strongly against us. Small business is likely to be much more negative on global warming as well. Against this, the environmental organizations are likely to be much more positive on global warming than fast track.

No Kyoto Agreement

A cynical but plausible argument holds that if Kyoto will fail because of developing country issues, and issues of implementation, it is better for us to have endorsed ambitious commitments so that we shift some responsibility for failure and at least keep faith with the environmental community. In fact, we fear we won't reap much environmental benefit and we will incur large political costs.

- *Most important of all, future negotiations are likely to begin where the last negotiations left off. A realistic negotiating stance for the present, even if no treaty is agreed in Kyoto, or subsequently ratified, is still the best for the future. Since it will* never *be acceptable to the Congress or desirable for the country unnecessarily to kill the economy, the place to begin is with a timetable and proposed implementation that will ultimately stabilize atmospheric carbon at realistic levels but with acceptable economic impact.*

- Even with a 1990 by 2010 commitment we will still have been seen as unconstructive by Europe and by domestic environmental groups, particularly if we insist on the Byrd amendment. So we do not escape much of the responsibility for the failure to reach an agreement in Kyoto.

- Much of the cost of ambitious commitments is borne even if there is no treaty. Public disclosure of our domestic implementation plan will be demanded. Any failure in Kyoto will lead to a new scheduled meeting and great pressure from the business community to take our offer off the table. And it is hard to see how we can raise the profile of the issue without also giving profile to the economic consequences of whatever goal we set.

III. Environmental Arguments

Despite the economic costs they would engender, and the political risks involved, there might still be a compelling case for ambitious commitments in Kyoto if a strong Kyoto treaty was likely to make the difference between a successful and unsuccessful international efforts to attenuate global warming.

The situation is more complex however. The Figure below depicts projected increases in global temperature in a baseline "do nothing" case, an ambitious Kyoto agreement case, where industrialized countries stabilize at 1990 levels in 2010 and developing countries stabilize in 2030, and a gradual agreement case where industrialized countries only get back to 1990 levels in 2040 and developing countries stabilize in 2050.

The results are striking. A human lifetime from now in 2070, the temperature rises 1.5 degrees if nothing is done, 1.4 degrees with ambitious efforts, and 1.3 degrees with gradual efforts. In *2070, the ambitious Kyoto strategy reduces temperatures by only 0.1 degrees more than the gradual strategy, or less than one-fiftieth of the baseline temperature increase.* .

The basic point that great ambition now produces relatively small incremental

environmental benefits relative to more gradualism can be made in another way. A number of studies have framed the question: Given a goal of stabilizing global concentrations at twice pre-industrial levels, what is the least cost emissions path? In all cases they conclude that a path far less ambitious than those implicit in a Kyoto agreement is justified. Essentially, this is because a cost-effective approach to carbon reduction forces the replacement of worn out plants with new technologies but not the scrapping of existing plants. And it waits for the development of superior technologies before forcing the replacement of exiting plant and equipment.

Politics and the Kyoto process aside, the question is not one of economic costs versus the *existence* of global warming--it is one of the economic costs of alternative policy paths versus their precise degree of environmental benefit. It is clear from this discussion that much more gradual approaches have essentially the same environmental benefit at only a small fraction of the economic cost.

IV. What Should be Done?

This analysis argues that: (i) any attempt to stabilize US carbon emissions at 1990 levels anytime near 2010 would require large increases in energy prices with substantial consequences, (ii) that such a commitment if offered would have highly adverse political consequences for the prospect of actually legislating emissions reductions, and (iii) that such a commitment would not yield large environmental benefits relative to the whole global warming problem and is not necessary to achieve ambitious environmental objectives.

We seriously doubt that these points can be finessed within any proposal that is anywhere near the proposals floated by the other parties to Kyoto. Pushing dates back from 2010 does not help that much substantively because baseline emissions rise; for example, the economic costs of delaying to 2020 are 90% as large as those of setting a 2010 timetable. Moreover, to the extent that such delay is domestically politically feasible because pain becomes remote, it also becomes internationally unacceptable.

The conclusion is that Kyoto should become a "turning point" rather than a "finishing point" in the global effort to control greenhouse gases. Given current realities the US should consider as an alternative to offering a target and timetable working with others for a "Kyoto mandate" that would:

- Articulate a commitment to stabilizing greenhouse gas concentrations and not just emissions. Emphasize that it is in the interest of all nations to have a "global least cost" approach to achieving stabilization of concentrations. Propose an IPCC-like exercise to determine how this could best be done. Issues of JI, traceable permits, and phasing could be considered.

- Recognize the political and analytical reality that to be effective any global approach to this problem must involve all major emitters, and invite them to participate going forward. Insist that a global effort for phased elimination of energy subsidies must be agreed upon prior to countries being required to introduce new energy taxes

- Recognize the increasing irrelevance of 1990 emissions levels by setting targets relative to the ratification date, not a subjective past date. Similarly, recognize issues of international equity by proposing targets that are differentiated on the basis of progress attainable through own-country domestic implementation (e.g. neither Germany nor the remainder of the EU should get credit for shutting down East German emitters).

- Establish a global research facility that is funded to explore the application of renewables, techniques of sequestration, methods of conservation, and gauging the seriousness of the global warming problem.

Domestic Implementation

Beyond international acceptance of a Kyoto Mandate, we must consider our domestic strategy going forward. Any long range plan should include several key features:

- A call for a Treasury Department report, or a National Commission, to suggest proposals for moving towards a strategy of "taxing bads, not goods" as a means of collecting government revenues.

- A concerted public education effort as to the seriousness of the problem.

- A climate-friendly electricity deregulation bill

- Major investments in R&D to help minimize the economic costs of reducing emissions

Beyond these initiatives our recommendation is a *gradual target and timetable. We view this option as both environmentally and economically responsible. It addresses global warming in a serious and "economically smart" way.*

A gradual target and timetable would eliminate emissions growth in the decade 2010-2020 and reduce emissions thereafter with a return to 1990 emissions levels by 2040. The US would commit to implement this target with a system of auctioned permits, with increasing constriction in the number of permits in small, gradual, but predetermined steps. This system would result in a gradual increase in carbon emissions prices over time from about $10 in 2003 to $25-$30 in 2020. A ceiling could be set to guarantee that the emissions price is capped at a moderate level. A carbon tax could be used as an alternative. It should be emphasized that no new regulatory burdens will be imposed as part of the domestic implementation program.

We view this as a compromise that will, at least grudgingly, satisfy all parties except special interests.

- The Administration should get credit for taking forceful steps to deal with an important problem and showing leadership in dealing with it.

- Environmentalists should be pleased that this policy will result in a commitment to stabilize concentrations and a meaningful increase in the price of carbon emissions-- serious action that they would not have expected. Although environmentalists would not get a 1990 by 2010 commitment, they should also understand that such an ambitious goal would have no chance whatsoever of passage in either House of Congress.

- The Congress should appreciate this approach because it has only modest effects on the economy, yet it is a start to dealing with the problem of global warming.

- The business community should appreciate a sensible, realistic economic policy based on a flexible, market-based approach along with the pledge of no new regulatory burdens.

- Consumers should appreciate this approach, especially if the revenues from the carbon tax will be recirculated in some appealing way. It can be presented as a taxing of a "bad", in this case carbon emissions, rather than a "good." It is a tax reform.

- Whereas the public previously had rejected a BTU tax, this tax has the rationale that this proposal will be the international contribution of the United States to deal with an important problem.

- The other members of the OECD should appreciate that for the first time the US is showing a willingness to take significant action to deal with our very large and disproportionate carbon emissions. In the past our use of energy has been a major factor in increasing the price of oil, at the cost of most other OECD countries, which are net importers.

- Although there will be some hue and cry that the US "blew up Kyoto," the US public will see instead that the Administration made a serious commitment to begin dealing with global warming.

- It is important that part of the revenues from the tax be used to help displaced workers, especially coal miners. The gradual nature of the displacement means that much of the loss in employment due to increases in coal prices will be matched with natural attrition.

The major benefit of this program is that it constitutes sound economic and environmental policy and therefore it is easy to defend. It is therefore a policy that if defeated can be taken up again. If rejected even noisily in Kyoto, the US can defend it as the best that we could do. If attacked in Congress it can be defended as a policy that is benign to the economy and at the same time will make a contribution to dealing with our responsibilities for global warming.

In contrast, the option of an aggressive "escape clause" with an ambitious target is much harder to defend because it is too tricky. It is necessary to explain why an ambitious target is a US aim, although straightforward analysis shows ambitious targets will be prohibitively costly. It will be necessary then to explain that our policy will not kill the economy because of the escape

clause. But if we think the escape clause will be binding then why did we insist on the ambitious target? Most likely the Administration will be simultaneously damned both for the ambitious target that will kill the economy and for not intending to meet the target because of the insertion of the escape clause.

The Economics of Reducing Emissions

It will not be possible to stabilize -- let alone reduce -- carbon emissions in the United States without substantial and continuous increases in the price of carbon fuels.

The Facts

- Carbon efficiency: Rising by 0.9 percent per year
- GDP growth: ~~2.5~~ 2.4 percent per year
- Carbon Emissions: Rising by ~~1.6~~ percent per year, or 16 percent over a decade
- Reducing emissions by 1 percent requires a $4-$8 per ton increase in the price of carbon

The Implications

- Holding emissions steady for a decade would require the price of carbon to rise by $64-$128 per ton
- Reducing emissions to their 1990 level from their year 2000 level would require price increases of an additional ~~$48-$96~~ per ton.
- So **achieving 1990 levels of emissions by 2010 requires a carbon price of ~~$112-$224~~ per ton**
- As the table shows, these costs rise as we move beyond 2010, since we must continue to hold emissions constant at 1990 levels:

1990 by:	2010	2020	2030
Price of Carbon	$112-$224	~~$~~176-$320	$240-$416

Some Relevant Comparisons

- The 1993 BTU tax was the equivalent of only a $20-per-ton carbon tax, so that this would amount to *at least 5-6 BTU taxes.*
- Even a $50-per-ton carbon tax would reduce the standard of living of the average family by about $550; this is roughly equivalent to more than one week's take-home pay. An increase in the price of carbon would also be *highly regressive* in its impact.
- Each $1 per ton increase in the price of carbon raises $1 billion in revenues, so that achieving 1990 levels by 2010 implies a tax increase of $112 to $224 billion.

09/30/97 TUE 14:35 FAX 202 6222633 JF cmts. 001

Office of Economic Policy — Department of the Treasury • Washington, D. C. 20220

FAX

cc: JA AM PL

Date: September 30, 1997 at 2:26 pm

Number of pages including cover sheet 9

	Name	FAX Number	Phone Number
To:	~~Michele Jolin~~ Jeff Frankel	395-6958	395-5084
~~From:~~ To	David Fischer	202-622-2633	202-622-2004

REMARKS: ☐

Michele,

I am the new Special Assistant in the Office of Economic Policy (the new David Rubin, if you knew him). Larry Summers has asked whether Janet would be a co-signator on the memo to the President that we are currently preparing on climate change. I am faxing a draft (we will gladly change all the "I"s to "we"s). Jon Gruber is very much hoping that it might be possible to get comments from Janet by the end of the day. Please call me with any question. Thanks very much,

David

These are my comments too.

Jeff Frankel

Global Climate Change: Which Way Forward?

Executive Summary

There is now a compelling scientific case that the build-up of greenhouse gases poses sufficiently great risks to justify international policy action to contain their growth. A central question is whether our course of action weighs appropriately the environmental benefits and the countervailing economic and political costs. This memo argues that American acceptance of the kind of ambitious targets and timetables envisioned in the Kyoto process would have highly adverse economic, political and, ultimately, environmental implications. In particular, adopting a strict target and timetable would require reductions in energy use exceeding those from the OPEC price shocks, ~~implying~~ a tax on energy use over five times as large as our 1993 BTU tax proposal. These costs cannot plausibly be claimed to be lowered by technology policy nor by international trading of permits. As a result, such a policy approach would leave us open to criticism along many fronts, and may set back for many years our ability to constructively tackle the climate change issue.

I go on to highlight the advantages of more gradual alternatives that are more consistent with sound economic performance, political realism and environmental protection and ~~are~~ at the same time do not contradict ~~with~~ commitments we have made. In particular, I note that a much more gradual approach can provide nine-tenths of the environmental benefits at one-tenth of the economic damage.

I. The Economics of Reducing Emissions

A central fact that should frame discussions of emissions control is this: *Between 1973 and 1985, the combination of two OPEC price shocks; a Presidential commitment that the energy issue was the moral equivalent of war; and extensive regulation, incentives and research was only sufficient to stabilize energy usage and carbon emissions.* Since 1985 and the end of the OPEC shock, energy demand has increased rapidly.

This example illustrates what virtually all economic models and reviews of historical evidence have concluded. *It will not be possible to stabilize let alone reduce carbon emissions in the United States without substantial and continuous increases in the price of carbon fuels.* Relevant rules of thumb based on optimistic but credible estimates are:

- Carbon efficiency is expected to increase by about 1 percent per year if no policies are undertaken to boost it. Assuming trend GDP growth of about 2.4 percent per year, carbon emissions will therefore rise about 1.4 percent per year in the absence of policy intervention, or about 15 percent over the course of a decade.

- Each $4-per-ton increase in the price of carbon fuels reduces emissions by about 1 percent after a decade.

Therefore, holding emissions steady for a decade would require the price of carbon fuels to rise by

the equivalent of about $60 per ton of carbon emissions. Reducing emissions to their 1990 level from their year 2000 level would require price increases of an additional $48 per ton in order to offset the 12 percent increase between 1990 and 2000.

Carbon price increases on this order of magnitude would have major economic and political implications:

- The 1993 BTU tax was the equivalent of only a $20-per-ton carbon tax.

- Even a $50-per-ton carbon tax would reduce the standard of living of the average family by about $550; this is roughly equivalent to more than one week's take-home pay. Preliminary evidence suggests that an increase in the price of carbon would be highly regressive in its impact; the burden on the lowest fifth of the population would be 6 times as great as the burden on the highest fifth. "relative"? "percentage"?

- Depending on the means and pace of implementation and the use of any revenues generated, higher fuel prices could have significant impacts on economic performance. Unlike the question of whether substantial price increases are needed to reduce emissions growth, there is divided expert opinion on how serious the economic effects of price increases may be. A conservative guess is that they would over each 15-year period be the equivalent of adding one mild recession to the economy's performance.

As a result of analyses like this, and environmental considerations noted below, none of the lead signatories on the recent economists' letter supporting action on climate change believes that stabilizing at 1990 levels by 2010 is warranted.

- Some have claimed on the basis of the S02 experience that current projections regarding the costs of a CO2 program are far too pessimistic. *We have not been able to find any outside expert who is willing to validate this tempting argument.* The S02 program is 1 percent of the size of a likely CO2 program. Its success is traceable to the fact that it replaced an enormously burdensome and inefficient command-and-control system. It also benefitted importantly from the deregulation of the freight railway system, which transformed the economics of using low-sulfur western coal.

Technology

In the very long run, technology determines what can be achieved in reducing carbon emissions, so major new research funding and perhaps funding for diffusing technology is important. But, it is very doubtful that even a concerted effort on technology could significantly alter the analysis just presented.

- ~~The~~ DOE's "5 Labs Study" is regarded as indefensibly optimistic by John Deutch and all your economic advisers. The study invokes a host of unrealistic assumptions about technology penetration rates and ludicrously high rates of return on public R&D expenditure (roughly 1700% for transportation R&D, for example). It plans through a series of government

if interpreted as a set of claims regarding likely effects of specific policy actions. (If interpreted as a "vision" of a desirable direction in which technology might evolve, independently of government policy actions, it is fine)

actions to redirect firms to invest an additional $50-$90 billion per year in energy efficient technologies, beyond what they would now choose to invest. Not only would it drain about 7 percent of total investment away from the other purposes to which it might be put, but it is simply implausible to imagine that this could occur without hugely costly government incentives.

- Yet even this highly optimistic study concludes that emissions cannot be reduced by more than 30% of the way from their baseline 2010 level towards their 1990 level without a substantial increase in price of roughly $50/ton.

International Trading

There is a strong case for seeking international flexibility in any global approach to greenhouse problems. But even under the most optimistic plausible assumptions, international flexibility is unlikely to radically alter the preceding analysis.

- It is doubtful that other countries will let the United States buy its way out of a large share (more than one-third) of its emissions control obligation, and even more doubtful that Congress would appropriate the $5-10 billion for the US to buy emissions rights from other countries. While it may be possible, we are not aware of any model that has been put forward for firms to buy emissions rights directly from foreign governments.

- Joint implementation shows enormous promise in pilot projects. But there has been no demonstration to date that it can be brought to scale in a way that is acceptable to developing countries. It only works if Americans are given credit for reductions in other countries' emissions--something foreign governments are likely to resist if they are covered by binding targets (DAVID: does this point make sense?)

No! Reduces that they are in.

Conclusion: Recognizing the enormous uncertainty associated with long run projections, and the likelihood of positive innovations, we are convinced that it will not be possible to claim that the US is going to restore 1990 emissions levels without very large energy price increases that are many multiples of those contemplated by the BTU tax. These costs will be borne by consumers regardless of whether an auction permit, tax or "grandfathering scheme". The only difference is that the first two schemes make it possible to compensate consumers for these costs, and avoid what your economic advisers regard as enormous administrative problems with an allocated permit system. (out of revenues)

Despite the economic impacts, committing to ambitious goals in Kyoto might nonetheless be justified if this ~~would~~ result in meaningful action in the US and abroad, and if it ~~was~~ were necessary scientifically. We turn next to these questions.

II. The Politics of Ambitious Commitments

The effects of ambitious commitments in Kyoto depend on whether a treaty is agreed or not. I begin by considering the impact of ratified treaty, and then the effects of ambitious commitments

implementation is by means of

that are followed by a breakdown of the process.

Ratifying a Treaty

Barring radical changes in the natural or political environment, it is very unlikely that the Senate would ratify any treaty embodying ambitious commitments, especially given the absence of a fast track mechanism to hold off amendments. The attempt would be a great gamble since a Senate rejection would risk a "League of Nations" effect of knocking serious American global warming action off the agenda for a decade.

Beyond special interest pleading about continuing scientific uncertainty, arguments that are likely to be persuasive in the political arena, though not necessarily valid, against an ambitious Kyoto treaty include:

- ***There They Go Again:*** Whether the mechanism is literally a tax, or is some kind of permit scheme that raises all residential energy prices, it will be very difficult to persuade people that higher energy prices are not essentially like a tax. This will play into stereotypes that we have worked to break down over the last 4 years.

- ***Large Economic Costs:*** This policy would immediately be recognized as five times the BTU tax. The recent EPI study warning of the loss of 2 million jobs, while highly questionable, is typical of the firestorm that would come forth. The group opposing ambitious Kyoto commitments would include: most large companies, all energy using small businesses, organized labor, consumer groups, and those fearful about competitiveness It is likely that moderate sources of analysis (e.g. Brookings, CBO, IIE, AEI, mainstream Democratic economists like Alan Blinder or Bill Nordhaus) would be unfavorable to ambitious commitments. Richard Cooper

- ***Unfair to America:*** Any "1990 by some date" goal will require far more radical action relative to the baseline in the US than in other Annex I signatories. For example a 1990 by 2010 treaty would require US actions to reduce emissions by 28 percent relative to the baseline, compared to 9 percent for the remainder of Annex I, 19 percent for the EU, and nothing for the UK, Germany, or Russia.

- ***A Giveaway to Developing Countries:*** Even if we agree not to submit any treaty for ratification until developing countries take on binding commitments, problems will remain. It is inconceivable that they will take on obligations nearly as severe as stabilization at 1990 levels. We will be open to the charge that we sacrificed all our leverage by making our commitment before they had made any commitment at all. China in particular will stand out as a major problem.

- ***Will Others Comply?:*** Because of our openness, transparency, and legal system, America will comply with any treaty it ratifies. It will be difficult to be convincing that China or many other countries will be bound by their treaty commitment. And it is hard to see what mechanism will be used to punish countries that emit too much. In market economies, Russia,

governments do not control emissions directly so it will be difficult to hold them responsible. Compliance with international fines in the billions of dollars range will seem problematic to say the least.

It is sobering to compare the political alignments on fast track and global warming. On an ambitious Kyoto treaty, the business support we have on fast track will largely turnout against us. and the support of elites will be very divided with economically oriented elites likely to turn strongly against us. Small business is likely to be much more negative on global warming as well. Against this, the environmental organizations are likely to be much more positive on global warming than fast track.

No Kyoto Agreement

A cynical but plausible argument holds that if Kyoto ~~will~~ fails because of developing country issues, and issues of implementation, it is better for us to have endorsed ambitious commitments so that we shift some responsibility for failure and at least keep faith with the environmental community. In fact, I fear we won't reap much environmental benefit and we will incur large political costs.

- Even with a 1990 by 2010 commitment we will still have been seen as unconstructive by Europe and by domestic environmental groups, particularly if we insist on the Byrd amendment. So we do not escape much of the responsibility for the failure to reach an agreement in Kyoto.

- Much of the cost of ambitious commitments is borne even if there is no treaty. Public disclosure of our domestic implementation plan will be demanded. Any failure in Kyoto will probably lead to a new scheduled meeting and great pressure from the business community not to keep our offer on the table. And it is hard to see how we can raise the profile of the issue without also giving profile to the economic consequences of whatever goal we set.

III. Environmental Arguments

Despite the economic costs they would engender, and the political risks involved, there might still be a compelling case for ambitious commitments in Kyoto if a strong Kyoto treaty ~~was~~ were likely to be the difference between a successful and unsuccessful international effort to prevent the costs of global warming.

The situation is more complex however. The Figure below depicts projected increases in global temperature in a baseline "do nothing" case, an ambitious Kyoto agreement case, where industrialized countries stabilize at 1990 levels in 2010 and developing countries stabilize in 2030. and a gradual agreement case where industrialized countries only get back to 1990 levels in 2040 and developing countries stabilize in 2050.

The results are striking. A human lifetime from now in 2070, the temperature rises 1.5 degrees if nothing is done, 1.4 degrees with ambitious efforts, and 1.3 degrees with gradual

efforts. In *2070, the ambitious Kyoto strategy reduces temperatures by only 0.1 degrees more than the gradual strategy, or only one-fifteenth of the baseline temperature increase.* Yet as the background paper to this one demonstrates, it requires ten times as great increases in energy prices over the next decade as the "gradual" strategy.

The basic point that great ambition now produces relatively small incremental environmental benefits relative to more gradualism can be made in another way. A number of studies have framed the question: Given a goal of stabilizing global concentrations at twice pre-industrial levels, what is the least cost emissions path? In all cases they conclude that a path far less ambitious than those implicit in a Kyoto agreement is justified. Essentially, this is because a least cost approach to carbon reduction forces the replacement of worn out plants with new technologies but not the scrapping of existing plants.

Politics and the Kyoto process aside, the question is not one of economic costs versus the existence of global warming -- it is one of the economic costs of alternative policy paths versus their precise degree of environmental benefit. While the idea of stabilizing emissions at 1990 levels by a near term date has taken on political significance in the years since Rio, it is not a necessary part of program to achieve even ambitious long term environmental goals. It is clear from this discussion that much more gradual approaches have essentially the same environmental benefit at only a small fraction of the economic cost.

IV. What Should be Done?

This analysis argues that: (i) any attempt to stabilize US carbon emissions at 1990 levels anytime near 2010 would require large increases in energy prices with substantial consequences, (ii) that such a commitment if offered would have highly adverse political consequences for the prospect of actually legislating emissions reductions, and (iii) that such a commitment would not yield large environmental benefits relative to the whole global warming problem and is not necessary to achieve ambitious environmental objectives.

I seriously doubt that these points can be finessed within any proposal that is anywhere near the proposals floated by the other parties to Kyoto. Pushing dates back from 2010 ~~does not help~~ that much substantively because baseline emissions rise; for example, the economic costs of delaying to 2020 are 90% as large as those of setting a 2010 timetable. Moreover, to the extent that such delay is domestically politically feasible because pain becomes remote, it also becomes internationally unacceptable.

five or ten year

The conclusion is that Kyoto should become a "turning point" rather than a "finishing point" in the global effort to control greenhouse gases. Given current realities the US should consider as an alternative to offering a target and timetable working with others for a "Kyoto mandate" that would:

- Articulate that it was in the interest of all nations to have a "global least cost" approach to stabilizing greenhouse gas concentrations. Propose an IPCC-like exercise to determine how this could best be done. Issues of JI, tradeable permits, and phasing could be considered.

- Recognize the political and analytical reality that to be effective any global approach to this problem must involve all major emitters, and invite them to participate going forward. Insist that a global effort for phased elimination of energy subsidies must be agreed upon, followed by ~~prior~~ to countries being required to introduce new energy taxes

- Recognize the increasing irrelevance of 1990 emissions levels by setting targets relative to the ratification date, not a subjective past date. Similarly, recognize issues of international equity by proposing targets that are differentiated on the basis of progress attainable through own-country domestic implementation (e.g. neither Germany nor the remainder of the EU should get credit for shutting down East German emitters).

- Establish a global research facility that is funded to explore the application of renewables, techniques of sequestration, methods of conservation, and gauging the seriousness of the global warming problem.

Domestic Implementation

Beyond international acceptance of a Kyoto Mandate, we must consider our domestic strategy going forward. Any long range plan should include several key features:

- A call for a Treasury Department report, or a National Commission, to suggest proposals for moving towards a strategy of "taxing bads, not goods" as a means of collecting government revenues.

- A concerted public education effort as to the seriousness of the problem.

- A climate-friendly electricity deregulation bill

- Major investements in R&D to help minimize the economic costs of reducing emissions

Beyond these initiatives, there are two alternative strategies for global warming policies:

Small but Concrete Policy Initiative: The first is to pursue a concrete domestic price-based policy, such as a small carbon tax. This strategy involves an explicit up-front committment and cost. It also explicitly acknowledges that Kyoto has blown up, and that we are sending the system back to the drawing board. But it leaves time for education before we pursue a more aggressive strategy, and it avoids a political firestorm.

Gradual Target and Timetable: The second is to combine a soft target and timetable (e.g. ~~stabilize~~ emissions growth by 2015; 1990 by 2040) with a vague policy approach, a position on developing countries that delays a Byrd ammendment battle, and ambitious rhetoric about the seriousness of the problem and of our response to it. But this approach *faces a serious risk of satisfying no constituency, domestic or international:*

- There is no Kyoto agreement or real satifisfaction of the environmental community
- There is an avalance of criticism about being prepared to put the economy at risk before there is public appreciation of the seriousness of the issue.
- There is a major loss of credibility from our inability to be explicit about the details and costs of our policy approach.

These risks are typified by the option of an aggressive "escape clause", which would appear to allow us to have it both ways by both having a strict target and timetable and capping the economic costs of our policy, but in fact satisfies no one. We would obtain no international satisfaction with such an approach, and our domestic adversaries will still play up the implicit tax increase inherent in the strict target and timetable.

I'd rather have less on the major criticisms of this proposal, please

This would mean paying Russia and other Eastern European countries to reduce emissions in place of us, an arrangement that could misfire for many reasons

CLOSE HOLD: PRELIMINARY
September 27, 1997

MEMORANDUM

FROM: Lawrence Summers
Janet Yellen

SUBJECT: Targets and Timetables for Reducing Greenhouse Gas Emissions

Executive Summary

This memo provides a preliminary evaluation of the likely economic consequences for the United States of a program to attain 1990 CO_2 emissions levels by 2010. It concludes that such a goal would be extremely difficult to achieve and would necessitate a very large increase in energy prices. *If attained through domestic emissions reductions alone* this target would entail a reduction in CO_2 emissions of about 25% relative to projected 2010 emissions in the absence of policy intervention--a greater change in energy use than was achieved during the decade of the oil shocks. An idealized system of international permit trading among Annex I countries could halve the change in carbon emissions prices needed to attain such a goal. ~~Joint implementation with non-Annex I countries could further reduce the price impact in the United States~~. However, the proposed schemes for both international permit trading and joint implementation require enforcement and monitoring mechanisms that may be difficult to establish in the near term.

Too optimistic

much reduction

possibly

and historical precedent

Economic analysis suggests that reaching 1990 emissions by 2010 would result in a substantial stagflationary macroeconomic shock. As in the decade of the oil shocks, both unemployment and inflation would undoubtedly rise for a time. Moreover, in comparison with an appropriately designed, slower-takeoff program, such a "front-loaded" emissions reduction path likely raises--by a factor between three and ten--the total cost of meeting a long-term goal of stabilizing atmospheric CO_2 concentrations. In this sense, such an aggressive path is extremely inefficient. A plan to achieve 1990 emissions by 2010 entails premature scrappage of capital and foregoes the considerable advantages of waiting for the development of carbon-lean technologies before replacing existing plant and equipment. Furthermore, the environmental benefits of an aggressive abatement target are extremely small since the differences in global temperatures between fast-abatement and slow-abatement paths are minimal. For example, the expected difference in global average temperature in 2100 along a fast-takeoff abatement path that attains 1990 emissions by 2010 and a slow-takeoff abatement path that peaks in 2015 and attains 1990 emissions by 2040 is less than 0.05 degrees Celsius. (Between now and 2100, global average temperature is expected to rise about 2½ degrees Celsius irrespective of the path chosen for stabilization.)

Italy

An economically and environmentally responsible approach for the United States would be to initiate meaningful actions now to create effective incentives to reduce carbon emissions over the next century. Such incentives must entail an early increase in the price of carbon emissions along with a credible commitment to further emissions price increases over time.

Italy

I. Introduction

The Framework Convention on Climate Change signed at the 1992 earth summit in Rio de Janeiro called for carbon dioxide emissions in 2000 at 1990 levels. Given that most countries, including the United States, are unlikely to achieve these emission reductions, most quantitative proposals that have been advanced in the run up to Kyoto focus on variants of the target and timetable agreed to at Rio. Such proposals thus represent the deferred fulfillment of a previously negotiated goal. Consequently, a proposal to "stabilize CO_2 emissions at 1990 levels by 2010" (and variants thereof, including a more stringent proposal by several EU countries to stabilize at 10% below 1990 levels by 2010) has received considerable attention.

This memo provides a preliminary evaluation of the likely economic consequences for the United States of a program to attain 1990 CO_2 emissions levels by 2010. It compares the costs and cost effectiveness of this baseline proposal with those of alternative targets and timetables that entail a less rapid initial reduction in CO_2 emission levels. The conclusions described here rely on the substantial body of economic analysis that has been conducted by researchers worldwide, including the Intergovernmental Panel on Climate Change (IPCC), and Administration economists.

II. 1990 by 2010: The Scope of the Task

To appreciate the ambitiousness of a program to curb U.S. emissions to 1990 levels by 2010 it is necessary to recognize that such a target involves a cutback of roughly 25 percent in energy use in 2010 relative to baseline. Carbon emissions are now 9 percent above 1990 levels. Growth in the economy over the next decade would further raise carbon emissions. Even under an optimistic assumption concerning the pace of improvement of energy efficiency (0.9 percent per year), assuming no change in the relative price of energy, there would be further increases in carbon emissions by 2010 of about 16 percent if we continue with business as usual. The net required reductions to achieve 1990 emissions in 2010 thus amount to about 25 percent.

Comparison with the Oil Shocks. Cutbacks in energy use (relative to baseline) of this magnitude are considerably greater than those that were achieved during the 1970s and early 1980s. Figure 1 shows aggregate energy use in the United States and the relative price of energy over the period 1960 to 1990. During the oil-shock decade--1972 to 1982--energy use was virtually constant in absolute terms, while GDP grew in real terms at about 2.25 percent per year. Over this period, the relative price of energy more than doubled: it rose about 150 percent. This historical experience, and other empirical analysis, suggests that energy use does respond to changes in the price of energy, but the responsiveness (the price elasticity of demand for energy) over periods as short as a decade is low--no higher than 0.2. In contrast to the oil shock period, the "1990 by 2010" program would entail an even larger emissions cutback. To meet the 1990 by 2010 goal it would not be sufficient just to keep emissions constant between now and 2010: a further 9 percent rollback in emissions would be needed to offset the expansion that has already occurred since 1990. Thus, we would need to accomplish a reduction in energy use considerably

larger than what occurred over a decade in which the relative price of energy more than doubled. This suggests that energy prices would likely have to rise by more than 150% to attain 1990 emissions by 2010.

Model results. Numerous economic/energy models have been used to estimate the impact of a 1990 by 2010 program on energy prices. These models arrive at the same conclusion as was generated above using no model whatsoever--that a program to achieve 1990 emissions by 2010 would entail at least a doubling of energy prices. A broad range of models place the carbon permit price required to achieve 1990 emissions by 2010 in the range of $80 to $200 per ton. If fully passed through to energy prices, a permit price of $100 per ton, for example, entails nearly a doubling of energy prices. The impact on the prices of different sources of energy are all large, but the effect on coal is particularly severe. The price of coal would more than triple, while the price of a barrel of petroleum would increase by about fifty percent. Gas at the pump would increase in price by about 26 cents. Relative to the BTU tax proposed by the Administration in 1993 a $100 implicit carbon tax is about 9 times as large. Thus, attaining a goal of 1990 by 2010 would entail very large economic consequences.

Evidence from International Comparisons. A final piece of evidence confirming the conclusion that a strong price signal over a long period of time is necessary to alter energy use comes from comparisons of energy usage between the United States and Europe. It should hardly be surprising that energy use per dollar of GDP is lower in Europe than the United States. Energy prices in Europe have long been substantially higher--roughly double U.S. energy prices. Moreover, major differences in living patterns between the United States and Europe result in higher European energy efficiency. In addition to the geographical "advantage", from an energy efficiency standpoint, of Europe's higher population density, resulting in lower transportation requirements, Europe has locked in place many long-run adaptations to high energy prices. Innovations in the design of housing and transportation systems and the configuration of residential areas have occurred in response to high energy prices. But in spite of its natural advantages and its long history of high energy prices, energy per dollar of GDP is only 44% lower in Europe than in the United States. This means that were the U.S. to become Europe--energywise per dollar of GDP--its energy savings, even in the long run, would be no greater than 44 percent. This U.S.-Europe comparison supports the conclusions drawn from the natural experiment of the oil shock: namely, a return to 1990 emissions will not occur in the absence of very major price measures over a long period of time.

The Role of Technology and the Scope for "No Regrets" Policies. According to the preceding assessment, a large price inducement is necessary to meet a 1990 by 2010 target. Your economic advisers agree on this conclusion. However several of your advisers are more optimistic about the chances of achieving a 1990 by 2010 target. They emphasize the current availability of "no regrets" (cost-saving) technologies that promise substantial opportunities for abatement. A recent report by the Department of Energy research laboratories, for example, catalogues emissions-savings technologies that, by their calculations, are currently "cost effective." If put in place now, the report concludes that such practices could reduce emissions by

between 30 to 50 percent of the amount needed to reach a 1990 by 2010 target. Even so, the report finds that "aggressive" and "invigorated" government policies--including potentially costly and intrusive regulations and standards--as well as a $50 carbon tax would be necessary to reach the 1990 by 2010 target.

Your economic advisers agree that there now exist unused technological opportunities for emissions reduction, but question by what means, over what time frame, and at what expense government policies could change private behavior if such opportunities are currently underutilized. Economists believe that engineering studies miss the sometimes subtle disadvantages of available cost-saving technologies or overestimate their hypothetical returns. An example is illustrative: significant energy and cost savings could result if consumers replace incandescent bulbs with compact fluorescents. Over the long lifetime of such bulbs there would also be a substantial monetary gain. However, actual adoption of these light bulbs has been slow to date, possibly due to pure inertia, possibly because consumers dislike their color, or perhaps because they apply a high "discount rate" when valuing energy savings that accrue after the purchaser may have switched residence. Several recent studies have demonstrated that the actual returns to home improvement investments, such as attic insulation, often fall short of those predicted by engineering studies. Regardless of the reasons, if consumers have not adopted "no regrets" measures at a faster rate, it is likely that additional incentives will be necessary for them to change their minds. Rather than stressing the mere availability of alternative technologies, your economic advisers insist on realistic estimates of likely rates of adoption and diffusion and they stress the need for economic incentives--in this case a higher implicit price for carbon emissions--to induce the adoption of emissions-savings technology. They point out too that the baseline energy demand estimates used to predict the price increase needed to attain a 1990 by 2010 target already assume substantial ongoing improvements in energy efficiency due to the diffusion of existing technologies and the development of new ones. Significant adoption of such technologies is necessary merely to meet this assumed baseline. Finally, it is important to note that the DOE labs study includes as part of its policy package to reach 1990 emissions by 2010 extensive regulations, including stringent CAFE and appliance standards and national building codes--command and control policies that your economic advisers would oppose--along with a $50 carbon tax.

To summarize, your economic advisers consider it unrealistic to predict a substantial increase in the pace of adoption of new emissions-savings technologies unless there is a very large increase in the price of carbon emissions--and hence of energy. Based in part on the evidence from the energy shocks of the 1970s, in part on international comparisons, and in part on model results, they are optimistic that such an increase in prices would bring forth a reduction in CO_2 emissions--with larger responses to a given price change likelier the longer the time period for response. The evidence is strong that a very large price increase will be necessary to attain emissions reductions of 20 to 30 percent over a period as short as a decade. *Moreover, other approaches that apparently do not involve large price increases (such as performance standards) will impose even higher costs on the American economy.*

In conclusion, your economic advisers believe that an increase in the price of carbon emissions and hence energy is an essential component of any effective strategy to reduce CO_2 emissions and to provide appropriate incentives for the development over time of lean carbon technologies. The solution to curbing carbon emissions relative to baseline, and also to induce private research and development, involves changing the incentive structure to encourage reductions in emissions and to spur the development of carbon-saving technologies.

III. Why are the costs of early emissions reductions so high?

The previous section argued that a "1990 by 2010" target would entail high carbon emissions prices and significant economic costs. This section shows that the 1990 by 2010 timepath for emissions reductions is so aggressive as to be inefficient--in the sense of raising substantially the total projected economic cost of reaching a given environmental goal. Economists have tried to demonstrate this point by examining how the total costs of achieving a fixed environmental target for greenhouse gas concentrations varies with the aggressiveness of the initial reductions. There are three major reasons why an aggressive takeoff in curtailing emissions raises overall costs: (1) it induces premature obsolescence of the capital stock because it does not allow adequate time for the capital stock to turn over naturally; (2) it provides insufficient lead time to develop and implement new technologies; (3) it causes a significant stagflationary short-term macroeconomic shock. Additionally, an aggressive timetable for emissions reductions does not allow time for the resolution of uncertainty and it does not take advantage of the time-value of money (resources not spent on emission reductions early on can be invested at a positive return which could purchase more emission reductions later).

The Role of Turnover of the Capital Stock. The most clear-cut and easily quantifiable reason for the high price tag associated with rapid emissions reductions relates to the need for premature replacement of plant and equipment in response to large increases in the price of carbon emissions. It is expensive enough to replace plants that are fully depreciated, but vastly more so if those plants are still in the prime of their productive lives. Within 20 to 40 years, much of our existing plant and equipment will be ready for replacement anyway; therefore building in greater carbon efficiency at that time will be relatively cheap. *It is important to emphasize that the case we are making here is not based on procrastinating for the sake of avoiding the problem; rather, it is based on simple principles of hard-headed business efficiency.*

The advantage of a slower emissions reduction timetable in avoiding the large costs associated with premature obsolescence of the capital stock can be illustrated by considering electrical power generation. The case of electricity generation is important in its own right since this industry is responsible for 88% of coal use and more than one third of all carbon dioxide emissions in the United States. Nevertheless, the same principle concerning the costs of premature replacement applies broadly because reduced greenhouse gas emissions may entail the accelerated retrofitting of housing and commercial structures, the premature scrappage of vehicles and appliances, and the premature replacement of plant and equipment in energy intensive industries.

Figure 2 illustrates the effect of an accelerated retirement schedule for U.S. electric power generation capacity installed during the last 40 years. Imagine, to take an extreme case, that a timetable is adopted that necessitates replacing all power plants with less-polluting technology within ten years. This would require retiring 630 out of 670 gigawatts of generating capacity before the end of its normal life span, or 94 per cent of the total. If the timetable were extended so that all power plants instead had to be replaced within 20 years, the accelerated replacement of capacity would affect 450 gigawatts of capacity, or 67 per cent of the total. Allowing this additional 10 years for turnover avoids the premature retirement of 27 per cent of existing electric power plant capacity. With a 30 years horizon, complete turnover would mean accelerated retirement of only 21 per cent of the total capacity and, with a 40 year timetable, there would be almost no additional costs due to premature obsolescence.[1, 2]

The Advantage of Waiting for Superior Technologies. The example of electric power generation also illustrates a second important reason why a slow takeoff in curbing greenhouse gas emissions is ultimately less costly: new technologies take a long time to develop. Waiting until these new technologies are available before making expensive emissions-saving investments offers the potential of both lower economic costs and higher environmental payoffs. Under a tight target and timetable with its associated high carbon emissions price, electric utilities will be forced to replace existing capacity in the very near future and to rely on currently available lean-carbon technologies, likely gas-turbine plants. If some delay can be factored in, however, they will be able to install more effective and less costly alternative technologies. A rapid timetable forces long-term investments to be made before superior technologies have been developed and refined.

Implication: The Need for a Credible, Long-Term Price Increase. The example of electricity generation illustrates two general principles. First, the responsiveness of both demand and supply are greater in the long run than in the short run. This means that, with a longer horizon, any given amount of abatement can be accomplished with a smaller increase in carbon emissions prices. Second, and perhaps yet more important for policy, any credible emissions reduction strategy must include both a price increase at the outset and also a clear commitment to maintain and likely increase prices further over time. Without such a commitment, the changes in behavior required to meet even a long-run target of emissions reduction will likely not occur. Consider a utility that today is drawing up its plans for a new power plant, either as replacement

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[1]The distribution has been truncated at 40 years, the average lifespan of existing electric power plants. A few plants of yet older vintage are still in use.

[2]The same exercise can be performed for coal-fired power plants. These generators produce the most carbon per kilowatt hour of electricity and thus will have a high incidence of replacement even under a moderate abatement plan. If a complete change-over of coal plants were to be accomplished in 10 years, 96 per cent of total capacity would be retired early. If retirement occurred over 20 years, only 64 per cent would be retired early. Allowing an additional 10 years for turnover would avoid premature retirement of one-third of existing coal-fired plant capacity.

for an old plant or as totally new construction. That utility will choose among today's technologies, which vary in their costs and CO_2 emissions. In order to induce the utility to choose a more costly, lean-emissions technology today, it must be clear that over the future (40 year or more) life of that plant, CO_2 emissions will be costly--costly enough to justify a more costly investment option today. A large cumulative reduction in emissions can be achieved over the long term with only a modest carbon emissions price increase now, but only if the commitment to still higher prices in the future is credible and clear.

Stagflationary Macroeconomic Impact. From a macroeconomic perspective, increases in energy prices constitute a "supply shock." Such shocks are stagflationary because they raise both inflation and unemployment simultaneously, creating a painful macroeconomic dilemma. As noted above, a plan to attain 1990 emissions levels by 2010 would require a change in energy prices over the first decade of the 21st century at least comparable in magnitude to the two oil shocks of the 1970s. Those shocks are widely acknowledged to have had substantial adverse impacts on both unemployment and inflation. Similarly, the energy price increases required by a 1990 by 2010 program would raise inflation, lower real wages, and raise unemployment. Unemployment in the four years after the first oil shock averaged 7.2 percent in comparison to 5.0 percent in the four years prior; and unemployment rose further, to an average of 8.6 percent, in the four-year aftermath of the second oil shock. There remains debate about how much of this was due directly to the oil shocks, because there was a simultaneous decline in productivity growth and transfers of real income to OPEC producers. Although the increases in energy prices associated with a treaty to reduce greenhouse gases would be anticipated, rather than a surprise, we should nevertheless expect that the efforts of the Federal Reserve to contain inflation, coupled with likely efforts on the part of workers to recoup real wage losses will lead to a period of higher unemployment.

Furthermore, it is important to note that most model-based estimates of the costs of a program to attain 1990 emissions levels by 2010 assume that resources are fully employed, thereby ignoring these potential short-term effects. Such models therefore provide no assessment of the consequent increases in unemployment.

IV. Quantifying the Economic Costs of Slow versus Fast Take-off

The relative costs of slow versus fast takeoff timetables in curbing CO_2 emissions has recently been analyzed by the Stanford Energy Modeling Forum (EMF-14).[3] The Stanford group used six large-scale economic/energy models to compare the total projected cost of two

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[3] To enable meaningful comparisons of results across models, the EMF has coordinated a series of projects in which a number of large scale energy models are used to estimate the impact of given, specified emission reduction scenarios under common standardized, benchmark assumptions concerning population and economic activity, discount rates, energy resource availability and prices and technology availability.

alternative emissions reduction time paths--one "frontloaded", the second more "backloaded". Both paths were designed eventually to stabilize atmospheric concentrations of CO_2 at double the pre-industrial level--550 ppmv.[4] Although a high degree of uncertainty attaches to particular numerical estimates from individual models, the simulations nevertheless point to some robust qualitative conclusions. *The major conclusion to be drawn from this project is that an emission reductions path characterized by an aggressive initial phase is substantially more costly--3 to 10 times more costly--than a path with a slower takeoff but larger eventual reductions.*

To enable a comparison of the costs of slow and rapid takeoff strategies, the EMF investigators asked each of six modeling groups to simulate the economic impacts of two alternative strategies to attain stabilization of CO_2 concentrations at 550 ppmv. The first strategy (the WG-1 path) corresponds to an emissions pathway published in 1994 by Working Group 1 (WG-1) of the Intergovernmental Panel on Climate Change (IPCC). Using the Wigley model of the carbon cycle, the working group computed a set of global CO_2 emissions pathways consistent with stabilization of concentrations at 550 ppmv and several alternative concentration levels. The WG-1 path entails an immediate departure from the baseline or "business as usual" emission path. Subsequently, Wigley, Richels and Edmonds (WRE) published an alternative set of emission profiles to achieve the same concentration targets. In contrast to the WG-1 paths, the WRE emission path was constructed to follow the baseline or "business as usual" scenario in the early years with sharper reductions after this initial phase. Wigley, Richels and Edmonds hypothesized that their slower-takeoff emissions pathways would yield identical environmental objectives with substantially lower economic costs, for the reasons discussed above. The EMF-14 exercise validates this hypothesis.

The EMF-14 comparison project assessed the total costs to the OECD, the EEFSU (Eastern Europe and the former Soviet Union) and the non-Annex I countries of the WG-1 and WRE pathways to stabilization of CO_2 concentrations at 550 ppmv. The appropriate economic measure of total cost is the present discounted value of losses in future consumption relative to a "Business as Usual" scenario. Estimates of regional costs depend on the extent of burden sharing--namely, the assumed "division of labor"--between Annex-I and non-Annex I countries in controlling emissions as well as the extent of international emissions trading. Recall that, by the end of the next century--by 2100-- assuming "business as usual"--non Annex 1 countries will have more than 90 percent of CO_2 emissions. Thus, developing country participation is absolutely essential to achieving stabilization of concentrations. Consistent with the Berlin Mandate, the simulations assumed that the burden of emissions reduction would fall on Annex I countries exclusively during the early decades; that by 2030, non-Annex I countries would begin to participate; and by 2050, a full transition to targets based on equal per capita emission rights is assumed.

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[4] All energy models make numerous simplifications and approximations in order to describe the energy sector globally and over the span of a century or more. In particular, all of the models assume full employment, thereby abstracting from the likely short-run macroeconomic costs of an emissions reduction program.

Figure 3 plots the OECD emission paths in the WG-1 and WRE scenarios. Under the WG-1 scenario, OECD emissions begin to decline immediately and continue to decline for roughly four decades. For example, OECD emissions fall 10 percent below initial levels ten years after implementation--corresponding closely to the requirement of a "1990 by 2010" timetable, which requires a reduction of 9 percent from current emissions in roughly a decade. In contrast, OECD emissions along the WRE path continue to rise for roughly two decades--corresponding closely to a plan calling for emissions to peak around 2020--return to 1990 levels around 2040 and decline substantially further in subsequent decades.

Table 1 illustrates a robust conclusion that emerges from this exercise: fast takeoff in emission reduction greatly increases the costs. Table 1 shows the cost for both the aggressive (WG-1) and slow-paced (WRE) paths--both with and without idealized international trading of permits. In 10 out of 12 simulations--for six different models with and without permit trading--the costs on the slow-takeoff WRE path is less than a third of the cost on the corresponding fast take-off path. Taking account of the likely adverse short-run macroeconomic consequences of an aggressive path would further strengthen this conclusion.

Table 2 illustrates a second, robust conclusion from the EMF-14 exercise: a viable system of international permit trading would very much reduce OECD costs. With global permit trading, the sharp, early emission reductions required of OECD countries under the aggressive (WG-1) approach would be avoided through the purchase of emission permits from countries with lower abatement costs. The average reduction in cost is 56 percent.[5]

Finally, it is important to note that in most of the EMF models, policy actions to raise carbon emissions prices must be taken at the inception of the slow-paced (WRE) program and a commitment to increasing emissions prices over time is required to achieve additional emission reductions. Naturally, the required initial carbon emissions price is substantially lower, at the outset, under the slower-paced (WRE) than under the aggressive (WG-1) path. Thus, although the slower-paced emissions path initially approximates the business as usual baseline, credible incentives must be put into place immediately, and strengthened over time, to achieve the needed investments in carbon-efficient technologies.

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[5] The computations in Table 2 verify that the slow paced (WRE) path, which permits emissions to depart relatively little from business as usual for several decades, is a substantially less costly than the alternative WG-1 path with its sharper immediate reductions. Since both paths are arbitrarily chosen to conform with the 550 ppmv concentration target, a natural question concerns the characteristics of an optimal or least-cost path for achieving this concentration target. An important recent study by Alan Manne and Richard Richels uses their MERGE model (included in the EMF-14 project) to compute the least cost path with 550-stabilization in 2100 and international permit trading. The optimal path, while not identical to the WRE path, is similar in character. This least-cost path peaks approximately three decades after the initiation of the program and declines thereafter.

V. The Environmental Consequences of Slow versus Fast Takeoff.

While the excess cost of a fast, compared to a gradual emissions reduction path is large, the difference in projected global temperatures over the next century between the fast and the slow paths is quite small, both in absolute amount and relative to temperature changes expected even if an aggressive policy path is adopted. Under "business as usual" assumptions, average global temperatures are expected to rise about 1 degree Celsius by 2050 and about 2½ degrees Celsius by 2100. An agressive emission reduction path that stabilizes emissions at 1990 levels by 2010 and maintains emissions at the 1990 level thereafter would mitigate this temperature increase by roughly 0.1 degrees by 2050 and 0.2 degrees by 2100. In contrast, a more gradual emissions path that peaks around 2015, stabilizes emissions at 1990 levels by 2040, and holds emissions constant at 1990 levels thereafter yields virtually identical environmental benefits: the temperature difference between the the aggressive and gradual paths diverges by no more than 0.05 degrees at any time over the next century. Similarly, the temperature differences along the aggressive WG-1 and less aggressive WRE paths--both designed ultimately to stabilize concentrations at 550 ppmv--differ by a maximum of 0.2 degrees over the next several centuries.[6]

The limited climatological impact of even an extremely aggressive emission reduction program measured in terms of temperature impacts during the next century results from the extremely long lags involved in the underlying physical processes and the dependence of temperature on the total stock of carbon dioxide in the atmosphere, rather than the flow of emissions at a given time. Emissions reductions do matter to temperature, but only over an extremely long horizon. The cumulative nature of the process suggests that there is little effect on global temperature from a slow rather than from a fast abatement takeoff. The addition to the total stock of carbon from a slow rather than a fast start to abatement adds relatively little to the total atmospheric stock of CO_2 between now and 2100 for four separate reasons: the difference in carbon emissions between a slow and a fast start over the initial decades of abatement is only a small fraction of total emissions in that period; the stock of CO_2 in the atmosphere is itself the result of many decades of emissions; some of the CO_2 emissions of the early decades will have been re-absorbed; and the most serious build-up in CO_2 under business as usual occurs late in the next century, as a consequence of burgeoning emissions from non-Annex I countries.

The preceding analysis abstracts from the possibility of catastrophic environmental effects, such as the melting of the West Antarctic ice sheet, a runaway greenhouse effect (e.g., from release of trapped methane with the melting of the permafrost), or structural changes in ocean

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[6] If a model assumes that sulfur dioxide emissions decline with the decline in carbon dioxide emissions under climate policy (as predicted, given the extent of sulfur emissions associated with fossil fuel combustion, and incorporated in the IPCC's IS92 emissions projections), the WG-1 path will be *warmer* than the WRE path between 2000 and 2040. This result reflects the negative impact of sulfate aerosols on the greenhouse effect. Early and substantial cuts in fossil fuel combustion, while decreasing the carbon emissions that warm the atmosphere, also decrease the sulfate aerosols that cool the atmosphere.

currents such as the Gulf Stream. However, even the potential for these disruptions does not fundamentally affect the basic trade-offs between the high costs of fast vs. slow takeoff paths. These factors do, however, add--perhaps greatly--to the urgency of adopting moderate long-term greenhouse gas concentration targets and a program involving an immediate, albeit moderate, increase in the price of CO_2 emissions.

VI. International Trading of Permits

As has already been noted, an effective system of international carbon emission permit trading among Annex I countries has the potential to substantially diminish the cost of a CO_2 abatement program. An Annex I trading system could, potentially, reduce the cost to the United States of any emissions goal by about 50%. Moreover, joint implementation projects with non-Annex I countries could, hypothetically, reduce the cost by half again.

Although international trading and joint implementation--so-called "where flexibility"--has enormous advantages in theory, your economic advisers are concerned that substantial barriers would arise in implementing any workable analogue of such an idealized system--at least in the near term. Consequently, they stress that Annex I international permit trading and joint implementation between the U.S. and non-Annex I countries realistically can serve only a limited role in reducing the costs associated with meeting a "1990 by 2010" target.

A hypothetical example shows how an international trading system would work, and why it would reduce each participant country's abatement costs. Suppose, ideally, that every country adopts a domestic permit system to implement its Kyoto target. Absent international trading, the price of emissions permits could differ across countries, reflecting differing marginal costs of abatement internationally. With different permit prices in different national markets, profit-seeking traders would be motivated to buy permits in countries where they are cheap and resell them in countries where they are more expensive. Such arbitrage activities would create an international permit market, bringing permit prices into equality worldwide. This idealized system promotes global efficiency in achieving any worldwide abatement goal. Countries with permit prices below world levels have the incentive to reduce emissions more than they otherwise would in order to profit in the international permit market. Countries with high permit prices would have the incentive to purcahse permits, thereby relaxing their Kyoto emissions constraints. The U.S. government could avoid any direct participation in such a system as long as it deems foreign-issued permits presented to the U.S. government by U.S. carbon-emitting entities as valid as those issued by the U.S. government itself.

The preceding description of how an international permit trading system would work provides an idealized picture of its possibilities. But the actual benefits of such a system are apt to fall short of this utopian portrayal in part because countries are not obliged to fulfill their Kyoto commitments via a domestic permit trading shceme; indeed, few Annex I countries have indicated an intention to do so. For example, consider a government that has decided to limit domestic emissions through regulatory controls. International permit sales that result in tighter domestic

constraints could well be politically unpopular so that a government would hesitate before selling its emission rights to the United States. Similarly, international permit sales by a country that is meeting its Kyoto obligations through domestic carbon or energy taxes would necessitate a hike in those taxes. In either case, international trading would involve government to government negotiations, and difficult political decisions. In contrast, in the idealized system, trades result from profit oriented transactions among individuals, mediated through the market.

Monitoring and enforcement issues are also likely to be paramount in insuring the workability of international trading. If domestic enforcement is effective in all countries, so that, in the aggregate, consumers and firms in each country actually limit their emissions to the national permit levels, international permit sales by private agents in the country actually translate into lower domestic emissions. But consider the difficulties that can occur with imperfect enforcement. If the government of a country--country X--finds it difficult either to measure domestic emissions or to enforce the purchase of permits by domestic emitters, then reductions in X's emissions may be insufficient to reach the Kyoto target. Those agents in X that are lucky enough to have been assigned the rights to X's permits will be able to sell them, at a quick profit, on the international market. With imperfect enforcement, international sales, without corresponding domestic emissions reductions, could emanate from countries with the weakest systems of enforcement. To prevent such "paper trades", which profit some participants and increase emissions, many countries, including the United States, will want controls to ensure the integrity of international permits. Buyers, too, will want clear concrete guarantees of the validity of permits so as to be sure they are not being passed counterfeit goods. These controls and guarantees will surely inhibit the efficiency of the market and render some--possibly much--of the estimated savings illusory. In fact, most of the benefits projected from the international sale of permits come from inducing emissions reductions from countries in Eastern Europe and the former Soviet Union--countries with particularly weak tax collection and enforcement mechanisms. Without these countries in the scheme the gains from international trading of permits will be very small.

Joint implementation with non-Annex I countries also has the potential to reduce the U.S. burden of attaining any given timetable. Under this type of approach, U.S. businesses could receive credit for the construction of nuclear, oil, or natural gas electricity generation plants in China if it were confidently expected that China would instead have constructed coal-fired plants with much higher CO_2 emissions. Certification of such credits might be overseen by an international agency to ensure that the projects were emissions-replacing. Such a project-by-project system is likely the most that is feasible in the absence of quantitative targets. Your economics advisers have concerns about even this level of endeavor due to the inherent difficulty in establishing that a particular set of projects has actually reduced a country's emissions, absent a reference path enabling a clear quantitative comparison. For example, the construction of a nuclear power plant in place of a coal-powered plant in China could indirectly raise CO_2 emissions elsewhere in the Chinese economy--partially offsetting the direct CO_2 reducing effect of the project--if the reduced demand for coal lowers its domestic price and encourages greater use elsewhere in the Chinese economy. A project-oriented approach to joint implementation will, in

effect, constitute a limited form of international trading with high transaction costs. As a result, it will probably capture only a small fraction of the total benefits of full international trading. In contrast, model results concerning the benefits of joint implementation treat it as equivalent to full international trading.

VII. Recycling of Revenues

The ultimate economic cost of an emission abatement program depends upon how the revenues realized from carbon taxes or auctioned permits are used. It has been estimated that the efficiency loss from collecting an extra dollar of tax revenue amounts to around 30 cents. If the revenues from a carbon tax or auctioned permits are used to reduce inefficient taxes inhibiting work or investment, the resulting welfare gains would partially offset the micro-efficiency losses from energy curtailment. According to some estimates, GDP would actually increase if the revenues were used to reduce taxes on capital.

Simulations by Nordhaus show that the optimal size of an abatement program would depend on how the revenues are recycled. For example, Nordhaus has estimated that an initial carbon tax of about $5 is optimal for the U.S., given his projections of abatement costs and environmental benefits, if the revenue from the tax is redistributed in so-called "lump-sum" fashion--namely, in a way that results in no favorable incentive effects. However when revenues are used to replace other taxes with an efficiency loss of 30 cents, the initial optimal carbon tax rises to almost $60. The simple lesson is that the costs of emission abatement are greatly reduced if the revenues from the taxes levied can be put to good use.

So far we have approached the recycling of revenues from the standpoint of microeconomic efficiency. There is also the potential for using the revenues to abate the macroeconomic consequences of the emissions program. The oil shock is believed by many economists to have resulted in increased unemployment because workers resisted the fall in real wages that was associated with the inflationary impact of higher energy prices. Increased wage demands added inflationary pressures to the economy that could only be suppressed by tighter monetary policy. Thus it might be argued that the effects of the real wage shock on inflation and unemployment could be diminished by lowering payroll or other worker taxes to offset the real wage losses from higher energy prices.

But England's experience points to the need for caution in assessing the potential for revenue recycling to allay the macroeconomic consequences of the rising energy costs. In 1979, immediately after her election, Margaret Thatcher increased the VAT tax and simultaneously decreased the income tax. These two policy changes had offsetting effects on real after tax incomes, and therefore might have been expected to have had no effect on wage bargaining. However, the increase in the VAT tax resulted in an immediately noticeable increase in the CPI. A wage-price spiral ensued as workers attempted to maintain their pre-tax real wages.

VIII. Policy Implications

The foregoing arguments point to the attractiveness, from both an economic and environmental standpoint, of a U.S. policy to raise the price of carbon emissions--either through a carbon tax or a system of auctioned permits--by a moderate amount--for example, between $5 and $25 per ton of carbon--in the near term, with further increases scheduled over the longer term. Under this program, U.S. emissions would continue to rise for at least a decade before declining to current, then 1990 levels and below. Such a program could be defended as a significant policy action consistent with a strong U.S. commitment to attaining the ultimate objective of the Framework Convention--namely to stabilize atmospheric concentrations of CO_2 and hence global temperatures.

A program involving gradual increases in the relative price of carbon emissions over time would avoid the possibly substantial macroeconomic consequences of a 1990 by 2010 program. The energy price increases associated with this program would have a modest impact on family income that could be offset by compensating cuts in other taxes.

Figure 1: Energy Prices and Changes in Energy Use

OPEC price hikes lowered energy use substantially

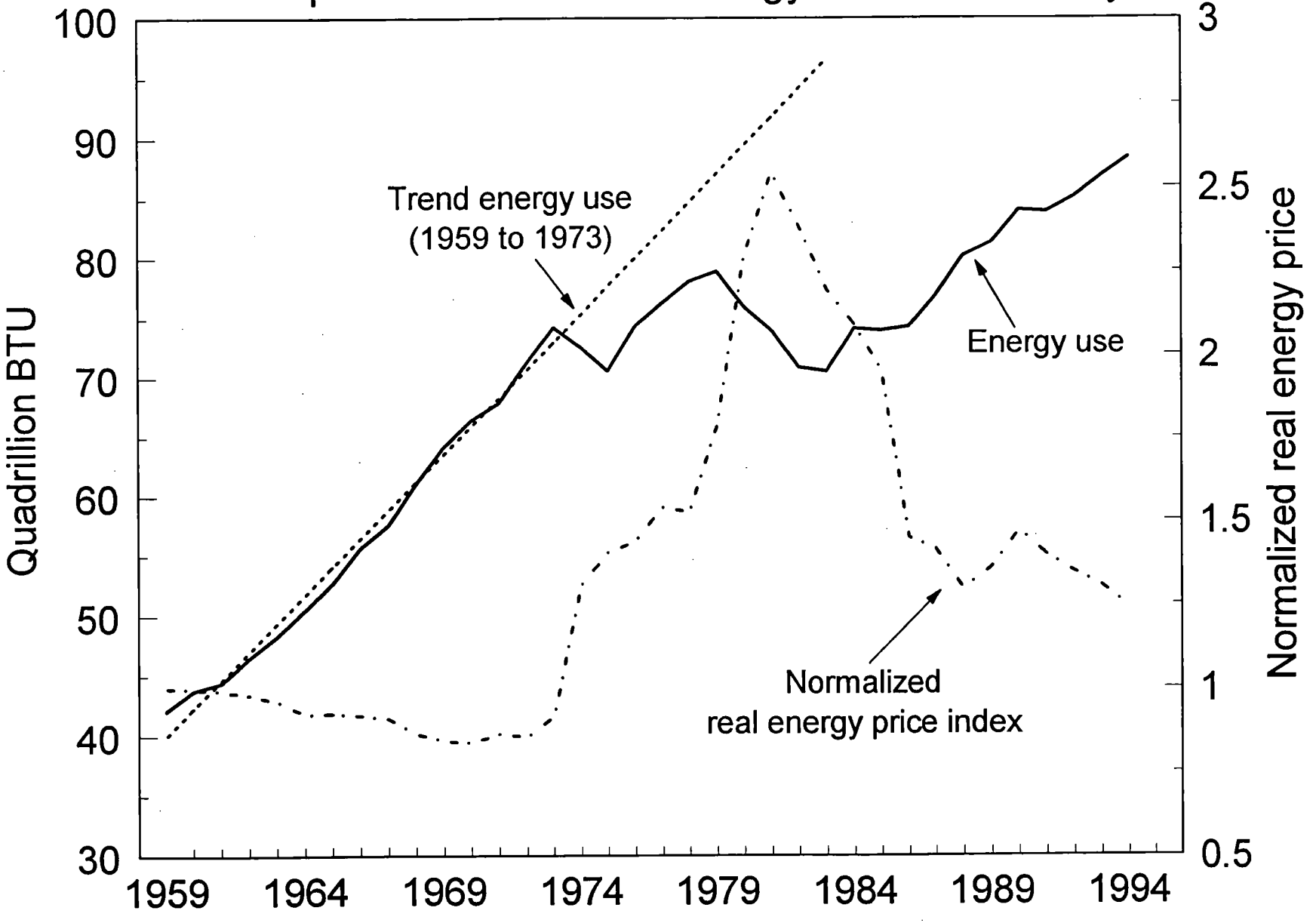
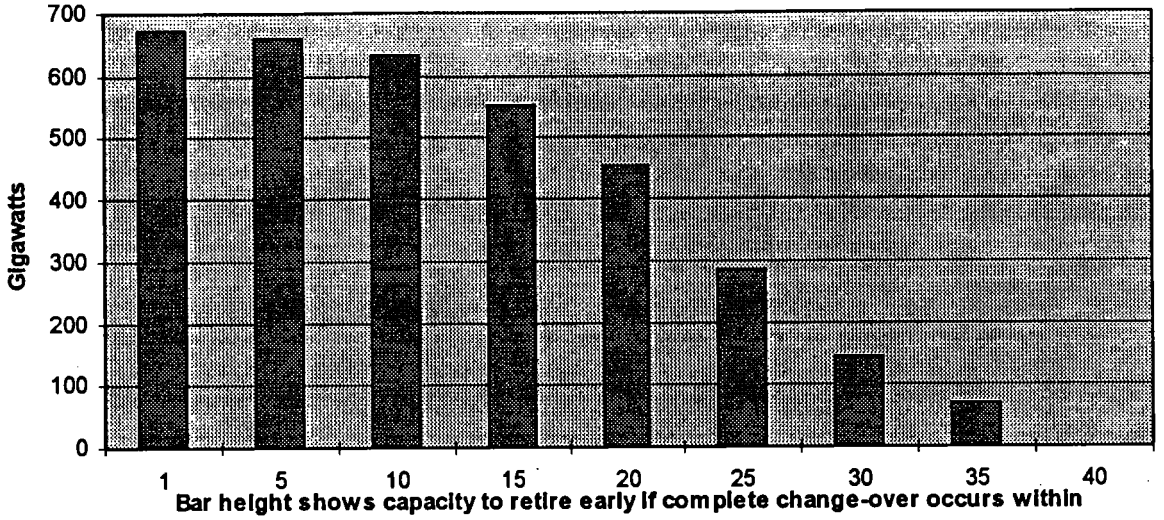
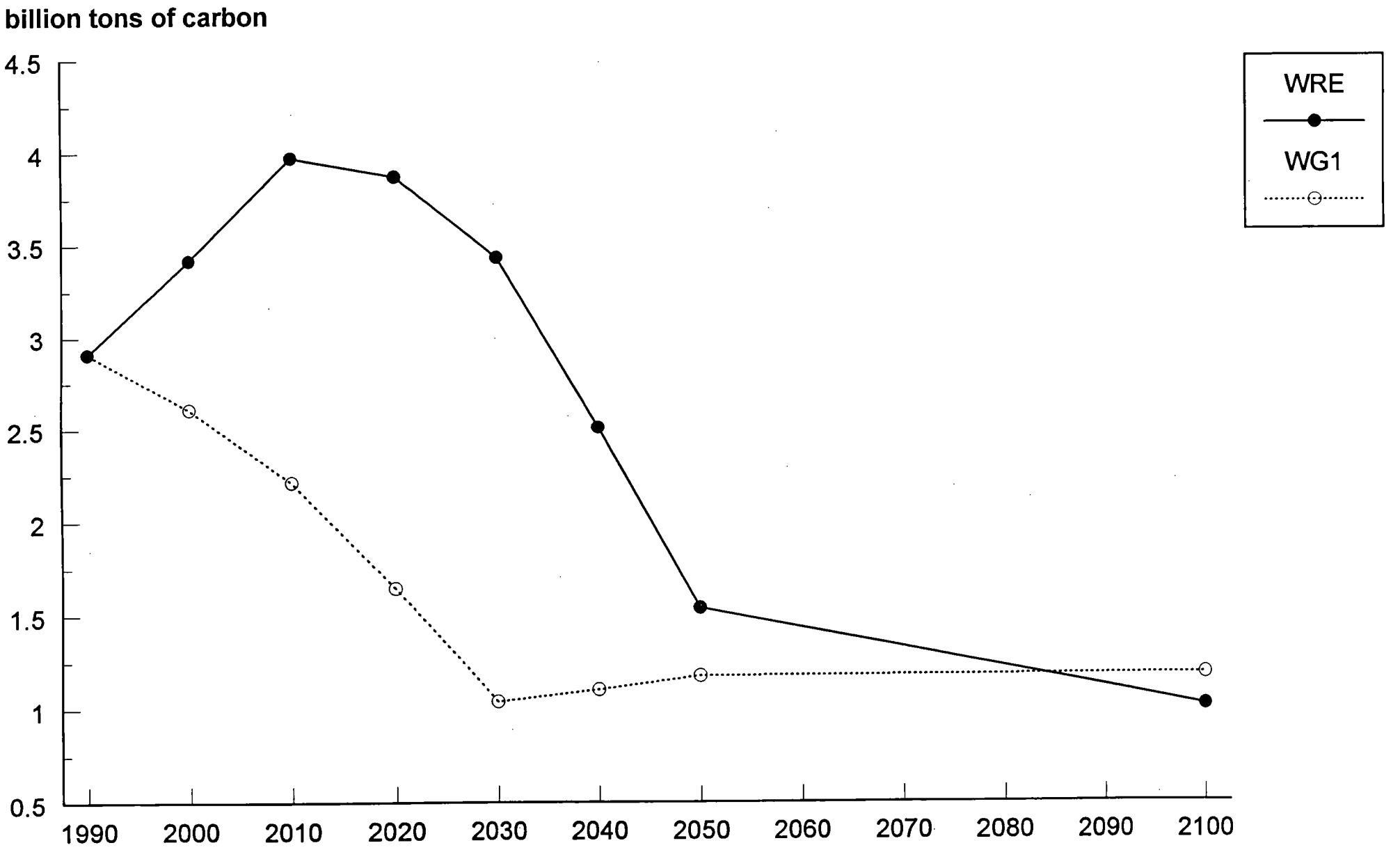


Figure 2: Accelerated Retirement of Electric Power Plant Capacity



Bar height shows capacity to retire early if complete change-over occurs within number of years indicated on the axis. Normal life span of a generator is 40 years.

Figure 3: WRE and WG-1 Emissions Pathways for OECD to Stabilize Concentrations at 550 ppmv



Source: Manne and Richels

The Effects of Emissions Pathway on Consumption Losses by OECD Countries, No International Permit Trading (trillions of 1990 U.S. dollars)

Model	WRE	WG1	WRE/WG1
CETA	1.83	5.94	0.31
CPBRIVM	0.64	3.25	0.20
FUND	9.82	11.71	0.84
MERGE	0.85	6.12	0.14
MiniCAM	1.58	6.51	0.24
SGM	1.84	6.17	0.30
		Average:	0.34

The Effects of Emissions Pathway on Consumption Losses by OECD Countries, International Permit Trading (trillions of 1990 U.S. dollars)

Model	WRE	WG1	WRE/WG1
CETA	1.86	4.03	0.46
CPBRIVM	0.17	0.99	0.17
FUND	1.47	4.97	0.30
MERGE	0.60	3.24	0.19
MiniCAM	1.54	3.44	0.16
SGM	0.13	1.48	0.086
		Average:	0.23
		Average (Trading + No Trading):	0.28

Table 1

The Effects of International Permit Trading on Consumption Losses by OECD Countries, WRE Emissions Pathway to 550 ppmv Stabilization (trillions of 1990 U.S. dollars)

Model	Trading	No Trading	Trading/No Trading
CETA	1.86	1.83	1.02
CPBRIVM	0.17	0.64	0.27
FUND	1.47	9.82	0.15
MERGE	0.60	0.85	0.71
MiniCAM	0.54	1.58	0.34
SGM	0.13	1.84	0.07
		Average:	0.43

The Effects of International Permit Trading on Consumption Losses by OECD Countries, WG1 Emissions Pathway to 550 ppmv Stabilization (trillions of 1990 U.S. dollars)

Model	WRE	WG1	WRE/WG1
CETA	4.03	5.94	0.68
CPBRIVM	0.99	3.25	0.30
FUND	4.97	11.71	042
MERGE	3.24	6.12	0.53
MiniCAM	3.44	6.51	0.53
SGM	1.48	6.17	0.24
		Average:	0.45
		Average (Trading + No Trading):	0.44

Table 2

DRAFT #5: CLOSE HOLD
September 26, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
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SUBJECT: Climate change

As promised in our climate change workplan, this memorandum provides more detail on some of the issues that were raised during our meeting with you on September 18. We will also be holding a principals meeting today, and another one early next week, to pin down specific recommendations from the NEC/CEQ principals. We will then put together an NEC/CEQ recommendations memorandum and a briefing book that contains the underlying memoranda from the principals and other background materials. The recommendations memo and briefing book will be submitted to you by the end of next week, to inform your thinking before the October 6 White House conference.

Specifically, this memorandum:

- Outlines the sources of current emissions in the United States;
- Discusses the potential for technology to reduce the costs of emissions reductions;
- Discusses several aspects of a tradeable permits system, including:

  →The benefits of a permit trading system relative to traditional regulation;

  →The lessons offered by the SO2 trading program; and

  →Grandfathering versus auctioning with revenue recycling;

- Explains the economic advantages of a gradual approach to reducing greenhouse gas emissions;

- Explains the risks of delay; and
- Explores a possible escape clause mechanism to limit the costs of a permit system.

I. SOURCES OF EMISSIONS IN THE UNITED STATES

Carbon dioxide (CO2) accounts for more than 85 percent of U.S. greenhouse gas emissions. Roughly one-third of CO2 emissions are from transportation, one-third from buildings and one-third from industry.1 U.S. CO2 emissions are now 12 percent above 1990 levels, and are projected to be 28 percent over 1990 levels by 2010 absent policy interventions. Other greenhouse gases include methane (from landfills and livestock), nitrous oxide, and some engineered chemicals such as CFCs and HFCs.

TRANSPORTATION

Transportation contributes 31 percent of of U.S. CO2 emissions. Its emissions are growing by about 2 percent (10 million tons) per year -- roughly twice as fast as industry and buildings -- because of increases in vehicle miles traveled and the increasing popularity of fuel-inefficient sport utility vehicles, minivans and pick-up trucks (which together now account for almost half of all new passenger vehicle sales).

Transportation: Sources of CO2 emissions

Source	Emissions in millions of tons	As % of transportation emissions
Automobiles	152	34.9%
Light trucks	101	23.2%
Heavy trucks	67	15.4%
Aircraft	57	13.1%
Other	59	13.4%
TOTAL	437	100.0%

BUILDINGS

Residential buildings produce 19 percent of U.S. CO2 emissions, and commercial buildings account for another 15 percent -- implying that buildings account for over a third of total emissions. Emissions from both residential and commercial buildings are growing by 1 percent annually (2.6 and 2.1 million tons respectively). Energy demand in residential buildings is greatest for heating, electrical appliances, and air conditioning. In commercial buildings, demand is greatest for lighting, electric equipment, and air conditioning.

Buildings: Sources of CO2 emissions

Source	Emissions in millions of tons	As % of building emissions
Space heat	211	43.0%

Appliances	98	20.0%
Cooling	69	14.0%
Lights	69	14.0%
Water heat	44	9.0%
TOTAL	490	100.0%

INDUSTRY

Industries produce about a third of all CO2 emissions. Emissions from this source are expected to increase at 0.8 percent per year (4 million tons). About 80 percent of all industrial CO2 emissions come from petroleum refining, chemicals, paper, lumber and other forest products, and metals.

Industry: Sources of CO2 emissions

Source	Emissions in millions of tons	% of industry emissions
Machine drive/electrolytic	149	32.0%
Steam	126	27.0%
Process heat	89	19.0%
Off-road equipment	33	7.0%
Heat/air conditioning/light	28	6.0%
Feedstocks/other	42	9.0%
TOTAL	466	100.0%

ELECTRICITY GENERATION

As noted, the CO2 produced to generate electricity is charged to the sector using the electricity in the accounting above. Emissions from all electricity production amount to 36 percent of CO2 emissions.

The table below shows that coal accounts for 50 percent of electricity generated in the U.S., but 77 percent of CO2 emissions from electricity generation. Coal produces 72 percent more greenhouse gases than natural gas per unit of energy delivered -- which is why a carbon emissions reduction program would have a much larger impact on coal prices than on natural gas or other energy prices.

On average, the electric energy produced by an electric generator is only about a third of the energy input -- the other two-thirds is released as waste into the air or nearby waters. As more generation occurs closer to industrial and commercial sites, it should be easier to capture more of the heat from electric generation that would otherwise be wasted.

Electricity

Source	Share of electricity CO2 emissions	Share of electricity generation
Oil	1.9%	1.5%
Natural gas	20.7%	23.0%
Coal	77.4%	50.1%
Nuclear	--	15.8%
Hydro & renewables	--	9.6%
TOTAL	100.0%	100.0%

II. THE ROLE OF TECHNOLOGY

All of your advisers agree that reducing greenhouse gas emissions in a growing economy depends on the deployment and development of technology to produce and use energy more

efficiently. *However, your advisers have sharp disagreements about the role of price increases in promoting the deployment and development of carbon-reducing technologies.*

Technology deployment. In the short- and medium-term (i.e., the next 15 years), the most promising approach to reducing carbon emissions through technology is to deploy currently available "off-the-shelf" efficiency technologies that have not yet achieved full market penetration. Examples of such technologies include:

- More energy efficient lighting, appliances, heating and cooling equipment, and building materials for homes and commercial buildings;

- More efficient power generation equipment, motors and compressors, and industrial processes for manufacturing plants.

A new study conducted by five of the Department of Energy's national laboratories -- and highlighted in the *Washington Post* on September 26 -- concluded that even without an increase in the price of carbon, "cost-effective energy efficiency alone can take the nation 30 to 50% of the way to 1990 levels" by 2010. (Similarly, a 1992 study by the National Academy of Sciences suggested that full use of existing efficiency technologies could cut carbon emissions by approximately 25 percent -- or nearly enough to offset expected emissions growth between 1990 and 2010 -- at a cost of less than $10 per ton of carbon.) In addition, some estimates suggest that voluntary programs to enhance technology deployment under your Climate Change Action Plan have cut the emissions growth rate by approximately one-third.

Treasury and CEA note that the studies mentioned above identify the technical *potential* to increase energy efficiency, but do not propose -- or reflect the full costs of -- *policies* to achieve that potential. They agree that there now exist unused technological opportunities for emissions reduction, but question by what means, over what time frame, and at what expense government policies could change private behavior if such opportunities are currently underutilized. Rather than stressing the mere availability of alternative technologies, *the Administration's top economists insist on realistic estimates of likely rates of adoption and diffusion and they stress the need for economic incentives -- in this case a higher implicit price for emitting carbon -- to induce the adoption of emissions-savings technology.*

Furthermore, they note, substantial energy efficiencies are already built into our baselines for future emissions -- so the policy challenge of achieving additional efficiencies beyond those already assumed to occur could be daunting. They also point to a number of what they consider to be unrealistically optimistic assumptions crucial to the results of the Energy Department study and others like it. For example, the study implicitly assumes that $1 of government spending elicits $6 of new private spending on emissions reductions.

In sum, your advisers differ on our ability to effectuate greater deployment of currently available technology without energy price increases. Some agencies believe relatively low-cost government programs, coupled with some some regulatory actions (e.g., appliance efficiency standards), could achieve a substantially higher diffusion of cost-saving technologies, moderating the price increase that would result from capping emissions. Other advisers believe these analyses

are overly optimistic, and doubt that non-price policies and programs have much additional benefit in the absence of a significant energy price increase.

Technology R&D. Increased deployment of today's technology could cut the costs of carbon emissions reductions. But over the longer run, it will be crucial to develop technologies that are more efficient or produce energy without greenhouse emissions. Since the world economy is likely to grow by several multiples during the next century, the ratio of greenhouse gas production to economic activity must be cut dramatically to reconcile continued economic growth with reduced greenhouse gas emissions. Three kinds of technologies may be promising:

- Technologies that use energy and materials more efficiently -- like the PNGV car;
- Technologies that produce energy using solar cells, plants and wood waste, and other methods that do not result in net production of greenhouse gases; and
- Technologies that can sequester or permanently store greenhouse gases in deep acquifers or in other ways.

There is agreement that a package of technology policies should be a component of any U.S. climate strategy. Options for such policies could include direct government expenditures, tax breaks for R&D, or regulatory standards.

There is disagreement, however, on the potential for technology development from government actions without the spur of a price increase. Paralleling the discussion of technology *diffusion*, some of your advisers -- in particular, Treasury and CEA -- point to the lack of specific proposals for government initiatives that would spur development. They point instead to the substantial body of evidence that ~~R&D~~ Technology responds effectively to changes in prices. They agree that technological developments will be one of the conduits for meeting an emissions reduction target, but note that historically, the most rapid energy technology advances have come in response to significant increases in the relative price of energy. For instance, over the entire postwar period, the fossil-fuel efficiency of the U. S. economy has improved at slightly more than one percent per year. Between 1970 and 1986, during which time the economy suffered two oil-price shocks, fossil-fuel efficiency grew by more than 2½ percent per year. The pace of efficiency improvement has slowed down, but not stopped, since the late 1980s, as the relative price of energy has fallen. Sharply

Summary of views on technology potential. As the discussion above indicates, your advisers have different views about the role of prices in spurring technological development and diffusion. The degree of disagreement on this crucial topic, however, can ~~easily~~ be exaggerated. Even the Department of Energy study mentioned above, which is ~~assumed~~ believed to be overly optimistic by the economic agencies, assumes a $50 per ton charge for carbon to achieve 1990 levels by 2010. Despite ongoing debates over the precise role of technology, therefore, *there is broad technical agreement that a significant price signal is crucial to achieving emissions reductions of the sort being considered in international fora.* For example, it would be impossible to achieve 1990 emissions levels by 2010 without a substantial increase in carbon prices.

III. Tradeable Permits

During our meeting with you, we discussed a tradeable permits system for reducing carbon emissions. This section examines several questions related to tradeable permits.

Tradeable Permits Versus Mandated Standards

A natural question about tradeable permits is why they reduce the costs associated with meeting a given emissions reduction objective. Wouldn't it be easier and more straightforward to mandate standards on items such as automobile fuel efficiency?

Mandated standards are more costly than market-based systems to reducing pollutionfor two reasons: First, standards usually only affect the market for new equipment; they do not increase the incentive for owners of existing equipment to scrap their old, inefficient capital more rapidly. Second, standards do not affect the incentive to conserve energy once the new equipment is purchased. For products where additional usage is discretionary (such as cars, but unlike refrigerators), this can be significant. A standard for automobile efficiency does not increase incentives to cut out wasteful driving. A tradeable permits system, on the other hand, focuses directly on the activity in question, allowing reductions to take place wherever they are cheapest and imposing no arbitrary constraint on incentives for further improvement. And in most cases, a tradeable permits system is less administratively costly.

An illustrative example

An example may be helpful. Assume that there are two types of coal-fired plants, both of which emit 100,000 tons of carbon per year. The first type can easily switch to less carbon-intensive fuels (such as natural gas), and thereby reduce carbon emissions even for a given level of energy output (since natural gas has less carbon per BTU than coal). To be more specific, this first type of power plant can achieve carbon emissions reductions at a cost of $25 for every carbon ton reduction. The second type, however, was designed in a manner that makes it extremely difficult to switch fuel to reduce emissions: it can achieve emissions reductions only at a cost of $150 per ton.

The average cost of mandating that carbon emissions at all plants fall by 30 percent is therefore $2.6 million per plant ($0.75 million at the first type, and $4.5 million at the second). Under a permit system, however, the total cost would be dramatically reduced by allowing the second type of plant to buy permits from the first type. This way, a 30 percent reduction in total emissions would cost only $1.5 million per plant (all of the 60,000 ton reduction would occur at the first type of plant, at a cost of $25 per ton). In this example, the permit system produces a cost saving of over 70 percent *to achieve the same environmental goal.* This level of cost saving is not unrealistic: studies by environmental economists often find that market-based systems reduce the cost of environmental regulations by as much as 90 percent.

CAFE standards

You had mentioned the specific case of fuel efficiency standards. When the CAFE standards first went into effect in 1976, new vehicle average fuel efficiency was 13.2 miles per gallon (mpg). The CAFE standard reached 27.5 mpg in 1985. There have been no net increases in fuel efficiency since manufacturers reached the 1985 regulated limit. Proponents of fuel efficiency standards argue that further increases in CAFE standards could markedly improve motor vehicle efficiency.

Your economic advisers stress that there is no evidence that CAFE standards were responsible for the undisputed increase in new car fuel efficiency between 1975 and 1986. They note that real gasoline prices increased by 70 percent between 1973 and 1981. Thus, they argue that the increase in fuel efficiency could have resulted from consumer demand for high-mileage vehicles in the face of rising fuel prices -- not from the CAFE standards. They also note that simply increasing fuel efficiency, without changing the price of gasoline, reduces the cost of driving additional miles and thus induces people to drive more miles -- so that the positive effects of increased fuel *efficiency* will be at least partially offset by an increase in *miles driven*.

Your economic advisers also emphasize that tighter CAFE standards -- particularly on sport/utility vehicles -- are an economically and politically costly way of reducing carbon emissions in the United States. Standards would have to be substantially tightened on sport utility vehicles and other light trucks as well as passenger cars to ensure effectiveness. Such vehicles now comprise *almost half* of new vehicle sales; tighter standards would therefore force consumers to forgo their obvious attraction to these (relatively) fuel-inefficient vehicles. Also, since the standards only apply to *new* cars and the median expected life of a passenger car is now 14 years (16 years for trucks), the full impact of any change in CAFE standards would not be felt by 2010.

Several studies have estimated the cost of reducing carbon emissions with CAFE standards. Krupnick *et al.* (1992) estimated the implied cost of carbon reductions from increasing the CAFE standard to 37.5 miles per gallon at $106 per ton of carbon reduced. Charles River Associates estimated raising CAFE standards to 40 miles per gallon is equivalent to a carbon price of $104 per ton -- relative to $23, $4 and $2 for achieving the same carbon reductions with a gasoline tax, an oil tax and a carbon tax, respectively.

The SO2 Example: How Much Can We Learn From It?

Another natural question regarding a carbon emissions permit trading system is what we can learn from the sulfur dioxide (SO2) allowance trading program. The SO2 permit program evolved out of the Clean Air Act Amendments of 1990, which required a 50 percent reduction in SO2 emissions from electric-utility boilers. To accomplish this goal, a fixed number of emission allowances were allocated to electric utilities based on historical fuel use. (In addition, a small number of allowances are auctioned every year.) Allowances may be traded to any party anywhere, and may be "banked" for use in future years.

Around the time that the 1990 Amendments were enacted, a commonly held view was that achieving the targeted reduction in SO2 would require the price of emissions to rise above $400 per ton, and possibly as high as $1,000 per ton. Today, the price of SO2 allowances ranges

between $90 and $120 per ton. Many observers have interpreted the discrepancy between predicted and actual prices as indicating that significant reductions in carbon emissions might likewise be attained at lower-than-predicted cost. These observers argue that businesses are often able to meet goals at a lower cost than outside observers had anticipated.

Treasury and CEA, however, argue that the comparison is not a valid interpretation of the historical record:

- First, most of the price estimates failed to distinguish between two phases of the program (we are still in Phase I of the program). Furthermore, early estimates of permit prices were based on inaccurate guesses as to the provisions of the final bill (e.g., that the EPA ended up distributing an extra 3.5 million bonus allowances). The last pre-enactment estimate (from an EPA/ICF study) -- the one with the best information about the legislation that would actually be passed -- projected that the Phase I permit price would be between $170 and $200 per ton.

- Second, the remaining discrepancy between predicted and actual permit prices partially reflects the deregulation of the freight-carrying railroads and the consequent reduction in rates -- a development that had nothing to do with the SO2 program. Similarly favorable factors may or may not emerge with respect to a carbon trading program.

costs of low-sulphur coal from the Powder River Basin

- Finally, careful analysis has shown that actual abatement costs to date have averaged about $200 per ton, and thus have substantially exceeded the currently prevailing permit price. The discrepancy between abatement costs and the permit price could result from implicit (from general public opinion) and explicit (from Public Utility Commissions) restrictions on the ability of utilities to purchase permits, or from overinvestments in long-term contracts for low-sulfur coal and in SO2 scrubbers. It is unclear whether these factors would also cause a discrepancy in the case of greenhouse gases.

Treasury and CEA also argue that the SO2 comparison is inappropriate, because in the SO2 case there were proven technologies on the shelf to address the problem, whereas (in Treasury/CEA's view) the same is not true for greenhouse gases. For example, a long-term solution to the carbon problem will require moving away from combustion of petroleum-based fuels in the transportation, utility, and manufacturing sectors. EPA, OSTP and other agencies strongly disagree, arguing that there are many technologies currently available to address emissions of greenhouse gases.

In any case, it is important to note that a greenhouse program would dwarf the SO2 program: Whereas the annual stock of permits under the SO2 program is worth less than $1 billion, the annual stock of permits under a carbon trading program might be worth between $30 billion and $150 billion. The difference in aggregate permit values reflects the fact that achieving a significant reduction in carbon emissions will require more fundamental changes in the structure of the American economy than the SO2 program. As a result, Treasury and CEA argue that any emissions trading system for carbon will be substantially more difficult to administer than is the case for SO2.

Direct Allocation Versus Auctioning-With-Revenue Recycling

Another issue related to a permit system, and one we touched upon in our meeting, is whether the permits should be auctioned or allocated (that is distributed by the government to designated recipients). One approach to allocating permits would be to "grandfather" them to existing emitters. *It is essential to recognize that regardless of whether the permits are auctioned or allocated, consumers are likely to bear most of the costs involved in reducing emissions (through higher energy prices).* Thus the choice between auctioning and grandfathering does not in any way avoid the role of higher energy prices in reducing carbon emissions.

To summarize the pros and cons:

AUCTIONS

- Auctioning would raise revenue -- potentially more than $100 billion a year -- that could be used to reduce other taxes, fund the adjustment programs favored by the labor unions, offset the regressivity of the emissions reduction scheme, or raise national saving. As some rough examples of what could be done under a revenue-neutral auction approach, $100 billion raised from auctioning permits could be used for one of the following:
  →Exclude over $6,000 of payroll from both parts of the 12.4 percent OASDI tax;

  →Cut the employees' OASDI payroll tax (currently 6.2 percent) in half;

  →Reduce the 15 percent income tax rate in the lowest bracket to 10.2 percent; or

  →More than double the standard deduction (currently $6,700 for married couple)

- However, business groups are likely strongly to oppose an auction. The theoretical benefits of auctions as a means of distributing the permits will be much less salient to the CEO of a large corporation than the necessity of having to purchase permits to continue operations. Businesses will view an auction as an obligation to pay for something they currently do for free -- even if they are able to pass the higher costs on to consumers.

- In addition, an auction would be more easily characterized as a tax than grandfathering. Although we could emphasize the differences between an auction and a tax, the auction would be scored as raising money for the Treasury. An allocation program, in contrast, does not involve raising revenue. Previous grandfathered programs -- such as the SO2 program -- have not been viewed as a tax, but that could be because they were sufficiently small that it was not worth demagoguing over the issue.

GRANDFATHERING

- One way to think about the difference between direct allocation and auctioning is to recognize that direct allocation is functionally equivalent to auctioning the permits, and then giving the proceeds of the auctions back to ~~the recipients of the permits~~. If permits are "grandfathered," this wealth would go directly to existing emitters.

- Even with grandfathering, companies are likely to pass most of the higher energy costs on to consumers. Any program that involves direct allocation to businesses -- such as grandfathering existing emitters -- thus *protects corporations even ~~though~~ they do not need protection, and gives away the funds that could protect consumers, who will bear most of the costs from adjusting to the emissions reduction scheme.*

- The optics of "giving away" to companies possibly upwards of $100 billion per year, which represents about *20 percent of total after-tax corporate profits,* may be difficult.

- Treasury and CEA have grave reservations about the efficiency of a grandfathered system, ~~which will very likely imply that~~ the permit requirements ~~are imposed~~ downstream (e.g., on electric utilities). First, any downstream option must settle for only partial coverage of emissions to limit administrative burden. Second, the typical downstream system creates obvious incentives for evasion (e.g., cheating or building units that fall just below the cutoff level) and limits the gains available for intersectoral trading. For example, the oil price control program of the 1970s set an artifically low price for "old" oil, and then allocated this oil in a manner ~~which~~ that heavily favored "small" domestic refiners. The cutoff for "small" refiners was set below the economically efficient production size, yet all of the new refineries entering the market after the regulations were enacted were in the "small" category, whereas this category had actually been falling in the previous few years.

IV. The Case for a Gradual Approach

Some of your advisers are extremely concerned that a target anywhere close to 1990 emissions levels by 2010 would be excessively costly and would mirror the costs resulting from the oil shocks of the 1970s. The two OPEC oil shocks raised energy prices sufficiently to hold energy consumption about flat over the 12-year period from 1973 through 1985. But to reduce emissions by 2010 to 1990 levels, the United States would have to *reduce* its energy consumption over the next 13 years by about 15 percent. Other advisers note that the analogy to the oil shocks is potentially misleading -- especially since the oil shocks were unanticipated, whereas the carbon reduction regime would be anticipated. In any case, Treasury and CEA calculate that achieving a goal of 1990 levels by 2010 could reduce the living standards of the average family by 4 percent -- equivalent to a *tax on consumers approximately seven times as large as the Administration's 1993 BTU tax proposal.*

Treasury and CEA emphasize that in fact, the same environmental goals can be achieved at substantially lower economic cost by adopting a more gradual approach -- one that allows the economy to adjust slowly over time to the new constraints being imposed. There are three major

raises

reasons that a more rapid approach ~~reduces~~ overall costs:

- It does not allow adequate time for the capital stock to turn over naturally;
- It does not provide enough lead time to develop and implement new technologies; and
- It causes a stagflationary short-term macroeconomic shock.

Capital stock. It is very expensive to scrap capital stock while it is still in the prime of its useful life, and replace it with new plant and equipment that is more energy-efficient. But over the course of twenty to forty years, much of our existing plant and equipment will be ready for replacement anyway. *Making efficiency improvements when the plants would have been replaced in any case significantly reduces the costs of such improvements because there are no additional costs to scrapping otherwise productive plant.* Thus a more gradual approach is substantially less costly -- because it allows the capital stock to turn over naturally with the improved technology.

Lead time for technologies. A second motivation for a slow takeoff in curbing greenhouse gases emissions is that it takes considerable time before emerging carbon-free or carbon-lean technologies are developed. Waiting until these new technologies are available before making expensive emissions-saving investments offers the potential of both lower economic costs and higher environmental payoffs. A rapid timetable forces long-term investments to be made before superior technologies have been developed and refined.

Macroeconomic impact. From a macroeconomic perspective, increases in energy prices constitute a "supply shock." *Your economic advisers believe that a plan to attain 1990 emissions levels by 2010 would require a change in energy prices over the first decade of the 21st century at least comparable in magnitude to the two oil shocks of the 1970s.* Just as the oil shocks had a substantial adverse impact on both unemployment and inflation, the energy price increases required by a 1990 by 2010 program would raise inflation, lower real wages, and raise unemployment. In contrast to the two oil shocks, the increases in energy prices associated with a treaty to reduce greenhouse gases would be anticipated, rather than a surprise. Nevertheless, your economics team expects that the efforts of the Federal Reserve to contain inflation, coupled with likely efforts on the part of workers to recoup real wage losses -- even if those losses are anticipated -- will lead to a period of higher unemployment.

Finally, your economic advisers argue that a *gradual approach will have almost no perceptible impact on the ultimate effect of our climate change policy on the environment.* Model estimates suggest that the difference in temperature in the year 2100 from a very aggressive (1990 emission levels by 2010) and a less aggressive (emissions peaking in 2015) policy is *less than 0.1 degrees.* Concern has been expressed that this type of approach understates the global warming implications of less aggressive targets and timetables, since more aggressive approaches by the U.S. may encourage ~~increase the pace of~~ emissions reductions in the remainder of the world, particularly the developing countries. But even accounting for this factor does not dramatically change the conclusions of our analysis. Even if we assume that the more aggressive

U.S. policy moves the developing countries from stabilizing emissions in 2050 to stabilizing emissions in 2020, the effect on the temperature in 2100 is *less than 0.3 degrees.* (which they are extremely unlikely to agree to) Where from?

V. THE CASE AGAINST DELAY

Other advisors highlight that, absent policy interventions, atmospheric greenhouse gas concentrations will increase during the next century to levels unknown on this planet for 50 million years. To avoid such extraordinary increases, *global* greenhouse gas emissions must begin to decline from projected levels early in the next century. For *global* emissions to begin to decline in this time frame, developed countries must move quickly to reduce their emissions, followed rapidly by action by developing countries.

EPA, CEQ and OSTP argue that, for the world realistically to avoid a doubling of pre-industrial greenhouse gas concentrations (to 550 ppm) in the next century, global emissions must deflect from a "business-as-usual" path by about 2010. (At a doubling of pre-industrial concentrations, projected impacts average global temperature increase of 2-6.5 degrees F., sea-level rise of 6-38 inches, more intense droughts and floods, and an additional 50-80 million cases of malaria worldwide. According to a NOAA study, this would mean increases in July temperatures of 5-15 degrees F., by the end of the next century). For the world realistically to avoid a near-*tripling* of greenhouse gas concentrations (750 ppm), they argue, global emissions must deflect from this "business-as-usual" path by 2020. Even assuming steep reductions in greenhouse gas emissions in distant decades, reductions must begin soon to avoid serious environmental damage.

If the United States delays emissions reductions, it seems likely that other developed countries will do so as well, and developing countries may do nothing. In such an event, the world will become more and more committed to greenhouse gas concentrations far outside the range of historic experience.

A slow start dramatically increases the rate of emissions reductions necessary later. For example, a ten-year delay in starting emission reductions requires that emissions be reduced twice as fast in later decades. As the scientists told you at the roundtable this summer, "the slower the rate of change, the less catastrophic the effects."

VI. ESCAPE CLAUSE

One way to address the uncertainties associated with the cost of climate change policies would be an "escape clause." Such a mechanism could provide insurance that the costs of meeting our target and timetable do not become excessive.

Under an escape clause, the U.S. Government would stand ready to sell permits at a given price (say $X per ton). If the market price threatened to exceed $X, firms would begin purchasing from the government -- thus expanding the supply of permits and driving down the price. The government's promise to sell at $X ensures that the economic cost of the overall policy is capped at $X per ton. *It is crucial to recognize, however, that if the escape clause is*

triggered we will not meet our target and timetable path because the government will be selling additional permits.

The value of $X is important to the design of any escape clause. If $X is set at a high level, the probability of triggering the escape clause would be low. If $X is set at a lower level, the escape clause is more likely to be triggered, and the target and timetable is therefore less likely to be met.

More complicated versions of the escape clause could include increases in the real value of $X over calendar years (e.g., $X for 2010-2020, $X+$15 for 2020-2030, etc.). The mechanism could also make provisions to raise $X as more permits are sold (e.g., $X for the first 100,000 tons through the escape clause, $X+$5 for the next 100,000 tons, etc.). If the price per ton rises as more permits are sold, the price increase will exert more pressure on emissions to return to the original target and timetable glidepath.

An escape clause could protect against high economic costs, and help reduce corporate opposition to a greenhouse gas control program. Technology optimists could believe that we will meet the target and timetable without triggering the escape clause. But, if we set the escape clause at too low a level, we face a substantial risk of appearing disingenuous to domestic constitutencies and the international community, since we will be forced to admit that we do not intend to meet our stated target and timetable .

International ramifications

An escape clause denominated as such would not be negotiable internationally, and a U.S. proposal in this regard would provoke significant international criticism. Furthermore, it is not clear how an escape clause of the type described above would function internationally, in the absence of an international permit-issuing entity.

However, the U.S. position already includes a provision -- known as "borrowing" -- that operates in a manner similar to an escape clause. Under our borrowing proposal, countries could temporarily exceed their targets and timetables for a given period, and have the overage charged to subsequent periods. An escape clause under domestic law could in theory be shaped in a manner consonant with a borrowing provision under the treaty.

One variant is that a multi-national authority could sell the permits to national governments (who would then retain the responsibility for ~~enforcing~~ independently implementing their national emission levels).