RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Keith O. Fuglie (CN=Keith O. Fuglie/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:23-SEP-1997 14:35:47.00

SUBJECT: Figure 2 for Target and Timetables Paper

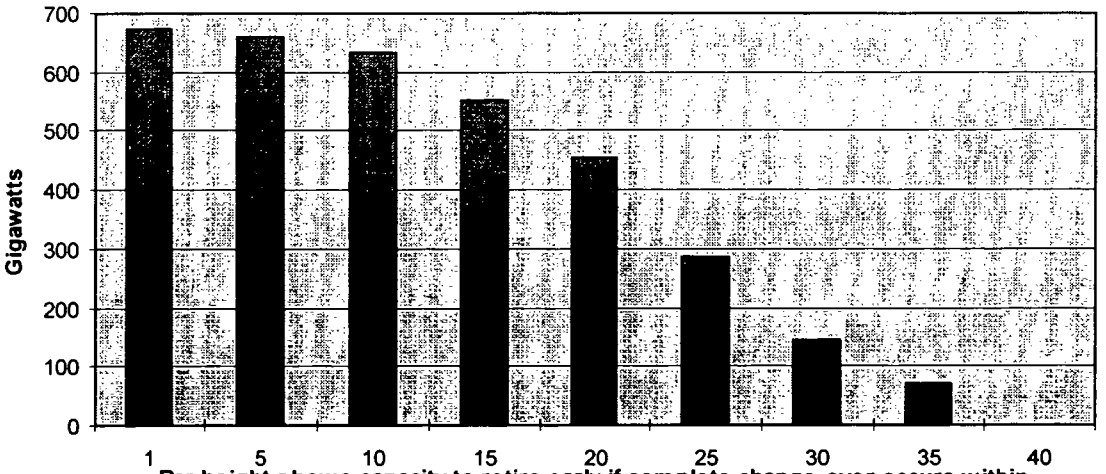
TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
The attached word perfect document has the figure on accelerated
retirement of electric power plant capacity.========== ATTACHMENT 1
==========

ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D16]MAIL45264556X.216 to ASCII,
The following is a HEX DUMP:

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.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:23-SEP-1997 12:09:39.00

SUBJECT: coal mining and Margaret Thatcher

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Mark N. Levine (CN=Mark N. Levine/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Zachary M. Candelario (CN=Zachary M. Candelario/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Daniel K. Chang (CN=Daniel K. Chang/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Our earlier task list indicated that you wished to include some material in the T&T paper on

1) the impact of a carbon tax on the coal industry (lost jobs, etc.), and

2) a comment on the inflationary (or not) nature of the VAT tax imposed by Margaret Thatcher. I understand she undertook a revenue neutral tax reform reducing distortionary income taxes with a VAT, but that it may have led to price increases. wished to cite this in the discussion of revenue recycling.

We have had RA's working on these topics, so have some material available if it is still desirable. Just let me know.

Adele

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: DAVID.WILCOX@MS01.DO.treas.sprint.com@INET@LNGTWY (
DAVID.WILCOX@MS01.DO.treas.sprint.com@INET@LNGTWY [UNKNOWN])

CREATION DATE/TIME:23-SEP-1997 13:19:00.00

SUBJECT: Targets and timetables

TO: Janet L. Yellen@eop (Janet L. Yellen@eop [CEA])
READ:UNKNOWN

TEXT:
Date: 09/23/1997 01:03 pm (Tuesday)
From: David Wilcox
To: EX.MAIL."yellen_j@a1.eop.gov"
Subject: Targets and timetables

Janet: attached are some inserts for your paper. I will also fax over a first installment of additional editorial suggestions.

Hope this is constructive from your point of view. If it is not, would you let me know? Otherwise, I will continue on this afternoon and send you more.

David Wilcox========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D33]MAIL43530556W.216 to ASCII,
The following is a HEX DUMP:

Insert 1: page 3

Model results. Numerous economic/energy models have been used to estimate the impact of a 1990 by 2010 program on energy prices. These models arive at the same conclusion as was generated above using no model whatsoever — that a program to achieve 1990 by 2010 would entail something on the order of a doubling of energy prices. This would correspond to carbon emissions prices of about $100 per ton. The impact on prices ...

Insert 2: page 4

To summarize, your economic advisers consider it unrealistic to predict a substantial increase in the pace of adoption of new emissions-saving technologies unless there is a very large increase in the price of 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. *Morever, other approaches that apparently do not involve large price increases (such as performance standards) will impose even higher costs on the American economy.*

Insert 3: page 5

... 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 not based on procrastinating for the sake of avoiding the problem; rather, it is based on simple principles of hard-headed business efficiency.*

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Daniel K. Chang (CN=Daniel K. Chang/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:23-SEP-1997 16:37:46.00

SUBJECT: Confirmation for T & T Paper

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Daniel K. Chang (CN=Daniel K. Chang/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Keith O. Fuglie (CN=Keith O. Fuglie/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
All charts and tables have been sent in.

Item	Checked off by
Figure 1. Energy Prices and Changes in Energy Use	Randy, Dan
Figure 2. Accelerated Retirement of Electric Power Plant Capacity	Keith
Figure 3. WRE and WG1 Emissions Pathways for 550 ppmv Cap	Joe
Table 1. The Effects of Emissions Pathway on Consumption by OECD	Joe
Table 2. The Effects of International Permit Trading, WRE vs WG1	Joe

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: DAVID.WILCOX@MS01.DO.treas.sprint.com@INET@LNGTWY (
DAVID.WILCOX@MS01.DO.treas.sprint.com@INET@LNGTWY [UNKNOWN])

CREATION DATE/TIME:23-SEP-1997 19:07:03.00

SUBJECT: one more insert for Targets and Timetables

TO: Janet L. Yellen@eop (Janet L. Yellen@eop [CEA])
READ:UNKNOWN

TEXT:
Date: 09/23/1997 06:24 pm (Tuesday)
From: David Wilcox
To: janet
Subject: one more insert for Targets and Timetables

<WP Attachment enclosed>========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D35]MAIL40010756N.216 to ASCII,
The following is a HEX DUMP:

========== END ATTACHMENT 1 ==========

========== ATTACHMENT 2 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
RFC-822-headers:
Received: from conversion.pmdf.eop.gov by PMDF.EOP.GOV (PMDF V5.0-4 #6879)
id <01INZQT6RQWW00HHOA@PMDF.EOP.GOV> for yellen_j@a1.eop.gov; Tue,
23 Sep 1997 18:59:31 -0400 (EDT)
Received: from storm.eop.gov (storm.eop.gov)
by PMDF.EOP.GOV (PMDF V5.0-4 #6879) id <01INZQT1UDW000DYHB@PMDF.EOP.GOV> for
yellen_j@a1.eop.gov; Tue, 23 Sep 1997 18:59:27 -0400 (EDT)
Received: from reston-mx1.telemail.net ([206.229.206.20])
by STORM.EOP.GOV (PMDF V5.1-7 #6879)
with SMTP id <01INZQSWWYP4005I93@STORM.EOP.GOV> for yellen_j@a1.eop.gov; Tue,

23 Sep 1997 18:59:18 -0400 (EDT)
X400-Received: by /PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/; converted
(ia5-text,undefined); Relayed; Tue, 23 Sep 1997 18:30:23 -0400
X400-Received: by /PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/; converted
(ia5-text,undefined); Relayed; Tue, 23 Sep 1997 18:30:23 -0400
X400-Received: by /PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/; converted
(ia5-text,undefined); Relayed; Tue, 23 Sep 1997 18:30:23 -0400
Original-encoded-information-types: ia5-text,undefined
X400-Content-type: P2-1984 (2)
X400-MTS-identifier:
[/PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/;12928132907991/1276094@TREAS]

X400-Originator: DAVID.WILCOX@MS01.DO.treas.sprint.com
X400-Recipients: yellen_j@a1.eop.gov
========== END ATTACHMENT 2 ==========

Insert #4

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 chages expected even if an aggressive policy path is adopted. Under "1990 by 2010" assumptions, average global temperatures are expected to rise by about 0.9 degree Celsius by 2050 and about 2.3 degrees Celsius by 2100. These figures are only about 0.1 and 0.2 degrees, respectively, below the levels that are currently projected under business as usual. Moreover, they differ hardly at all (less than 0.05 degrees Celsius) from the temperatures that would prevail under the more gradual strategy of attaining 1990 emissions levels by 2040.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:24-SEP-1997 14:50:53.00

SUBJECT: estimates of SO2 allowance prices

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/24/97 02:50 PM ----------

Adele C. Morris
09/24/97 10:51:04 AM
Record Type: Record

To: David.wilcox @ treas.sprint.com @ inet
cc: Peter R. Orszag/OPD/EOP, Jeffrey A. Frankel/CEA/EOP, Joseph E. Aldy/CEA/EOP
Subject: estimates of SO2 allowance prices

While I don't have the primary sources for the CEA table of SO2 allowance price estimates, I've found the secondary sources from which the table was constructed.

The ICF/EPA II study estimate of Phase I price appears as 170-200 in the table.

The secondary source for those numbers more precisely quotes the ICP/EPA II study with a Phase I range of marginal cost projections (not allowance price estimates) as $173-197.

The secondary source is "The Behavior of the Allowance Market: Theory and Evidence," by Robert Hahn and Carol May, appearing the in March 1994 issue of The Electricity Journal.

The primary source is "Comparison of the Economic Impacts of the Acid Rain Provisions of the Senate Bill (S.1630) and House Bill (S. 1630 [sic? in Hahn and May])" , prepared for the U.S. EPA, Fairfax, Virginia, July 1990.

If you have any other specific questions about the table or its sources, please let me know.

Adele

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:24-SEP-1997 14:51:19.00

SUBJECT: Re: [Fwd: OP Ed Piece]

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/24/97 02:50 PM ----------

pizer @ rff.org
09/24/97 11:45:00 AM
Record Type: Record

To: Jeffrey A. Frankel
cc:
Subject: Re: [Fwd: OP Ed Piece]

Jeff,

Here's the uncoded text. It's actually updated; for some reason the version I sent you was dated.

Billy

Draft: September 24, 11:30 am

A Better Policy for Climate Change.

Raymond Kopp, Richard Morgenstern and William Pizer

Over the next few months big business and environmental advocates will bombard the American public with high dollar, slick advertisements reflecting the deep disagreement that exists within the US and across the world regarding global warming and what ought to be done -- or not done. The motivator for this media blitz is the upcoming December meeting of the Framework Convention on Climate Change,s Conference of the Parties
in Kyoto, Japan. Environmental advocates hope that one of the products of this meeting will be an agreement by the US to binding targets and timetables for reductions in the emissions of greenhouse gases (GHG)

which may be linked to disastrous changes in the world's climate. On the other hand, many in the business community would like nothing better than to see no agreement at all.

About the only thing the protagonists in this debate can agree upon is that there exists great uncertainty about the two pieces of information that are crucial to the development of a reasonable climate policy: the gains from reducing GHG emissions and the costs of attaining those reductions. While acknowledging our lack of precise knowledge, environmental advocates believe that the risks to our planet posed by climate change are so great that aggressive action must be taken now. By the same token they see the cost of that action as relatively low. In contrast, many in the business community see the climate risks as too uncertain and the costs too high to warrant drastic action. They would prefer a wait-and-see policy or, at most, a limited expenditure on GHG emission reductions.

As a compromise, we propose an alternate policy which attempts to at least partially satisfy both parties. Recent research using a climate policy model developed at Resources for the Future by Pizer suggests that a hybrid system coupling an emissions target with a relief mechanism for unexpectedly high costs goes a long way towards addressing each groups, concerns. In particular, the policy (1) fixes emissions targets that are binding as long as costs remain reasonable and (2) allows the target to rise somewhat if costs are unexpectedly high.

Consider the position of the environmentalist camp. Their policy of choice is a tradable permit system where each permit gives the holder the right to emit a specified amount of GHG into the atmosphere. By limiting the number of permits, one can precisely control GHG emissions and guarantee they remain below the threshold for disastrous climate change. In contrast, while GHG emissions can be set with certainty using a permit system -- and by implication the benefits of GHG control obtained with certainty-- the cost of control is highly uncertain. That is, the estimated cost to society, in terms of higher prices for fuel and reduced productivity, varies greatly under a permit system.

Within the business community, as well as among consumers in general, the ideal climate policy is one that sets upper limits on climate related expenditures. Businesses are concerned with maintaining a stable environment for planning and investment. The risk of unexpectedly high compliance costs under a strict permit system thwarts that stability. For that reason, most businesses would prefer some sort of contingent policy that would keep costs low and predictable.

The hybrid system we propose would establish a fixed number of tradable permits consistent with the attainment of some emissions goal. It would then provide additional permits at a prespecified trigger price. As long as the cost of controlling a ton of GHG emissions remains below the trigger level, the emission target would be attained.

If you are an environmentalist, the hybrid approach guarantees that emissions will not exceed the tradable permit limit as long as the price of the tradable permits (i.e., the marginal cost of GHG control) does

not rise above the trigger price. If you believe that the cost of reducing GHG emissions is low) and these beliefs turn out to be correct -- the permit price will never reach the trigger level and emissions will remain capped.

If you are in the business camp, you are guaranteed that the cost of control per unit of GHG emitted can never exceed the specified trigger price that would be charged for additional permits (and could always be less). Thus, while you may still feel the benefits of GHG control are not commensurate with costs, you can at least make business plans based on the knowledge of a well-specified cost structure.

The hybrid approach proposed here is not entirely new. Aficionados of US air pollution policy will remember that the 1990 Amendments to the Clean Air Act, which established the sulfur permit trading system, also had a provision that enabled industry to buy additional permits at a pre-specified fee. This option was never exercised because the price of the permits (the cost of sulfur control) began low and has fallen over time. Similar mechanisms have been employed to regulate imports and domestic agricultural production. More recently, economists McKibbin and Wilcoxen went on record as favoring a hybrid policy for GHG controls based on their concern about enforcement, monitoring and international trade) important issues, but distinct from our focus on benefit and cost uncertainties.

A final advantage of the hybrid policy is its enhanced credibility relative to a straight permit alternative. The idea that binding targets and timetables will remain inflexible in the face of unexpectedly high costs is unrealistic. By providing an automatic mechanism to relieve cost pressure, the hybrid policy stands a much greater chance of remaining in force and consequently convincing businesses to take action.

The current choice of policies facing both environmental advocates and the business community are too tightly drawn. What we propose is a more flexible policy with the potential to address the substantive concerns of both groups, i.e., uncertainties about both benefits and costs. The hybrid policy does just that. By implementing a tradable permit system where the pool of available permits remains fixed as long as the price remains below a reasonable threshold, the risk of catastrophic climate damages is greatly diminished. By capping the potential expenditure on GHG abatement and allowing additional permits to be purchased if costs turn out to be particularly high, the policy protects against runaway costs for business and consumers, and enables sound business planning.

From the environmentalist perspective this may not be fully satisfactory, but if the cost of GHG control is as low as suggested by both the environmental community and our experience with the sulfur trading program, these concerns are unwarranted. Similarly, the business community may be unhappy with the level of required expenditures -- but at least those expenditures remain capped. While a hybrid policy does not address all the thorny issues of GHG control, we believe it provides a valuable degree of freedom to bring the sides together and it may, indeed, be a valuable approach for the Clinton Administration in Kyoto.

--
Billy Pizer
Resources for the Future
202-328-5039
pizer@rff.org

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
RFC-822-headers:
Received: from conversion.pmdf.eop.gov by PMDF.EOP.GOV (PMDF V5.0-4 #6879)
id <01IO0PWHZK1C00B830@PMDF.EOP.GOV> for "Jeffrey A. Frankel"@oa.eop.gov; Wed,

24 Sep 1997 11:44:44 -0400 (EDT)
Received: from storm.eop.gov (storm.eop.gov)
by PMDF.EOP.GOV (PMDF V5.0-4 #6879) id <01IO0PWEY8UO00GRTT@PMDF.EOP.GOV> for
Jeffrey_A._Frankel@oa.eop.gov; Wed, 24 Sep 1997 11:44:40 -0400 (EDT)
Received: from elmo.rff.org ([204.176.103.4])
by STORM.EOP.GOV (PMDF V5.1-7 #6879)
with ESMTP id <01IO0PVS43S60060NW@STORM.EOP.GOV> for
Jeffrey_A._Frankel@oa.eop.gov; Wed, 24 Sep 1997 11:44:11 -0400 (EDT)
Received: from rff.org ([204.176.103.223])
by elmo.rff.org (Post.Office MTA v3.1 release PO203a ID# 0-34915U200L100S0)
with ESMTP id AAA87 for <Jeffrey_A._Frankel@oa.eop.gov>; Wed,
24 Sep 1997 11:39:56 -0400
Organization: Resources for the Future
X-Mailer: Mozilla 4.02 [en] (WinNT; I)
========== END ATTACHMENT 1 ==========

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:24-SEP-1997 20:14:02.00

SUBJECT: House commerce questions

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Attached are my comments on the answers provided by State. On the whole
they look pretty good. Let's talk in the morning.

Joe

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D50]MAIL475537664.216 to ASCII,
The following is a HEX DUMP:

Comments on Q&As

1. Insert period after "meetings".

3. Change "accumulate" to "account for".

7. Rewrite second sentence to read: "However, the IAT process was unsuccessful in providing a definitive answer on the economic effects to support the Administration's overall decision-making process." The range of results, as specified in the draft, are less of a concern (especially since the range is in part a function of the different trading, AEEI, and revenue recycling assumptions). Of more importance are the flaws raised by the peer reviewers. Note: Janet's testimony reads "the effort to develop a model or set of models that can give us a definitive answer as to the economic impacts of a given climate change policy is futile."

8. Rewrite second sentence to read: "As the work done by the IAT proceeded, the concerns raised by the peer reviewers called into question the benefits of continued IAT work on these economic models, given the many other competing claims on agency resources." Since the Committee already has the peer reviewers comments, there should not be any problem with referring to the peer reviewers.

9. Insert a comma after "situations" and delete "and models" at end of first sentence.

9. The range of the IAT results are incorrect. If the context is all permit prices for all runs reported, the highest permit price is $207 in the year 2020 with Markal Macro under the 1990 -10% case. If the context is the highest 1990 permit price, then the highest permit price is $200 with DRI under the 1990 -10% case. The $145 value only applies to the 1990 in 2010 case.

9. The third sentence should be rewritten to read: "The IAT found that the estimates of the costs to the U.S. economy of a carbon emissions reduction policy depended on several factors, including targets and timetables, the use of market based incentives, technology assumptions, implementation of international emissions permit trading, and revenue recycling." There are probably other factors to list here as well, so let's talk about these.

10. Delete "wide" in first sentence.

11. Rewrite first sentence to read: "The IAT's analysis focused on a standard emissions target widely used in the academic literature for comparing model results."

12. Replace "or" with "and" in first sentence.

15. Rewrite answer based on revised answer 9 (permit price range, inserting factors affecting costs).

17. Do we want to list agencies, or just note that agency involvement will be a function of the characteristics of implementation?
18. Make "it" possessive in last sentence.

25. In the third sentence, is the statement following the dash necessary?

25. Do we want to state that a "full assessment of the costs and benefits of action would be taken prior to committing the United States to any new legal obligation" at the end of the first paragraph?

28. Should our discussion of international emissions trading be couched in more uncertainty, given that under some targets and timetables, we are actually a net seller of permits? Further, any JI might affect the conclusion drawn at the end of this answer.

Questions Unanswered:

19, 20, 23, 26, 30, 33, 34, 35, 36

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Steven N. Braun (CN=Steven N. Braun/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:24-SEP-1997 19:42:54.00

SUBJECT: GDP growth in 1997:Q3

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Charles F. Stone (CN=Charles F. Stone/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Christopher D. Carroll (CN=Christopher D. Carroll/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:

The recent weak trade figures and moderate advance orders have not changed my forecast of third-quarter growth--which remains at 3.4 percent. I expect to see strong investment and consumption partially offset by weak net exports and a decline in inventory investment.

Forecasted Contribution to GDP growth in percentage points:

Consumption	5.0
Business Investment	1.2
Residential Investment	-.2
Inventory Investment	-2.0
Net Exports	-0.8
Federal Government	0.0
S&L Gov't	0.3
Total	3.5

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:24-SEP-1997 13:07:55.00

SUBJECT: international aspects of the Escape Clause proposal

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Janet
Here's another copy of the e-mail I sent you last week.
JF
---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/24/97 01:07 PM ----------

Jeffrey A. Frankel
09/19/97 12:57:51 PM
Record Type: Record

To: Janet L. Yellen/CEA/EOP, Adele C. Morris/CEA/EOP, Randall W. Lutter/CEA/EOP, Joseph E. Aldy/CEA/EOP
cc: Jon D. Haveman/CEA/EOP
Subject: international aspects of the Escape Clause proposal

At the principles meeting and in recent conversations with Rafe Pomerance at State, it has become clear that (1) some basic aspects of the price-triggered Escape Clause proposal have not been widely understood in other agencies (2) there are also parts of it that we ourselves need to think through more clearly. This is particularly true of the international dimension.

I attach a two-page write-up. It enumerates the features of each of the several versions of the proposal that seem to me to be workable. (I make no judgments about their relative merits in the memo, or indeed about the merit of the whole idea, tho I certainly think it has some.) The point here is just addressing workability. To take an extreme example, different countries cannot have escape clauses with different trigger prices in the presence of international trade in permits.

Please let me know what you think. Then let's meet to discuss it among ourselves.

JF

========== ATTACHMENT 1 ==========

ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D13]MAIL43818466O.216 to ASCII,
The following is a HEX DUMP:

ESCAPE CLAUSE: INTERNATIONAL ASPECTS

Multilateral version:

- A supranational authority, presumably the same one that is to monitor countries' emission levels under any sort of agreement, stands ready to sell permits (beyond the basic agreed-to target levels) to whatever *national governments* wish to purchase them at a pre-determined price P.

- In the basic agreement, countries agree to emission targets, but reserve the right to whatever manner of domestic implementation they desire (as in current US position against "common policies and measures").

- Parties would have to agree in advance how to divide up the revenue.

- International trade in permits is superfluous in this case, but would do no harm.

Why couldn't individual firms also buy permits from the supra-national authority? In the multilateral version, it is suggested that only national governments be allowed to buy permits from the supra-national authority. Only they can be held internationally responsible for meeting their countries' aggregate emissions commitment. If permits could be purchased by individual firms, the government might be able to explain away any excedence of its target by claiming that domestic firms might have paid for the extra permits in private transactions.. (This is also an argument why, aside from escape clauses, international trading probably needs to be done via national governments.) It might work for governments to act as the agents for individual firms in making international purchases.

National version:

- National governments stand ready to sell additional permits *to their own citizens* at a predetermined price P.

- In the basic agreement, countries agree to a common plan for domestic implementation: a scheme of tradable permits.

- It does not matter whether the initial allocation of permits in a particular country is done by auction or arbitrary allocation, insofar as the workability of the escape clause is concerned. All that matters is that the initial allocation is the quantity agreed to in the treaty.

- Each government would get to keep the revenue raised.

- International trade in permits is again superfluous in this case. Indeed, it might be necessary to rule it out. Otherwise an irresponsible government (think "transition economies") could flood the market with permits, which it prints at the cost of the paper while receiving real money for them. (Of course such a country would be grossly out of

compliance with the international treaty. But one does not wish to structure a treaty in such a way that a single irresponsible government can result in the breaching of intended emission limits, not just by its own economy, but worldwide.)

Why couldn't countries retain their own domestic implementation schemes? If some countries implemented their emission limits by means other than tradable permits, whether taxes or regulation, then it would be difficult to enforce the principle that the country's total emissions are to be limited by their initial allocation plus those demanded at the marginal cost P. The "marginality" becomes suspect. There would be nothing to stop a country from abolishing its existing energy taxes and regulations (or even adding energy subsidies!) and selling a lot of permits to its citizens because the true marginal cost of emission overruns would be far below P.

Wimp versions

The two versions described above pre-suppose a desire for an honest and workable system. It is possilbe that the multilateral version would be viewed as unacceptable because of aversion to supra-national authorities, and the national version as unacceptable because of aversion to insistence on a common domestic implementation measures. Is there some other way that the U.S. could tell its businesses they will be protected against a price higher than P?

(1) The U.S. could insist that the U.S. government be the only one with the right to sell additional permits at price P. If this were accepted, it would have the desirable efficiency properties, while simultaneously transferring potentially huge amounts of money from other countries to the U.S. It is hard to see why any other country would be willing to consider this.

(2) The U.S. (and other countries if they wished) could assure its citizens that if the price were to rise above P, with scope for buying emission permits internationally already having been exploited, then *the country would borrow, as agreed to internationally, however many permits were necessary* to keep the domestic (and world) price from rising above P. This is perfectly workable institutionally. But it is hard to see why it would be any easier to attain quantity targets in 2015, and simultaneously pay back past borrowings, if the 2010 targets have turned out to be prohibitively expensive to meet.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:24-SEP-1997 14:52:21.00

SUBJECT: EMF results

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
estimates of magnitude of international transfers in the form of US permit purchases.
---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/24/97 02:51 PM ----------

Joseph E. Aldy
09/24/97 12:41:13 PM
Record Type: Record

To: Jeffrey A. Frankel/CEA/EOP
cc:
Subject: EMF results

Jeff,

From Battelle:

WG-1 550: 2035: $181.4 billion for US
2050: $169.8 billion for US

WRE 550: 2035: $32.0 billion for US
2050: $84.6 billion for US

I will check about the model -- I think these might be MiniCAM results, not SGM.

Joe

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 20:32:11.00

SUBJECT: corporate-welfare grandfathering

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Peter reports from some WH meeting: in arguing the failings of grandfathered permits, "corporate welfare" resonated deeply ("a giveaway equal to 1/5 of profits") among Podesta and others. "Difficulty of implementation" did not resonate so deeply.

(I told him that "corporate welfare" was our preferred line of attack as well.)

JF

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Sandra F. Daigle (CN=Sandra F. Daigle/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 14:07:05.00

SUBJECT: Steve's revised letter is attached

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D63]MAIL489025762.216 to ASCII,
The following is a HEX DUMP:

September 24, 1997

Dear Congressman Frank:

Thank you for your letter of September 2, 1997 on the subject of the NAIRU. I appreciate your thoughtful inquiries about the CEA's use of the NAIRU as a forecasting and analytical tool.

I have attempted to answer your specific questions in more detail below:

1) Does CEA use the concept of a NAIRU in its economic forecasting; and,
2) Does CEA use the concept of a NAIRU in any policy recommendations it makes?

Yes, the CEA uses the unemployment rate--together with the NAIRU (the rate of unemployment consistent with a stable inflation rate)--in its economic forecasting. Inflationary pressure tends to increase when unemployment is below the NAIRU and decreases when unemployment is above the NAIRU. A number of explanations for this phenomenon have been proposed, but one plausible story is that, when unemployment is low, firms have to offer higher wages to attract, retain, and motivate new workers than they do when unemployment is high. Nominal wage growth is passed on to purchasers in the form of faster growth of prices.

Some measure of economic slack is necessary to determine whether a future economy has exceeded its capacity--a circumstance that would eventually be evident in rising rates of inflation. Although the unemployment rate is not the only measure of slack (other possibilities are the capacity utilization rate, the insured unemployment rate, and the help-wanted index), it has advantages over its rivals insofar as it covers the entire economy, is produced by a reliable survey on a timely basis, and is easily integrated into standard economic models.

Although it is useful for forecasting purposes, the NAIRU is not used by the CEA for any policy recommendations.

3) If CEA does apply the concept of a NAIRU, at what level does CEA believe it currently exists?

Because of a host of measurement issues, any estimate of economic parameter is imprecise. As a result, it is technically more accurate to cite a range for the NAIRU rather than a point estimate. At present, our best estimate of this range if 4.9 to 6.1 percent.

4) Does CEA believe that there has been a reduction in this level in recent years? and,
5) If CEA does believe that there is a NAIRU and that the level has dropped recently, to what does CEA attribute that drop?

We believe that there has been a reduction in the level of the NAIRU in recent years. The three principal factors that have lowered the NAIRU over the past decade are: the changing demographics of the labor force; the delayed alignment of workers' real wage expectations with productivity growth; and increased competition in labor and product markets.

1. Demographics. Young people have the highest unemployment rates because they spend more time searching for jobs than older workers, and having found a job are more likely to quit. The share of young people (16-24) in the labor force has been falling for the past 20 years and is now the lowest since 1956. For some time, this demographic trend has had the effect of lowering the NAIRU.

2. The delayed alignment of workers' real wage expectations with productivity growth. The second factor that has probably driven the NAIRU's decline involves the relationship between the changes in productivity growth and workers' demands for real wage increases. Workers' demands for increased real wages may depend on past increases, possibly because people get accustomed to a certain rate of increase in their standard of living. Hence, changes in the rate of productivity growth can have temporary effects on the NAIRU; specifically, after a fall in the productivity growth rate workers may initially demand wage increases that are faster than productivity growth can justify. This puts upward pressure on the inflation rate and implies that a higher level of unemployment is required in order to have a stable rate of inflation. This increase in the NAIRU is likely to be only temporary, either because the productivity slowdown is temporary, or because workers eventually moderate their demands in response to permanently lower productivity growth. Either way, the NAIRU eventually returns to the level that prevailed before the slowdown in productivity.

This "wage aspiration" effect raised the NAIRU following the productivity slowdown of the 1970s, and left the NAIRU at an elevated level for some time. However, by 1990 workers had time to adjust their aspirations for real wage growth until they moved in line with slower average productivity growth; this has helped the NAIRU return to its earlier, lower rate. Our best estimate of this effect shows it lowering the NAIRU significantly since the early 1980s.

Although it is not evident in the official productivity data, some unofficial data hint at a rise in productivity growth over the past 4 years. If true, the productivity pickup could account for some of the recent decline in the NAIRU inasmuch as real wage demands may have been slow to catch up to the acceleration of productivity. (This is a response that is opposite but similar to that which occurred after 1973.)

3. Increased competition in labor and product markets. Many of the likely suspects for the remaining decline in the NAIRU fall under the heading of increased competition in product and labor markets--partly as the consequence of opening markets at home and abroad through regulatory reform and trade agreements--might have played a part in the NAIRU's decline. Although imports remain a small fraction--about 13 percent--of GDP, the fact that much of the U.S. manufacturing sector faces potential import competition could provide some wage restraint. Over the past two years, prices of nonoil imports have been falling at a 5 percent annual rate. Changes in labor market institutions and practices may also have acted to reduce inflation, whatever their other impacts might have been. Quantifying these general notions of increased competition and the institutional structure

of the labor market is extremely difficult; however, they can plausibly explain much of the decline in the NAIRU that is not accounted for by the factors discussed above.

I hope this information has been useful. Please let me know if you have any other questions on this important issue.

Sincerely,

Janet L. Yellen

The Honorable Barney Frank
House of Representatives
Room 2210 Rayburn House Office Building
Washington, D.C. 20515-2104

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 21:01:55.00

SUBJECT: T&T

TO: Daniel K. Chang (CN=Daniel K. Chang/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Zachary M. Candelario (CN=Zachary M. Candelario/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
I have made some more revisions in the attached file.
High on the priorities for this paper is checking all the described
Manne-Richels results against the nice new write-up (a paper dated 9/21)
that Richels sent us.
(1) Does everybody have that paper?
(2) Since Joe is away Friday, can Adele or Zack or Dan do that
fact-checking?
JF========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D84]MAIL444767760.216 to ASCII,
The following is a HEX DUMP:

Predecisional draft. Preliminary. Close hold. Do not distribute. 8/29; rev. 9/16/97,am19,jf25

Targets and Timetables : Executive Summary

How ambitious should we be in seeking to ameliorate global climate change? Is it more advisable to reduce emissions of greenhouse gases (GHG) early and rapidly, or more gradually? This paper examines policy options for GHG emissions targets and timetables and reviews the academic literature and other relevant information and analysis to compare them. We find that a given environmental goal, expressed in terms of the level at which atmospheric GHG concentrations are induced to level off, can be attained at far lower economic costs if emission reductions are phased in gradually rather than suddenly. More specifically, we conclude that a moderate path such as "eliminate emissions growth by 2010-2020, and return emissions to 1990 levels by 2040," seems to be preferable on economic grounds to the more aggressive alternative "return emissions to 1990 levels by 2010."

1. Tradeoffs between front-loading and back-loading emissions reductions

It is easy to state the basic forces at work in the trade-off between front-loaded (reducing emissions earlier) and back-loaded emissions reductions (allowing emissions reductions over longer periods).

Four factors work in favor of back-loading:

- allowing time for the capital stock to turn over. By way of stylized illustration, scrapping all coal-fired power plants by 2010 would mean writing off 88% of the capital stock in this sector; waiting until 2020 would necessitate scrapping only 49% of the plants before the end of their normal useful life.
- the time-value of money. Resources not spent on emission reductions early on can be invested at a positive return, so as to purchase more emission reductions later.
- allowing for uncertainty to be resolved.
- giving more lead time to develop and implement new technologies.

The most important argument in favor of front-loading:

- political credibility. An announcement by the world's governments that they are committing to a serious agreement -- but that stringent policy measures will not be taken until 50 years or more into the future -- will not be credible. Only early concrete measures will send the signal necessary to move patterns of research, investment, and consumption onto the new path.

2. The costs of "1990 levels by 2010"

The costs of reducing emissions to 1990 levels by 2010, as the cost of any path, depend heavily on the international regime and domestic implementation. "We can do it smart or we can do it dumb." But any effective program will have to raise the cost of GHG emissions, particularly the cost of using fossil fuels that put carbon dioxide into the air. A broad range of models place the carbon permit price required to achieve this target in the range of $70 - $200 per ton. This surcharge translates into an increase in the price of gasoline between 18 and 50 cents per gallon and an increase in the price of coal between 250 and 500 percent. Averaging over fuels, these price increases are nine times greater than the BTU tax that was proposed in 1993, and as great as the oil shocks of the 1970s. (The necessary increase in price could be cut if we are able to pay Russia, developing countries, or others to reduce emissions in our place. But the remaining price increase would nevertheless be substantial.)

These increases in the price of energy might or might not have the substantial negative effects on output of the 1970s oil shocks. Whether they do depends on many things, such as whether the policy is implemented efficiently (e.g., by auctioning emissions permits or a carbon tax) or inefficiently (e.g., by command-and-control style regulation), and whether any revenues that may be generated are redistributed by means of tax cuts that lower the cost of capital to firms. In any case, the policy will have substantial negative effects on consumption, in order to free up resources for investment in new low-carbon plant and equipment.

3. The effects of a moderate path, peaking in 2010-2020

One possible more moderate path is specified as follows:

(i) begin to reduce the rate of growth of emissions in the near-term (2000-2010),

(ii) eliminate emissions growth in the medium term (so that emissions at the end of the decade 2010-2020 were the same as at the beginning), and

(iii) return emissions to the 1990 level in the longer term (e.g., 2040).

The overall cost of this approach is much less than that of the more aggressive timetable, 1990 by 2010. Estimates suggest that the price of carbon would be between $5/ton and $12/ton in 2010. (It would have to continue to rise thereafter, as is also true under the first approach.) Gas prices would rise by an estimated 2 to 3 cents in 2010, and coal prices by 25%-35%. Effects on the economy are scaled down accordingly. Estimates of the loss in consumption are roughly 1/10-1/3 the size of the more aggressive approach.

4. Environmental effects of alternative dates for stabilizing emissions

What is the environmental loss that the planet must bear in exchange for economic gain from slowing emissions cuts? The answer depends entirely on emissions during the remainder of the 21st century (and thereafter). Differences in emissions in the early years of the century have virtually no effect on the cumulative concentration levels. But "even the longest journey begins with a single step." Differences in that first step are important to the extent that they begin the journey down different pathways.

Let us consider the environmental effects of four different emissions paths of increasing ambition in controlling GHG emissions. The first path represents emissions growth in the absence of any policy intervention, a.k.a. business as usual (BAU). The second is the moderate path described above, which peaks in 2010, and the third is achieving 1990 by 2010. The final path is even more aggressive and achieves emissions 10% below 1990 levels by 2010. We assume that each path eventually stabilizes annual emissions at the 1990 level (or 10% below, in the last case) through the remainder of the century. Note that this assumption, while it implies a growing gap with the BAU growth path over time, does not cut emissions enough to prevent concentrations in the atmosphere from increasing.

As one can see from the table below, under BAU, estimated temperatures rise 1.06 and 2.36 degrees centigrade in 2050 and 2100, respectively. The moderate path mitigates the warming by 0.06 degrees in 2050 and 0.19 in 2100. The 1990 by 2010 path reduces the warming relative to BAU by an estimated 0.08 and 0.21 degrees, in the respective years, a very small additional effect relative to the moderate path. The most aggressive path has virtually the same small effect. The three policy options postpone by 6 to 9 years the date at which total atmospheric CO2 concentrations reach a level that is double the pre-industrial level (about 550 ppmv).

Environmental effect (degrees centigrade)	Path of emissions of GHG			
	BAU	Moderate path	1990 levels by 2010	10% below 1990 levels by 2010
Temperature increase in 2050, **total**	1.06	.99	.98	.97
Temperature increase in 2100, **total**	2.36	2.17	2.15	2.11

Temperature increase in 2050, **relative to BAU**	0	-.07	-.08	-.09
Temperature increase in 2100, **relative to BAU**	0	-.19	-.21	-.25
Additional years until CO2 doubling, **relative to BAU**	0	6	7	9

5. A big difference in cost for two paths to the same ultimate goal

Perhaps the strongest case against an aggressive path like "1990 in 2010" is that *the same ultimate goal in terms of concentrations* can be achieved far more cheaply by imposing aggressive cuts in emissions later in the 21st century rather than earlier. Recall that estimated concentrations and temperatures continue to rise in subsequent centuries under any of the paths outlined above. In order to put a bound on the eventual climate disruption, one has to put a bound on concentrations, which in turn requires that we reduce emissions below 1990 levels. Modelers can compute the path that minimizes the total economic costs of attaining a given ultimate concentration target, and we can compare it to other paths leading to the same target.

The most important implication of the least cost mitigation path is that it costs the U.S. $0.124 trillion in terms of lost consumption (present discounted value), as compared to $0.303 trillion under the "1990 in 2010" path. Thus *the least cost mitigation path generates savings of 60 percent from the 1990 in 2010 path.* Assuming that environmental effects depend on concentrations, there is little or no environmental cost to be weighed against the large economic benefits of going more slowly.

The estimated least-cost path has several other interesting implications. It indicates that emissions rise gradually in the early years and that Annex I countries' emissions peak in the decade 2020-2030 at about 29 percent above 1990 levels. Annex I emissions do not return to their 1990 levels until after 2050. This least cost mitigation path generates quite low values for carbon emissions rights in the early years. The permit price is only $2/ton in 2010, and slowly rises thereafter. Only in the latter part of the century does it rise significantly, to $156/ton in 2100.

The experiment assumes that developing countries are successfully brought in to the

agreement, with their participation phased in between 2030 and 2050. Emissions from developing countries peak in 2050. Without the participation of the developing countries, attaining the target of 550 ppmv concentrations is virtually impossible, since they are such a rapidly growing share of world emissions.

It is important to keep in mind that all these cost estimates are "best case" scenarios, in the sense that they assume efficient market implementation, international trading, and full international participation and enforcement. Actual costs could be much higher if less efficient command-and-control mechanisms of implementation are used, if there is not effective international trading, or if some countries do not accede to or abide by a treaty.

6. Political credibility

A path under which emissions peak in the decade 2020-2030 is far more conservative than the paths that have been discussed in international negotiations. The strong argument for moving the timetable forward is the one mentioned above: political credibility. The year 2020 is more than two decades in the future. A path under which emissions peak in the decade 2010-2020 represents early commitment to a tangible target ("eliminate emissions growth"), while estimates suggest that it is almost as beneficial as the least-cost path. The political credibility of the path could be further boosted by commitments at earlier dates such as 2000-2010 ("reduce emissions growth"). Credibility would be particularly enhanced by a specific proposal to raise the price of energy, even if by only a small amount, if domestic political opposition was not overwhelming.

More aggressive paths are likely to arouse greater political opposition, in correspondence to their greater economic cost. Where domestic opposition is sufficiently great to kill a proposal politically, the set-back will be to international political credibility -- and to environmental progress. The last section of the paper, however, discusses one possible option that might have the effect of helping to limit the economic cost and corresponding domestic opposition, for any given target/timetable: an escape clause triggered by the price of carbon emissions.

Predecisional draft. Very preliminary. Close hold. Do not distribute

Targets and Timetables

A U.S proposal for "targets and timetables" for reducing countries' emissions of greenhouse gases (GHG) must be made soon. The U.N. Framework Convention on Climate Change has called for economically cost-effective remedies to the problem [cite? From JY]. Tradeoffs have to be made -- both with respect to the ultimate target and with respect to the timetable under which it is achieved. The subject of this paper is how to do them. (The paper does not directly focus on two other key sets of policy decisions -- domestic implementation, and proposals for developing country participation and other sorts of "when-and-where flexibility".)

It is futile to search for a single comprehensive econometric model within which these questions can be appropriately raised and definitively answered. Even within a given model, answers depend critically on the precise nature of the question asked (e.g., the extent of global participation and international trading, whether and how any revenue is recycled, what is assumed about technological progress, etc.) Furthermore, each model has strengths and weaknesses; each has questions to which it is better or worse suited to answer. Some, for example, model the energy sector in detail. Some allow for the fact that a coal-fired power plant cannot costlessly be converted to one that runs on natural gas. Some have enough tax policy detail to distinguish alternative ways of redistributing tax revenues. Some are capable of showing short-term macroeconomic disequilibria. Some include a long-term "carbon cycle" model that can keep track of the accumulation of GHG concentrations in the atmosphere and their climatological effects. Some break down the rest of the world into regions and so can model international trade. No one model does everything.

The existence of modeling difficulties does not mean that we can abandon rigorous economic analysis. Rather, we must employ a broad set of economic tools to analyze the policy options. The tools employed in this paper include results from models of the energy sector and economy over the next 25 years, including but not limited to the models that were used by the Interagency Analytical Team (IAT) earlier in this year. The survey also includes models that are designed to operate on the longer time frame that is relevant for thinking about climatological effects. Other tools include simple relevant statistics, "meta-analyses" of existing models, historical and sectoral examples, and basic economic reasoning. Drawing on this broad array of analytical tools allows an intelligent evaluation of the policy alternatives.

1. Why do economists estimate high costs to early reductions in emissions?

The large economic impact of aggressive action

The measures necessary to implement serious reductions in GHG emissions would inevitably have very major effects on the U.S. economy. One path that has been widely discussed in the U.S. is to return to 1990 levels in 2010. (Still more aggressive paths seek to cut emissions 10 percent or more below 1990 levels by 2010. Intermediate paths are to return to 1990 levels by 2020, or to 10 percent above 1990 levels by 2010.) Estimates suggest that to reduce 2010 emissions to the level of 1990, it would be necessary to increase the price of energy on the order of $100 per ton of carbon.

This is a rough midpoint, around which there is a great range of uncertainty. The range of estimates in the IAT exercise was $80-$140, for the case without international trading. Some agencies believe that the necessary increase in price would be less than this, others that it would be more. It is anticipated that prices would have to continue to increase after 2010, even if emissions were not brought down any further, because of the widening gap vis-a-vis the business-as-usual case. (Energy modelers often make the assumption that, once the price of carbon goes high enough, some sort of unidentified "back-stop technology" will eventually be developed, thereby putting a limit on how high the price ultimately goes. But there is no way of knowing when or at what price such technology would come in.)

These estimates are representative of the broad economic literature. In a similar exercise, the Energy Modeling Forum, based in Stanford, has assessed a set of targets and timetables with 10 models (EMF-12, 1994; Gaskins and Weyant, 1993; Weyant, 1994; Richels, Edmonds, Gruenspecht, and Wigley, 1996). These models, employing the same benchmark assumptions, assessed the economic effects of achieving carbon emissions stabilization relative to 1990 in the year 2000 (with implementation beginning in 1990). The modeling results all clearly indicate that the tighter the emissions constraint, the higher the price of carbon.

[insert chart on average carbon taxes required to achieve C emission reductions in the U.S., 2000-2020]

The rough estimate of $100/ton in 2010 represents an increase in the price of oil of $11/barrel (52%), an increase in the price of gasoline of 26 cents/gallon, and an increase in the price of coal of 273%. One standard of comparison is the BTU tax that the Administration proposed in 1993. The increase contemplated here is 9 times larger. (This is for a weighted average of fuels. The multiple for coal is greater than this, and for oil is less.)

These large price changes signal major changes in the allocation of resources across activities and sectors. Need they require a reduction in the rate of growth of aggregate income and output? This depends, in particular, on two things. First, adjustment costs can impose a negative effect on GDP and employment, especially in the short term. Model estimates of GDP losses from "1990 by 2010" reached __ in the IAT exercise under some pessimistic assumptions,

and are higher in some other estimates. ___. The EMF-12 exercise also demonstrated that higher permit prices associated with tighter carbon emissions constraints resulted in larger GDP losses in 2010.

[insert chart on GDP losses from EMF-12]

Second, if measures to raise the price of energy result in the generation of revenues for the government, and they are used to reduce the cost of capital to firms (e.g., by means of an investment tax credit), despite the regressive implications for the distribution of income, then negative effects on economic growth can in the long run be moderated, eliminated, or possibly even reversed.[1] The meta-analysis of 162 simulations derived from 16 leading models by Repetto and Austin (1997, p.13) concludes that the negative effect on national income from stabilization in 2020 can be offset or reversed *if*:
(i) tax revenues are recycled so as to reduce the cost of capital to corporations,
(ii) developing countries participate in the agreement, *and*
(iii) optimistic assumptions are made regarding the availability of non-carbon backstop technologies, efficient economic responses, and increased energy and product substitution. If any of these optimistic assumptions fail, the GDP effect turns negative.

However, the best single measure of aggregate economic costs is the appropriate summation over time -- the present discounted value -- of foregone consumption. Even in a case so optimistic that there might be no effect on output, early action to address climate change would require a diversion of resources from consumption to investment. Thus the present discounted value of consumption is likely to fall. By way of analogy, defense build-ups have appreciable economic costs, in terms of foregone consumption, even though there is often little or no negative effect on aggregate GDP.

Analogy with the oil shocks of the 1970s

[1] E.g, Jorgenson (1996).

A standard of comparison for judging the magnitude of the price increases entailed in climate change policy is the oil shocks of the 1970s. The energy price increase now contemplated [an estimated 88 percent] for stabilization by 2010 is on the same order of magnitude as either the 1973-74 or 1979-80 oil price increases. Again, this is for a weighted average of primary fuels. Fossil fuel prices net of inflation doubled between 1972 and 1975, and doubled again by 1981. Gasoline prices rose by 30 percent between 1972 and 1974 and by nearly another 50 percent from 1974 to 1981. Coal, as a substitute for oil, also experienced a price increase in the earlier episode, but by much less.

One can check independently how the price increase necessary in the present context compares to those of the oil shock decade . Carbon emissions in the year 2000 will be about 15% percent above 1990 levels (EIA ___). Between 1973 and 1984, U.S. energy use departed from its usual growth trend, and was essentially unchanged in absolute terms. U.S. emissions fell by only 6.2%. This comparison suggests that to return emissions to 1990 levels between 2000 and 2010, a decline of 15%, would require much greater increases in energy prices than took place over the decade of the oil shocks.

Those price increases, which are designated "supply shocks," are widely believed to have led to high levels of inflation that were eventually reversed only by means of high interest rates and very large losses in output over time. More specifically, they are believed to have led directly to the recessions of 1974 and 1980. (Indeed, the contraction in output, as much as the fall in the energy/output ratio, was a prime force reducing energy use below its long-run trend.) Some economists also believe that the oil shocks may have played a role in the abrupt slowdown in the long-term trend of productivity growth evidenced in the U.S. and other industrialized countries after 1973; but that is much less certain.

The large models that have been used to examine climate change policy tend to exclude supply-shock effects. [Only the DRI model is a macro model capable of addressing these effects; and it shows a loss of only 150,000 to 400,000 jobs in 2010.] The idea is that a path of gradual increases in energy prices will be fully built into the expectations of firms and workers, because of clear commitments to future policies. Thus they will be able to plan ahead and avoid serious microeconomic dislocation and macroeconomic disturbance. Furthermore, the 70s oil shocks entailed large transfers from the U.S. and other oil-importing countries to OPEC, thus depressing real income and spending in the former; a self-imposed energy price increase to address global climate change need not entail such a transfer of purchasing power. Still, if it is contemplated to introduce large increases in energy prices over a period as short as a single decade, it is worth remembering the experience of 1972-81.

The role of turnover of the capital stock

Why do economic models consistently find that the cost of major reductions in emissions is

much higher if they are implemented by 2010 than if they are stretched out for another decade or more? There are several arguments against early reductions and in favor of waiting. (There are also a number of reasons for wanting to go fast, listed in bullet form in the Section on cost-benefit analysis below.) They include:
(1) the time-value of money (resources not spent on emission reductions early on can be invested at a positive return, so as to purchase more emission reductions later[2]),
(2) allowing for uncertainty to be resolved, and
(3) giving more lead time to develop and implement new technologies. But the most important reason for waiting is :
(4) to allow time for the capital stock to turn over.

The basic point is that it would be very expensive to scrap the entire capital stock, to replace it with more carbon-free plant and equipment, while it is still in the prime of its useful life. But 20 to 40 years out into the future, much of our existing plant and equipment will be ready for replacement anyway, whether because the plant and equipment have depreciated gradually or because they have more suddenly come to the end of their useful life.

[FIGURE 1 GOES HERE]

The effect of the turnover of the capital stock is built into some of the models used to address climate change [e.g., Markal Macro; though not into most "bottom-up" engineering studies, like the Department of Energy's Five-Labs study]. But it may be useful to look at a simple illustration of the point, for the case of the capital stock in power generation.

Figure 1 shows the effects of an accelerated replacement schedule for all of the 7.900 electric power plants built during the last 40 years. [One could skip directly to coal-fired plants (next paragraph), to save space.] Imagine, to take an extreme case, that all power plants had to be shut down within ten years (by 2007), and replaced with less-polluting technology. This would imply replacing 6,330 plants before the end of their normal lifespan, or 80 per cent of the total. Now imagine a policy that required replacement of all power plants in 20 years. This would constitute an accelerated replacement of 4,600 plants, or 58 per cent of the total. If one could wait 30 years, the complete replacement would mean an accelerated replacement of 2,000 plants, 26 per cent of the total. If one waited forty years, under the stylized assumption of a 40-year life there would be no additional cost to replacing them. [We have truncated the distribution at 40 years, the average lifespan of existing electric power plants. There are other

[2] Meanwhile, a higher fraction of carbon emissions will have been naturally removed from the atmosphere by a fixed date, e.g., into the oceans, the earlier those emissions occur. (Manne and Richels (1995, 1997).

plants that are still in use 50, 60, or even 90 years after they were built. But their numbers are small, and by the end of 40 years the cost of shutting them down would in any case be much-reduced, particularly as technology will have advanced in the meantime.]

Figure 2a does the same exercise for the set of power plants that are coal-fired. This is the class of generators that produce the most carbon and that would thus have to be replaced even under a moderate plan to address climate change. If a complete change-over of coal plants were to be accomplished in 10 years, 799 of the 1,122 coal-fired plants (71 per cent) would have to be replaced before the end of their expected lifespan. If replacement occurs over 20 years, 488 plants would be affected, or 43 percent of the total. If one could wait 30 years, 227 plants would be closed prematurely, or 20 per cent of the total.

Perhaps a comparison between 2010 and 2020 would be most relevant, as these two years figure prominently in the targets-and-timetables debate. In our stylized hypothetical experiment, imagine that all power plants had to be shut down by 2010 (i.e., within 13 years). This would imply replacing 88 percent of the plants before the end of their normal lifespan. Now imagine that all power plants had to be replaced by 2020 (23 years). This would constitute an accelerated replacement of only half the plants.

[FIGURES 2a AND 2b GO HERE]

Figure 2b repeats the exercise on the basis of coal plant *capacity*. Since newer plants tend to have larger capacity, the effects of a rapid replacement schedule are magnified. Closing all plants within 10 years implies that 289 million KW of capacity would be prematurely shut down, or 90 per cent of the total. If one could wait 20 years, 235 million KW of capacity would be affected, or 73 per cent. For 30 years, the capacity that would have to be replaced falls to 116 million KW, or 36 per cent of the total.

This exercise is not intended to be an estimate of the costs of different time-tables, even within this one sector. Rather, the point has been to illustrate concretely the importance of allowing time for the capital stock to turn over, and to illustrate it in a transparent framework that is independent of modeling assumptions over which analysts might differ.

Evaluation of alternative paths

One can pose the question regarding effects of alternative paths in three ways. (I) How do the economic and environmental effects of "1990 by 2010" compare to those of more moderate paths, e.g., in which that level is attained at some later date? (ii) What are the economic effects of alternative paths toward the same ultimate environmental objective, e.g., eventual stabilization of concentrations at twice pre-industrial levels? (iii) What is the optimal unconstrained path to balance estimates of economic costs and environmental benefits? The remainder of the paper

considers each question, though in reverse order.
[or would it be better to do it in order
(i) (ii) (iii): 1990-LEVEL RESULTS, THEN 550PPM CONSTRAINT, THEN IA MODELS?]

2. Cost-benefit analysis in the Integrated Assessment models

It is difficult to put economic costs and climate benefits into the same unified analytical framework. This is in part because the effects are so uncertain, especially with regard to climate, and in part because the climate effects take place on a very long time scale. So-called Integrated Assessment models attempt to put everything into one framework. They attempt to quantify the benefits of averted climate change in the distant future, as well as the economic costs of programs to address emissions, and to compare the two.

Integrated Assessment models began with Nordhaus (1989, 1994). By now many of these models exist. An Appendix I to this paper elaborates, and the literature is surveyed by Manne (1996). Those models that can be used for cost-benefit analysis tend to give a similar result: a plan that optimally balances costs and benefits calls for relatively small actions at the beginning, with the result that GHG emissions continue to rise, although at a reduced pace, for at least a century. Concentrations reach ___ ppmv by 21__.

In the simplest case, damage from warming is assumed to rise linearly with temperature. But it is plausible that the costs in fact begin to rise more sharply, e.g., when concentrations and temperature go above a threshold level. Findings by Peck-Tiesberg (1992), using the CETA model and the case of a non-linear damage function (allowing the damage to rise increasingly sharply with the temperature), call for emissions peaking in 2080-2090.

Some of the authors have characterized in a striking way the gap between the optimal paths that their models produce and the frequently heard proposal to return emissions to 1990 levels by 2010: In their models, the economic costs of such a strong early response are so great that, if that were the only alternative, we would be better off doing nothing at all [Jorgenson testimony? Can't find it in there. It's ____ of Stanford?]. In other words, the economic costs of "1990 levels by 2010" outweigh the benefits.

Arguments for earlier action

This conclusion, and the methodology that produced it, have been criticized on a number of grounds.

- Some claim that it gives insufficient weight to the (small, but nonetheless alarming) probability of a discontinuously-large and essentially irreversible catastrophe, such as the melting of the West Antarctic ice sheet [which might raise ocean levels by 5 to 6 meters], a runaway "positive-feedback" greenhouse effect (e.g., from methane release), or structural

changes in ocean currents such as the Gulf Stream. [references: Cline (1992, p.34-35, Revelle, 1983, p.442, IPCC 1996a; Schelling AER 1995?]

- Some claim that it gives insufficient weight to the welfare of future generations that will bear the costs of climate change (that is, the discount rate is too high). [references: Cline (1992) and Howarth (1996).]
- Some claim that it neglects basic uncertainty about all parameters -- the economic effects, the climate effects, and the discount rate necessary to compare the two. [reference: Pizer (1996)]
- Some claim that it omits a basic point about political credibility: an announcement by the world's governments that they are committing to a serious agreement -- but that stringent policy measures will not be taken until 50 years or more into the future -- will not be credible, and understandably so (Austin, 1997). The arguments for postponing sharp cuts in emissions ten years only work if people use the intervening period to begin adjusting. If they are skeptical of the need to adjust, then ten years later nothing will have been accomplished, and the economy at that point will face the same high costs to early reductions as before. Only early concrete measures will send the signal necessary to move people's patterns of research, investment, and consumption onto the new path. [3]

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3. Estimates of least-cost paths to stabilize concentration levels

For the reasons just enumerated, much of the debate about GHG stabilization takes as given that simply allowing emissions to continue to grow for a long period, even at a reduced rate, as contemplated by the authors referenced in the preceding section, puts the biosphere at too much risk and is not credible politically. An alternative strategy is to reason that the probability of catastrophe may rise to unacceptable levels unless GHG concentrations are capped at some particular level. Such an approach has the disadvantage that the choice of any specific concentration cap is arbitrary, and is inconsistent with the spirit of cost-benefit analysis. But it has the advantage of being analytically tractable, and offers a meaningful focal point for negotiation.

Stabilization of concentrations at 550 ppmv

[3] An opposing credibility point is also made: A proposed agreement that demonstrably imposes much higher costs than an alternative more measured approach, and thereby invites prohibitively great domestic political opposition, will also suffer from credibility problems both here and abroad.

We will consider the question of the optimal path subject to the constraint that concentrations be stabilized at 550 ppmv (approximately double the pre-industrial level of 275 ppmv[4]). One might ask why we need accept a level of concentrations, and corresponding probability of catastrophe, as high as this. Indeed, why accept <u>any</u> probability of catastrophe? It is important to recognize that it is already too late to keep this probability at zero (even if one were to accept that it would have been worth the cost to do so, had we known at the beginning of the Industrial Revolution what we know now). Atmospheric concentrations are already at 365 ppmv, and it is impossible to prevent them rising further in the short run; one would have to reduce emissions almost to zero to do so.

[It would be useful to quantify the implicit gap between this strategy and the strategies resulting from the unconstrained optimization by the Integrated Assessment models. The difference represents the role being accorded to the four bullet points above. In addition, some sensitivity analysis with respect to the level of the concentration constraint would be desirable.]

Results for a less aggressive path

The Energy Modeling Forum evaluated two forms of emissions paths to achieve specified carbon dioxide concentrations (EMF-14). A suite of six models, employing the same set of benchmark assumptions, assessed an aggressive path, the IPCC Working Group I path (WGI), and a more moderate path, based on work by Wigley, Richels, and Edmonds (WRE). Both sets of paths can achieve concentration stabilization at 550 ppmv or other targets levels. WRE argue that a less aggressive path can achieve the same stabilization goal at much lower economic costs.

The aggressive WGI path entails Annex I fossil fuel emissions peaking in 1990, and falling 24 percent worldwide below 1990 levels by 2010.[5] (Of course, it is too late for this scenario to be realized. Seven years have passed during which emissions manifestly have not in fact begun to fall in the overwhelming majority of OECD countries. Below, we will also consider other alternative proposals that, while sufficiently ambitious as to be expensive to achieve, at least have the virtue of not having been ruled out by history.)

[4] The concentration figure refers only to CO2. Emission of other greenhouse gases will raise the carbon-equivalent, or warming potential, above this level.

[5] *Worldwide* emissions rise 8 percent by 2010 [from 5.885 to 6.351]. These numbers come from 8/28 personal communication with Richels. (Earlier information had worldwide emissions rising 13.64% by 2010 under the IPCC path [to 7.798 PgC]. Evidently the former statistic refers only to fossil fuel emissions and the latter to all carbon emissions.)

For the WRE path, emissions from OECD countries as well as from other Annex I countries (Russia and most of Eastern Europe) peak in the decade 2010-2020. (Annex I emissions do not return to their 1990 levels until sometime early in the decade 2030-2040. The price of crude oil peaks in 2040.) The peak in worldwide emissions lags two decades behind the peak in Annex I emissions because the developing countries' emissions do not peak until 2050. Both paths stabilize global carbon dioxide concentrations under the same timeframe.

[insert chart with WRE and WGI emissions paths]

To estimate the economic effects of these pathways, the modelers must employ a burden-sharing rule. Carbon dioxide concentrations cannot be stabilized without developing country participation. Consistent with the U.S. negotiating position, these model runs assume that developing countries agree to binding targets in the future. The modelers assumed that developing countries will continue to increase their emissions along the business as usual path until 2030. During this period, Annex I will undertake emissions reductions. In 2030, developing countries will begin to reduce their emissions growth. By 2050, emissions rights will be allocated to countries on a per capita basis.[6]

As noted earlier, the best single measure of aggregate economic costs is the present discounted value, i.e, the appropriate summation over time, of foregone consumption. The following two tables illustrate the conclusions -- robust across various models -- from the comparison of the aggressive and moderate paths to the same environmental goal. The first table indicates that, on average, the moderate path achieves the same environmental goal at only 30% of the cost of the aggressive path. Indeed, with international permit trading, the cost of the moderate path is approximately 20% of the cost of the aggressive path. The second chart, a permutation of the first, clearly demonstrates the value of international permit trading. With one exception, the

[6] Based on 1990 populations. This formula could imply large transfers from OECD countries to developing countries. We consider an alternative scenario in the next section -- that the developing countries do not participate at all. It would also be desirable to look at the implications of a plan under which a small number of middle-income countries (particularly Korea and Mexico) begin to limit emissions by 2010. Without China and India, however, the emissions of the middle-income countries are a small fraction of the world total, so that their involvement would be important only in order to point the way for other emerging economies, rather than to reduce emissions perceptibly in their own right. A plan where developing countries ultimately were assigned targets determined by a formula putting equal weight on population, GDP, and past emissions would probably be more realistic (even though more complicated) than simplified extremes such as population alone or past emissions alone. Formulas based on population are probably too generous to poor countries for rich countries to agree, while formulas based on 1990 emissions alone are far too generous to rich countries for the poor countries to agree.

ratios of the costs of an emissions path with trading, to the same path without trading, are considerably less than one. International permit trading, on average, results in less than half the costs of the same emissions path without trading.

The Effects of Emissions Pathway on Consumption Losses by OECD Countries, 550 ppmv Stabilization Goal, EMF-14

Model	Trading	WRE	WG1	WRE/WG1
CETA	no	1.83	5.94	0.31
CPBRIVM	no	0.64	3.25	0.20
FUND	no	9.82	11.71	0.84
MERGE	no	0.85	6.12	0.14
MiniCAM	no	1.58	6.51	0.24
SGM	no	1.84	6.17	0.30
CETA	yes	1.86	4.03	0.46
CPBRIVM	yes	0.17	0.99	0.17
FUND	yes	1.47	4.97	0.30
MERGE	yes	0.60	3.24	0.19
MiniCAM	yes	0.54	3.44	0.16
SGM	yes	0.13	1.48	0.086
			Average:	0.28

source: Weyant, 1997

The Effects of Trading on Consumption Losses by OECD Countries, 550 ppmv Stabilization Goal, EMF-14

Model	Pathway	Trading	No Trading	Trading/No Trading
CETA	WRE	1.86	1.83	1.02

CPBRIVM	WRE	0.17	0.64	0.27
FUND	WRE	1.47	9.82	0.15
MERGE	WRE	0.60	0.85	0.71
MiniCAM	WRE	0.54	1.58	0.34
SGM	WRE	0.13	1.84	0.07
CETA	WGI	4.03	5.94	0.68
CPBRIVM	WGI	0.99	3.25	0.30
FUND	WGI	4.97	11.71	0.42
MERGE	WGI	3.24	6.12	0.53
MiniCAM	WGI	3.44	6.51	0.53
SGM	WGI	1.48	6.17	0.24
			Average:	0.44

source: Weyant, 1997

The modelers in the EMF-14 exercise did not attempt to calculate the least-cost path for achieving concentration stabilization goals.

The least-cost mitigation path, compared to 2010 constraints

Manne and Richels (1997a,1997b) are believed to be the first researchers to have computed the path that minimizes costs (using the MERGE model), subject to the constraint of stabilizing concentrations at a level such as 550 ppmv.[7] As the EMF-14 results illustrate, the MERGE model generates results on the costs of concentration stabilization that fall among the middle of the economic models. In their papers, they employ the same international burden-sharing rule as EMF-14.

Their model implies that the least cost mitigation path has emissions from Annex I countries peaking in the decade 2020-2030, a bit behind the WRE path. The peak of Annex I

[7] Also Manne and Richels (1995). Kosobud, et al (1994) examine alternative paths to achieve a given temperature target in 2100. All three papers find that a return to 1990 emission levels early in the 21st century is a needlessly costly way to attain the 2100 goals for concentration and climate.

emissions is 29 percent above 1990 levels. [Source: personal communication from Richels, 8/21 and 8/28/97.] Emissions do not return to their 1990 levels until after 2050. Emissions from developing countries peak in 2050. The sum of the two, total worldwide emissions, also peaks in 2050. (By mid-century, developing countries are such an important source of emissions that they dominate the global peaking date and the date of return to 1990 levels.) Worldwide emissions return to their 1990 levels shortly before the end of the 21st century.

This least cost mitigation path generates quite low values for carbon emissions rights after implementation in 2000. The permit price is only $2/ton in 2010, and rises slowly to $3/ton in 2020. Only in the latter part of the century does it rise significantly, to $156/ton in 2100.

The following table, from Manne and Richels (1997b), demonstrates the effect of constraining Annex I emissions relative to 1990 levels in 2010, in contrast to the least cost path. This constraint is imposed over the period 2010-2030. After 2030, further reductions in Annex I emissions occur in order to meet the constraint of concentrations at 550 ppmv.[8] Manne and Richels (1997b) constrained the year 2000 emission levels to the BAU level, under the assumption that treaty implementation could not occur before that date. Developing countries again participate, consistent with the burden sharing formula described above. Thus the permit price estimates presuppose full global participation and trading ("where flexibility") but not intertemporal trading ("when flexibility").

Change in emissions relative to 1990 in 2010	Permit Price in 2010 ($/ton)	Permit Price in 2020 ($/ton)	Consumption Losses (trillions of dollars)[9]		
			U.S.	Annex I	World
+10%	4	65	0.293	0.564	0.782
0%	67	88	0.303	0.619	0.939
-10%	120	112	0.429	1.054	1.276

[8] The proponents of "1990 by 2010" do not always specify what they would like emissions to do for the remainder of the century. In this section, we assume further reductions in order to meet the 550 ppmv constraint. In the next section of the paper, we instead "straightline" the rest of the century.

[9] The present discounted value of consumption assumes a 5% discount rate and a time horizon of 1990-2100.

According to Manne and Richels (1997b), their least cost mitigation path costs the U.S. $0.124 trillion in terms of lost consumption (present discounted value), as compared to $1.28 trillion under the IPCC Working Group path and as compared to $0.303 trillion under the "1990 in 2010" path. Thus the least cost mitigation path generates savings of 90 percent from WG1 and 60 percent from the 1990 in 2010 path.[10]

[10] Most of this gain is also reflected in the WRE path, which peaks in 2010-2020, as described above.

It is important to keep in mind that all these cost estimates are "best case" (almost utopian) scenarios, in the sense that they assume efficient market implementation, international trading, and full international participation and enforcement. Actual costs could be much higher if less efficient command-and-control mechanisms of implementation are used, if there is not effective international trading, or if some countries do not accede to or abide by a treaty.

What if the developing countries do not agree to go along?

It is difficult to imagine that taxpayers in the U.S. and other industrialized countries will agree to transfers to developing countries on the scale implied by the EMF/Manne-Richels burden-sharing schedule. According to one model, transfers under the "1990 by 2010" path would be $8 ½ billion in 2010, and rise to $24 billion by 2050. According to another set of estimates (from Battelle), the U.S. would have to pay $32 billion to other countries in 2035 under the WRE path, and $181 billion under the WG-1 path. The transfers would then continue to rise, to an estimated $85 billion or $170 billion, under the two respective paths, in 2050.

What if rich and poor countries are unable to come to an agreement? How would the absence of the developing countries from an agreement affect the targets-and-timetables decision of industrialized countries? On the one hand, as a matter of arithmetic, meeting the 550ppmv concentration constraint would require more aggressive targets and timetables on the part of the Annex I countries, if indeed it would be possible at all. On the other hand, as a matter of politics, the absence of the developing countries would probably lead the peoples of the Annex I countries to choose a less aggressive path, even though it would produce a higher terminal concentration level. (An analytical balancing of costs and benefits would give the same answer -- a less ambitious target -- once the concentration constraint is relaxed.) [11]

To consider the possibility that developing countries might decline to participate, we ask what would be the effects, both economic and environmental, if the Annex I countries are constrained to the WRE path, but developing countries"free-ride" (i.e., developing countries remain on their BAU path). The welfare losses (in terms of present discounted value) will depend upon whether there is trading in emission rights among Annex I countries. If Annex I trading occurs, then Annex I countries' losses increase from $0.62 trillion to $0.91 trillion, or 47%. If emission trading among Annex I countries does not occur, then losses rise to $1.00 trillion, or 61%. For the U.S., in the absence of developing country participation, welfare losses rise from

[11] Conversely, the developing countries are less likely to agree to participate if the Annex I countries have not already taken serious action.

$0.28 to $0.36 trillion, or 29%, assuming Annex I trading. Without Annex I trading, U.S. losses rise to $0.41 trillion or 46%.[12]

[12] For purposes of this comparison, we assume that if developing countries do participate, there will be full global trading.

Meanwhile, the non-participation of the developing countries means a clear failure to meet the goal of capping global emissions at 550 ppmv. Even if the Annex I countries choose an aggressive path of reducing emissions 10% below 1990 levels by 2010 (and stay at that level thereafter), the effect is to reduce global concentrations only 7 % below BAU levels in the year 2100. This is less than a third of the reductions achieved when the developing countries participate [22%; conversation 8/28] This result illustrates the problem of free riding. Moreover, the estimate does not include an allowance for "leakage" of carbon savings from participating to non-participating countries (e.g., reduced oil demand in the former, via a lower world price of oil, raises oil consumption in the latter). Once leakage effects are added to the free-riding problem, the difficulty of accomplishing meaningful reductions without the help of developing countries are even greater. The savings is only 5 percent in this case. In other words, of the 22 percent reductions achieved when the developing countries participate, 15 percentage points are lost to free-riding, and another 2 points to carbon leakage. [conversation 8/29.] This estimate captures only one of the possible leakage channels, via the world oil and gas market. It omits, for example, the relocation of production in polluting industries to non-participating countries. Indeed, models do not even attempt to measure this effect, because it is so difficult to do.

**

What if there is no international trading?

It is important to keep in mind that the permit price estimates cited earlier assume perfect global trading. Under this assumption, emission reductions occur where it is cheapest to do so regardless of geographic location. What if there is no opportunity to buy emission reductions from lower-cost countries? The following table shows permit prices in 2010 when Annex I emissions are constrained to 1990 levels under alternative assumptions about where flexibility. If the U.S. must attain its target entirely by domestic emission cuts, because developing countries do not participate and there is not trading even among Annex I countries, then the cost rises steeply. These conditions triple the price of the "1990 by 2010" target, in terms of the marginal cost of abatement, from $67/ton to $204.

U.S. Permit Prices in 2010, 1990 Level in 2010 Scenario

Where Flexibility	Global Trading	Annex I Only Trading	Domestic Only Trading
Permit Price in 2010 ($/ton)	67	132	204

It is important also to note that the gains from international trading are highly uncertain. In the case where developing countries do not participate, the extent to which Russia and Eastern Europe are a source of low-cost emission reductions depends heavily on the extent to which they fail in the future to recover from their recent contractions in output. Discussion usually presupposes that the United States will be a net buyer of permits, and several models confirm this. (The SGM shows "1990 by 2010" leading to $8 ½ billion in U.S. permit purchases in 2010, rising to $54 billion in 2050. This is why Annex I trading reduces the permit price in the table.) The U.S., however, is the next lowest-cost major emitter among Annex I countries, after the former Communist bloc. (Europe and Japan already conserve on energy, largely via already-high energy taxes on petroleum products, so they have less scope for further reductions.) If Russia and Eastern Europe begin to grow strongly, the U..S. could become a net *seller* of permits before long. If so, international trading will result in a higher price, not a lower price. McKibbin and Wilcoxen ( ) have built the G-cubed model to explore the international dimensions of climate change policy. They find that the U.S. turns into a net seller of permits by 2020 (to the tune of $38 billion, as opposed to purchases of $2-3 billion in 2010). If this result is right, then the high prediction for the carbon price is the right one, regardless whether there is trading among Annex I countries or not (though trade in permits is still beneficial).

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4. What is the trade-off between the paths currently under discussion?

As we have seen, the Manne-Richels results suggest that the optimal path has Annex I emissions peaking in the decade 2020-2030 and returning to 1990 levels after 2050. The WRE path has Annex I emissions peaking in 2010-2020, and is almost as cost-effective as the least-cost path. Yet the paths for emission reductions that have been discussed in the international negotiations are far more aggressive than these.

What are the additional economic costs, and climatological benefits, of moving from the least-cost path to "1990 levels by 2010"? Table 4, "Climate and Economic Variables under Alternative Emissions Paths," is designed to answer this question. It reports results from the SGM model (on economic variables) and the MAGICC model (on climatic variables), under the assumption that once emissions are returned to their 1990 levels, they are held there for the remainder of the century. The economic costs of the more aggressive path can be measured in several ways. The price of gasoline in 2010 would rise by 26 cents a gallon and coal prices by 273 percent, as compared to only 3 cents per gallon on the less ambitious path, and an increase in coal prices of only 53 per cent. The total economic loss, in the present discounted value of foregone consumption, $206 billion, as compared to only $95 billion on the less ambitious path. [These

figures cumulate lost consumption out only to 2050, and thus are not comparable with the figures cited in the preceding section.] What is accomplished by the more aggressive strategy? The date at which concentrations are doubled is postponed by a mere 3 years (beyond the nine-year postponement achieved by the less aggressive path). The estimated warming in 2100 (2.45 degrees under the business as usual case) is reduced by a mere .03 degrees.. While different observers will weigh the economic costs and climate benefits in different ways, the percentage increase in costs from early action seems large compared to the percentage reduction in concentrations and warming.

This conclusion omits that concentrations continue to rise in subsequent centuries. The way to address such concerns is by means of models (such as Integrated Assessment models) that keep track of economic and environmental effects on a longer time frame. The preceding section of the paper ("Least-cost Paths to Stabilize Concentration Levels") explains how more moderate paths can attain the identical objective, in terms of terminal concentration levels, with lower economic costs than "1990 in 2010." But all these results leave out the major argument for early action mentioned elsewhere: the need for political credibility of an announced long-term plan. This argument suggests that a moderate path should be accompanied by early and specific announcement of serious domestic measures of implementation.

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		Concentration Level (ppmv)		Year at Which Concentration Reaches 2x Pre-Industrial Level **	Change in Temperature from 1990 Level (Celsius)	
	Year	2050	2100		2050	2100
	Business As Usual (BAU)	502	711	2065	1.06	2.36
Deviation from BAU:						
Annex I Participation Only	1990 -10% beginning in 2010	-21	-66	+9	-0.09	-0.25
	1990 beginning in 2010	-18	-55	+8	-0.08	-0.21
	peak in 2015, 1990 in 2040	-13	-53	+6	-0.06	-0.19
	1990 +10% beginning in 2010	-13	-49	+6	-0.07	-0.18

		Carbon Permit Price ($ per ton)				Consumption *** (billions of $)
		Domestic Trading		Annex I Trading		
		2010	2050	2010	2050	
	Business As Usual (BAU)	0.00		0.00		121,650
Deviation from BAU:						
Annex I Participation Only	1990 -10% beginning in 2010	+175	+924	+91	+238	-980
	1990 beginning in 2010	+108	+582	+41	+149	-740
	peak in 2015, 1990 in 2040	+12	+563	+11	+153	-270
	1990 +10% beginning in 2010	+60	+310	+17	+113	-460

Table 4: **Climate and Economic Variables under Alternative Emissions Paths ***
Summary description

A plan to return carbon emissions to their 1990 levels by 2010 postpones by 9 years the date at which CO_2 concentrations reach twice pre-industrial levels. Global warming would be reduced by 0.21 degrees by the year 2100 versus an estimated 2.36 degrees under BAU. Under this emissions path the value of the estimated foregone consumption is $740 billion.

A less ambitious path -- "eliminate emissions growth by 2010-2020" -- would postpone the doubling date by 2 years less, and would lead to another 0.02 degrees of warming. But, the economics would become much easier: The value of foregone consumption would be only $270 billion.

* Preliminary CEA projections. The origin of these preliminary numbers is described on the accompanying page.
** Pre-industrial concentrations of CO2 were approximately 275 ppmv.
*** Assumes domestic trading only. Annex I or worldwide trading may substantially reduce these costs.
Deviations are foregone consumption assuming a 5% discount rate for the time horizon 2000-2050.

September 10, 1997

Sources and Explanations

Sources

Business As Usual (BAU) emissions projections are based on the assumptions employed in the IAT process. These projections incorporate the Annual Energy Outlook and International Energy Outlook projections, and closely mirror the IPCC IS92a emissions profiles with modifications made for the economic decline in the Former Soviet Union and Eastern Europe. BAU concentration and temperature projections are from the MAGICC model. Carbon permit price estimates and foregone consumption figures are from the SGM model. All these results were provided by Jae Edmonds, Marshall Wise, and Chris MacCracken at Battelle, Washington, DC.

Participation Cases

Annex I Participation Only: Assumes full compliance of stated targets and timetables by countries in Annex I; rest of the world behaves as in BAU.

Targets and Timetables

1990 (+/-10%) in 2010: Emissions follow BAU through 2000, reduce to 1990 (+/-10%) levels by 2010, and remain at 1990 (+/-10%) levels thereafter.

Peak in 2015, 1990 in 2040: Emissions follow BAU through 2005, peak at 2010 BAU levels in 2015, and stabilize at 1990 levels in 2040 and into the future. Because of linear interpolation in emissions profile between 2015 and 2040, this scenario may slightly overestimate the deviation of concentration from BAU.

Trading Scenarios

Domestic Trading: Trading only within each country.

Annex I Trading: Permits are grandfathered to Annex I nations based on 1990 emissions levels. All Annex I countries participate in the trading of permits.

Price Assumptions

Carbon: U.S. permit prices for the four policy options are from SGM, which assumes that all revenues are returned to the economy through a lump-sum redistribution.

Consumption: Deviations are present discounted value of foregone consumption differences for United States in billions of dollars between BAU and scenarios. The present discounted value assumes a discount rate of 5% and a time horizon of 2000-2050.

****

5. Escape clauses and other flexibility provisions

In addition to the question of the stringency of targets and timetables, there are a number of other important determinants of the economic costs of a program encompassed in the term "flexibility". The U.S. has proposed both "when flexibility" and "where flexibility."

Examples of "when flexibility" are our proposals for targets that are multi-year averages, for multiple target periods, and for banking and borrowing. An example of "where flexibility" is international trading, especially with the participation of developing countries. All of these proposals could substantially reduce the cost of a given level of emissions, and are crucial elements of our ability to attain moderate targets, let alone more ambitious targets. Costs would be far higher without them.

Another possibility that has recently received attention in the inter-agency process is to add one or more escape clauses. The main idea is to safeguard against unexpectedly large economic costs of emissions reductions. These are costs that could turn out to be unexpectedly large if the economic growth rate turned out higher than expected, or if unrealistic estimates regarding the ease of reducing emissions were built into treaty targets. One possible escape clause would focus on the price of energy per ton of carbon.

Nordhaus (1997) and McKibbin and Wilcoxen (1997) have proposed plans under which there is a cap on how much the price of carbon can rise. The proposal is that above a certain level, governments (or perhaps a supranational authority) could make available an indefinite quantity of emission permits at the predetermined price. The system would operate as a "tariff-rate quota," in

which countries were allowed to emit up to their assigned share for free, but then bore a penalty for any emissions in excess of that share. Pizer (1997) estimates that, in the presence of uncertainty, the optimal price rule generates gains that are five times greater than the optimal permit (quantity) rule. While the academic proposals tend to call for common policies and measures to be negotiated worldwide, the idea could usefully be integrated into the U.S. proposal for targets and timetables regarding emission quantities, in the form of a conditional escape clause. The effect would be to convert the quantity limit into a price instrument under circumstances when the burden would otherwise be too burdensome.

Escape clauses could also serve other purposes as well. Possibilities include:

.• An escape clause that would be triggered in the future if continued **scientific research** determined that the dangers from GHG concentrations and climate change were much less than previously feared. Presumably the treaty would be renegotiated in such a case anyway. But the arguments for putting this language in now are three: (1) to facilitate the change, should this come to pass, (2) so that we don't look foolish in the eyes of history if this should come to pass, and most importantly, (3) to help allay the fears of today's skeptics.

- An escape clause that would be triggered in the future if **developing country accession** turned out to be less than we expect after Kyoto.

- An escape clause that would be triggered by other Annex I countries' **failure to abide** by their commitments.

Each of these proposals, might be useful in avoiding economic costs that otherwise might be incurred needlessly.

6. Conclusions and Summary

[SEE EXECUTIVE SUMMARY AT THE BEGINNING]

Appendix I: Integrated Assessment Models (M. Toman)

*******2. Cost-benefit analysis in "Integrated Assessment" models

Integrated Assessment (IA) analyses try to bring together assessments of the physical, ecological, economic, and social impacts of climate change with assessments of policies for responding to climate change and their socioeconomic consequences. Generally speaking, the models can be described schematically as linking economic decisions in the energy (and agriculture) sectors that give rise to GHG emissions (and changes in carbbon sequestration), models of atmospheric composition, climatic change, and changes in oceans, and models that describe the potential impacts of climate change on health, natural resources, coaatal areas, and other factors of socioeconomic interest. Different components of various IA frameworks are represented in differing degrees of detail and sophistication. A few models contain the capacity to be used for a benefit-cost analysis, in which it is possible to evaluate changes in the long-term path of GHG emissions that maximizes the net benefits of GHG control (these benefits are the avoided damages of climate change less the costs of control). A larger number of IA models can evaluate the benefits and costs of specified policies but are unable to indicate what emissions reductions maximize net benefits. IA frameworks are inherently more "top-down" in their characterization of economic decisionmaking, though some models contain a fair amount of energy sector detail.

A very striking feature of IA models is that they tend to indicate the desirability -- from the perspective of maximizing net benefits over time -- of emissions continuing to rise well into the next century, if not beyond. (For a recent comparison of IA model results, see Manne 1996. By 2010, the models indicate only small deviations downward from a business as usual (BAU) path (see also IPCC 1996b, Chapter 10). In some cases the emissions do stabilize toward the middle of the next century, but in other cases they continue rising (though more slowly than with business as usual) even beyond 2100. These emissions paths clearly imply increases in atmospheric concentrations of GHGs well beyond the kinds of targets that have been considered in current policy debates (e.g., 550 ppm). One important consequence is that the models indicate costs of near-term emissions stabilization well in excess of the avoided damage costs.

Criticisms of the results in the Integrated Assessment models

As noted in the text, number of criticisms have been levelled at these IA results. These criticisms include:

Failure to consider the possibility of unlikely but catastrophic events that could result from climate change (e.g., catastrophic sea level rise from melting of the Antarctic ice sheet, runaway global warming from frozen methane releases, or relocation of the Gulf Stream).

Failure to give adequate consideration to the scale of potential damages, even in the absence of catastrophe. Cline (1992), for example, argues that damages are much higher than is incorporated in most IA models (see also IPCC 1996a, Chapter 6 for various estimates). One specific concern that has been raised is that the IA models do not account adequately for the costs of a less stable climatic and ecological systems in the face of GHG accumulations.

Failure to consider the adverse consequences of less aggressive abatement policies for future generations + in the context of IA models themselves, the criticism is that discounting of future generations' well-being is excessive. Cline (1992) also raises this concern, as does Howarth (1996).

Failure to consider how uncertainty about all these effects affects the "optimal" decision (Pizer 1996).

Failure to consider how lack of early action will jeopardize the achievement of any longer-term mitigation by signalling a lack of political will, or how lack of early action will retard induced technical progress that is needed to make mitigation affordable (Grubb *et al*/1995).

Sensitivity analyses carried out with IA models suggest that at least some of these criticisms are not major concerns; others may be serious concerns, but empirical judgments are not possible given the current state of knowledge. The Manne (1996) survey referred to above considered scenarios in which the climate's sensitivity to accumulating GHGs was greater than is typically assumed, or the the damages are larger (by a factor of almost 8) for a given change in the atmosphere. In either case emissions should (from the perspective of maximizing net benefits) be lower, but the extra degree of emissions reductions required by 2010 is significant (on the order of 25 percent or more) only if climate damages are much higher than expected (the sensitivity of the atmosphere to GHG emissions seems much less important in these analyses). And even in this case, emissions still will be higher than 1990 levels unless the atmosphere and the ecological-economic systems both are quite sensitive. (Broadly similar conclusions follow if, instead of looking at higher damages, one looked at damages that grew proportionately faster as atmospheric GHG concentrations grew (Peck and Teisberg 1993). Thus, the IA models give little

support for a policy of near-term emissions stabilization unless damages turn out to be much higher than at least some experts expect.

As noted, one of the criticisms of many integrated assessments (IAs) is that they do not incorporate the possibility of catastrophe. Recent extensions of the IA literature include the possibility of a major, discontinuous jump inh the damages caused by climate change. For example, a European paper by Gjerde et al (1997) incorporates the risk that climate change will sudenly cause damages equal to a significant share of global GDP. The risk is assumed to rise with an increase in temperatre from global warming; following Nordhaus (1994b), the benchmark risk scenario assumes a 12% chance of a loss equal to 25% of GDP (the scale of the great depression) in 2090 if climate has warmed by 3 degrees C. Incorporating this risk into the IA framework causes the optimal path for global emissions to be reduced, but not by that much in the early years. By 2060, optimal emissions are only somewhat over half what they would have been without the risk of catastrophe, but the reduction by 2020 is on the order of 15% below the no-catastrophe case and still above emissions in 1990.[13] Even sharper emissions reductions are implied if the catastrophe is truly shattering (on the order of the entire GDP), or if the discount rate is extremely low (high intergenerational egalitarianism.)

It is also true that the results of IA models are sensitive to the choice of discount rate used to compare consumption today and in the future. A very low discount rate will imply greater weight on damages accruing over time to future generations, and thus the need for a more aggressive abatement strategy. This tradeoff is influenced by the rate of economic growth, since growth will make future generations better off and thus better able to afford and respond to the damages of climate change (Schelling 1995). However, there are numerous economic and ethical controversies surrounding the appropriate way to discount future damages in IA models, and no clear consensus has emerged. One important point that is often ignored in this debate is how much *today's* generation is willing to sacrifice to provide for the increased protection of future generations through GHG abatement; this is a critical unknown since it is today's generation that must necessarily must decide to pay the bill. All that can be said analytically, therefore, is that intergenerational equity *might* be an argument for more aggressive abatement.

[13] The no-catastrophe optimal path is substantially below BAU in this analysis, an artifact of the assumptions of low abatement cost and high damage cost.

Uncertainty about future damages or other influences on the costs and benefits of abatement can make a difference. However, Pizer's (1996) analysis suggests that the most important source of uncertainty concerns the nature of our preferences for consumption and environmental protection. (Unlike the Manne (1996) analysis, Pizer considers the possibility that damages may be lower as well as larger.) A recent paper by Gjerde *et al* (1997) considers the risk of a sudden loss of economic output and well-being on the scale of the Great Depression from climate change. While their analysis indicates more aggressive abatement than other IA analyses without this risk, the introduction o the risk has little relative effect on the desirable level of emissions reduction by 2010, and little effect for a number of years thereafter (unless the loss is much larger even than the Depression).

This leaves the issues of political credibility and induced technical change. As for the latter, it is true that sending a less strong signal to energy markets will slow up technical progress. However, there is great uncertainty about how much of a loss this would be in practice, and the loss would have to be greater than most models seem to indicate before the substantial costs of near-term stabilization could be justified. This does *not* mean, however, that *no* actions are justified on cost-benefit grounds to reduce emissions or stimulate technical progress. Aside from initial steps to curb emissions growth, which signal the need for technical change, longer-term measures to promote the development of new technology are warranted. Political credibility is a more complicated issue.

****

First Steps Toward a Credible and Effective Long-Term Strategy

As noted, the intertemporally flexible alternative approach to achieving a long-term emissions reductions target has been criticized in some quarters as being akin to a license for indefinite postponement of emissions reductions, making the proposal noncredible in terms of the long-term enforceability of domestic emissions reductions (Won't those who want to delay now just want more delay later? Why would anyone be motivated to pursue emissions reductions early with this expectation?) and in terms of the signal sent to the international community. There also has been criticism that these policies will not stimulate enough near-term innovation to lower the cost of long-term emissions reductions. These are important concerns that need to be addressed in a complete analysis of intertemporally flexible policy options.

As for reduced innovation incentives, there may indeed be some negative effect, but the size of this effect is unknown and may be minor and/or transient if emitters do see the long-term policy goal as

credible. It can also be lessened by appropriate policy commitments to the funding of GHG-reducing R&D programs.

The credibility issue is more complicated, but even here there are several sides to the issue. A policy of significantly larger and more expensive near-term emissions reductions is by no means automatically more credible, from either an economic or political perspective. Moreover, intertemporal flexibility is not the same as doing nothing for a period of many years. Some near-term reductions can still be implemented, to build confidence in the commitment to longer-term reductions and to gain experience with the process of and opportunities for emissions reductions. We would thus advocate that a policy of cost-effective intertemporal flexibility in the timing of emissions reductions be coupled with a mandate for some modest but concrete initial emissions reductions, relative to business as usual, that grow over time as the economy makes the transition toward leveling off and reducing its emissions. Again, this can be coupled with a policy of support for R&D that lowers the cost of future GHG emissions reductions.

"Safe corridors"

Several recent studies have used the "safe corridors" concept for specifying desirable paths of emissions reductions over time. This concept seeks to indicate which time paths of emissions satisfy not only a limit on long-term concentrations of GHGs, but also other constraints. Common additional constraints are that the rate of temperature rise should not exceed a certain amount per decade, ostensibly as a proxy for avoiding environmental damages that might be produced by more rapid temperature rises; and that emissions reductions should not be larger than a certain percentage per year, ostensibly as a proxy for not imposing too large a cost burden on the economy.

These studies generally call for relatively significant near-term emissions reductions, largely as a result of the constraint on the decadal rate of temperature increase. However, this approach to damage avoidance is entirely ad hoc. While some scientists have expressed concerns about environmental stress from rapid temperature change, the IPCC does not provide a strong scientific basis for concluding that certain decadal rates of temperature increase are unacceptably risky (indeed, even specifying a more continuous relationship between the rate of temperature change and damages, like the relationships in IA models between the long-term change in temperature and damages, can only be done on the basis of analyst judgments). In addition, the arbitrary constraints on the rate of

emissions reduction do not in any way capture the links between the shape of the emissions path and the costs to the economy, as discussed in Section 3 ("Estimates of least-cost paths to stabilize concentration levels"). Accordingly, we do not believe the safe corridors approach offers a sound basis for public policy evaluation of emission control strategies.

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RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Maria J. Hanratty (CN=Maria J. Hanratty/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 17:49:12.00

SUBJECT: meeting with bls on measuring disabilities

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
I went to the meeting today with BLS on adding a question on disability status to the BLS. I think that the meeting went pretty well. Diane Fortuna at DPC is going to
redraft the executive order to be more in line with what BLS asked for: ie. it will specify what process they will follow to try to incorporate some questions on disability into the CPS, without committing them to a final outcome. The only difference is that they may insert some deadlines for finishing some specific tasks.
I did not get the impression that BLS thought this was unreasonable (assuming of course that the specific deadlines are workable). I will check in with BLS to be sure that they do not have further concerns with the meeting. I have also asked Diane to send me a copy of the executive order when she has finished it.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 14:57:54.00

SUBJECT: The Plan

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Here is the current version of The Plan (a possible candidate for joint
CEA-Treasury proposal), which came out of discussions with Larry.
Janet, are there changes you wish to make?
JF========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D40]MAIL40674576J.216 to ASCII,
The following is a HEX DUMP:

PLAN Rev. 9/25/97

1. Targets and timetables: A moderate path

:

- begin to reduce emissions growth in the short term
  (e.g., the emissions rise in 2000-2010 < the rise in 1990-2000)
- *eliminate emissions growth 10-20 years after treaty is ratified* (e.g., in 2010-2020, so emissions at the end of the decade = emissions at the beginning))
- subsequently return emissions to 1990 levels (by a date to be set at a future Conference of the Parties; perhaps 2040 for modeling purposes)
- aim for a path to stabilize concentrations in the longest term (550ppmv for modeling purposes)

2. Require full "when and where flexibility"

- Require developing country participation
- Insist on flexibility provisions of current U.S. position:
  - international trading
  - multiple multi-year targets
  - banking and borrowing
- Add *escape clauses*
  - *Economic trigger*: If carbon price goes as high as a pre-determined P (set substantially above expected price necessary to achieve targets), national governments or a supra-national body will sell additional emission permits to keep price from rising above P.
  - *Science trigger:* If the scientific community (IPCC) should decide in the future that the risks are not what was feared, the treaty shall be re-negotiated.

3. Unilateral actions (in the event that negotiations break down?)

- U.S. adopts a small carbon tax of $15-$25/ton phased in over 199_-20__, with the proceeds fully recycled so as to reduce other taxes. (If a tax is ruled out politically, then could do auctioned permits as a second-best.)
- U.S. leads movement toward global ban on fossil fuel subsidies
- R&D/diffusion subsidies up to $3 billion/yr.
- a sensible version of Joint Implementation, e.g., subsidize non-carbon energy

sources in developing countries through the World Bank.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 20:38:14.00

SUBJECT: Re: fast-track language on L&E

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: HOPKINS_M (HOPKINS_M @ A1 @ CD @ LNGTWY [UNKNOWN]) (CEA)
READ:UNKNOWN

CC: Jon D. Haveman (CN=Jon D. Haveman/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP [CEA])
READ:UNKNOWN

TEXT:
Janet,
Where do we stand on recruiting former CEA chairs for fast track. Do they (Vickie) still want it? I think I should call Bhagwati, to see if I can persuade him that we have a bill he should support. Do you want me to do something beyond that (e.g., talk to Boskin or any other formers?)
JF

---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/25/97 08:34 PM ----------

Lael Brainard
09/25/97 07:24:58 PM
Record Type: Record

To: Jeffrey A. Frankel/CEA/EOP
cc:
Subject: Re: fast-track language on L&E

"directly related to trade" is Archer (Republican) language, which is intended to be limiting in the way you suggest

Republicans are unhappy for three reasons:

1. Political posturing (main reason)
2. We added back in language from 88 that puts labor as an objective (although narrower than 88 since confined to WTO and ILO) and we have added similar language on environment that is new
3. We did not narrow the bill as much as they wanted, which would have explicitly precluded labor and environmental provisions

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 16:59:21.00

SUBJECT: Senate Questions

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D23]MAIL488026765.216 to ASCII,
The following is a HEX DUMP:

Responses to Senator Chafee's Questions

1. **Dr. Yellen, you indicate at the beginning of your testimony that the Administration, "has not settled on a particular set of new policies to reduce greenhouse gas emissions." We are now twenty weeks away from Kyoto. When will it? Is there still time for informed public review and debate on the options?**

   The President, Members of the Cabinet and Senior White House officials have been meeting with a wide range of parties interested in the issue of global climate change. We have been consulting with representatives from business and labor, environmental groups, scientists, economists and others about the best, most cost-effective way to reduce greenhouse gas emissions. On October 6, the White House will hold a conference to discuss the scientific evidence, the economic impact and the international implications of global climate change. These discussions are intended to inform the Administration's decision-making process, which will culminate in a U.S. policy position for the international negotiations in Kyoto in December of this year.

   With the lessons we have learned so far, the Administration has established a broad framework within which this policy position will be developed. For example, we support the use of flexible approaches, such as international emissions trading. We support the requirement that non-Annex I countries, as they become wealthier, abide by binding emissions goals that are formulated in international treaty negotiations. And, for domestic implementation, we support the use of flexible, market based approaches.

2. **You also say in your prepared remarks that, "the effort to develop a model or set of models that can give us a definite answer to the economic impacts of a given climate change policy is futile." How are we to respond? What reliable tools do we have to determine what, if any, agreement is best for the United States?**

   No one model, or even a small set of models, can give a definite estimate of the effects of a policy on the economy 20 or 30 years into the future. The existence of modeling difficulties does not mean, however, that we can abandon rigorous economic analysis. Rather, we must employ a broad set of economic tools, and incorporate insights from the existing body of research on climate change policies, as we analyze the policy options. Some of these may have strengths on issues where the models used in the Interagency Analytical Team (IAT) analysis were weak.

   Drawing on this broad array of analytic tools allows an intelligent evaluation of policy alternatives. I am confident that the analytic tools and perspectives available to the Administration can provide us with sufficient information to generate ranges of estimated economic effects so that the Administration can make informed policy decisions.

3. **Is the Administration considering some form of new energy tax to administer a new treaty, domestically?**

At this time, the Administration has not settled on a particular set of policies. The Administration is considering an array of market-based approaches to implement climate policy.

4. What advantages or disadvantages (economically or environmentally) might a trading system have over energy taxes?

Tradeable emissions permits and energy taxes share several important characteristics. First, they both send a price signal to markets that would encourage energy conservation and stimulate the development and adoption of energy efficient technologies. Second, they both provide flexibility to achieve emissions goals. In the case of tradeable permits, firms that find it very costly to reduce emissions may purchase permits from firms that find it less costly. In the case of taxes, firms would reduce their energy use until it became more costly than the tax. These both achieve emissions reductions at substantially lower costs than through command and control approaches.

Tradeable emissions permits would provide greater certainty than energy taxes of attaining a specified emissions cap. By specifying a number of permits and allowing firms to trade these permits, the country can ensure that it is meeting an agreed upon carbon emissions goal. A tax, on the other hand, would provide greater certainty than a cap-and-trade approach of limiting costs, since the increase in unit costs would be determined by the tax. Taxes and permits may also differ in their administrative and transactions costs and ease of enforcement, particularly depending on how a permit trading system is implemented.

5. In order to use flexibility instruments like the proposed joint implementation and emissions trading, do we need to have a cap on nations' emissions?

To what extent can these instruments reduce the cost of implementation of greenhouse gas emissions reductions for the United States and others? Is there reliable data available?

For international emissions trading, all countries participating in the trading scheme will need to have their emissions capped. For joint implementation, all countries can participate, regardless of whether their emissions are capped. However, it will be necessary to set standards for approving joint implementation projects sufficient to ensure that the credit received by U.S. companies actually results in incremental abatement activities abroad.

International permit trading allows emission reductions to occur in areas where the costs of those reductions are lowest. If some of the emissions reductions necessary to achieve the U.S. goal can be undertaken in other countries at lower costs, then U.S. emissions control costs will fall, by some estimates as much as two-thirds. While every country is better off when it can voluntarily buy or sell permits according to its respective emissions reduction

costs, the ultimate permit price and traded quantities depend heavily on the degree of participation by developing countries and economic growth in Russia and Eastern Europe.

6. **Some have argued that innovation toward less greenhouse-intensive technologies will occur in the absence of any market signal. Do you agree? Why or why not? If a market signal is needed, how should it be provided?**

Some shift towards a less energy-intensive economy occurs in the absence of deliberate government influences on price, some believe because of the changing composition of the U.S. economy towards less energy-intensive sectors. Many studies suggest that energy use relative to GDP falls each year, regardless of the price signal, by 0.5 to 1.25 percent. To the extent that energy use is associated with climate change effects, and in turn causes damages not reflected in market prices, the business-as-usual decline in energy use relative to GDP is unlikely to be sufficient. Additional incentives to innovation, such as price signals or support for R&D may be needed.

7. **Many are concerned that caps on industrialized nations' emissions, without similar caps on developing nations' emissions, will simply promote the flight of jobs, capital, and polluting activity to developing nations. Is this a valid concern? How should it be addressed? Would joint implementation help?**

Certainly the participation of developing countries is key to the long term success and cost-effectiveness of a global reduction in greenhouse gas emissions. In the next century, developing countries will likely reach and surpass currently developed countries in their share of global emissions. Any emissions reductions that Annex I countries achieve can be undone by others who do not so carefully address the problem. In addition, the important opportunities for low cost reductions created by developing countries' participation could reduce the overall cost of achieving a given environmental goal by more than a half by some estimates.

Some observers of the climate change issue have suggested that capping only developed countries' emission will result in "leakage": the escape of jobs, capital, and polluting activity to developing countries. Even if caps are not initially placed on developing countries' emissions, the economic evidence does not support the argument that sensible climate policies will adversely affect overall U.S. economic competitiveness.

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leakage. Firms that decide to relocate to other countries do so because of international differences in labor costs, capital costs, material costs, and exchange rate changes that all swamp the costs of complying with environmental regulations.

Responses to Senator Boxer's Questions

1. **In the Administration's economic analysis, it is stated that, "There is no evidence of a wholesale 'capital flight' from the United States resulting from an emissions reduction policy." Can you please expand on this?**

Certainly the participation of developing countries is key to the long term success and cost-effectiveness of a global reduction in greenhouse gas emissions. In the next century, developing countries will likely reach and surpass currently developed countries in their share of global emissions. Any emissions reductions that Annex I countries achieve can be undone by others who do not so carefully address the problem. In addition, the important opportunities for low cost reductions created by developing countries' participation could reduce the overall cost of achieving a given environmental goal by more than a half by some estimates.

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2. **The United States has far lower energy costs than Europe and Japan. How would our costs of emission reductions compare with theirs? How would this affect our ability to compete?**

The costs of reducing emissions in the U.S., and in Europe and Japan, depend on how all of these countries implement their policies. If the U.S. employs a market based approach,

the costs will not be that high relative to Europe and Japan. Regardless of the implementation approaches used in these countries, the costs of emissions reductions are not likely to affect U.S. competitiveness. As noted above, energy costs comprise a small share of total manufacturing costs (2.2%). Further, two-thirds of carbon emissions occur in non-tradeable sectors. The evidence on energy price differentials across countries suggests that they are not sufficient to spur firm relocation to other countries.

Several analyses indicate that Western Europe will bear *higher* costs for reducing carbon emissions than will the United States. Western Europe already has high energy taxes relative to the U.S., and has already "backed out" of fossil fuel use to varying degrees. This implies that a lot of the less expensive measures for reducing carbon reductions have already occurred in Europe, so that the U.S. has relatively more opportunities to inexpensively cut carbon emissions. For example, 20% of all energy in France, and a majority of its electricity production, is from nuclear power, while only 7% is from coal. Since nuclear is not carbon-based, France cannot further reduce carbon emissions from that energy source, and can achieve relatively limited emissions reductions from its low use of coal. In contrast, in the U.S. nuclear power comprises only 9% of total energy production, while coal comprises 23%.

3. **Dr. Yellen, we have heard horror stories of all the catastrophic economic effects that embarking on a policy of reducing greenhouse gas emissions would cause. Did the administration's analysis consider the positive effects on health, environment, AND the economy that reducing greenhouse gases would produce?**

The IAT report did not assess the human health and environmental benefits of reducing greenhouse gas emissions. In addition, the IAT did not study the risks of effects of climate change on economic activity. However, the report did assess the impacts of climate policy on the economy. The IAT analysis confirms other economic research (for example, the recent report by the World Resources Institute) that smart climate policy could produce some benefits for the economy. For example, the IAT analysis found that auctioning off tradeable permits and using the proceeds of the auction to reduce other taxes that distort work and savings decisions could produce economic benefits that offset the costs of meeting a climate change goal.

4. **We heard last week that the longer we wait to implement our reductions, the more costly it will be in practically all sectors -- health, environment, and jobs. This reminds me of the commercial where the grizzled mechanic says, "You can pay me now, or you can pay me later." What did your analysis find in terms of the costs of delaying action?**

We believe it is important to take early, credible action towards a long term strategy to control greenhouse gas emissions. More gradual efforts to reduce our carbon emissions can significantly lower the economic costs relative to very aggressive reductions efforts while still achieving the same carbon dioxide concentration goal. For example, some international proposals to reduce carbon emissions would have Annex I countries cutting

emissions to 20% below 1990 levels by 2005. Such a target and timetable would have very substantial economic costs because it does not provide enough time for the capital stock to turn over. It is very expensive to prematurely scrap the existing capital stock while much of it is in the prime of its life. Further, such a goal would require the economy to employ existing low-carbon and carbon-free technologies while longer-term reductions would provide more lead time to develop and implement superior technologies. Given that it is the stock of carbon dioxide, not the annual emissions of carbon dioxide, that drive global warming, flexibility in the timing of emissions reductions can lower costs while not undermining our commitment to achieving a given ultimate concentration.

5. **California has been a leader in development of new energy technologies. Based upon your analysis, what industries are likely to grow over the next 20-30 years?**

It is very difficult to forecast the nature of the economy, especially specific industries, 20 or 30 years into the future. If the country embarked on a policy of reducing carbon emissions, obviously the firms and industries that can creatively and cost-effectively reduce their emissions will benefit relative to their competitors. It is reasonable to envision that the products and services of industries that develop energy efficient technologies and industries that develop low-carbon based energy (such as renewable energy sources including wind, solar, and biomass) would be in greater demand during a period of reduction in greenhouse gas emissions.

Responses to Senator Lieberman's Questions

1. **Congressman Dingell suggested on 6/19/97 that the Administration's analysis is "too late to inform the process, and likely will be used to justify what the Administration has already decided to do." Please comment on his concerns.**

The Administration's analysis on the issue of climate policy has not occurred in a vacuum. In fact, climate change has been one of the more active areas of research in economics this decade. The economic literature on climate change, complemented by the IAT report, has already done quite a lot to inform the policy development process. Based on the economic research, we have identified some of the important characteristics of the climate policy we will develop: international emissions trading, developing country participation, emissions budgets, and market-based, flexible domestic implementation. My interpretation of the role of economics differs -- I believe economics has informed the process, and I am confident that it will continue to play an important role in our country's deliberations over a climate policy position.

2. **If the economic impacts of climate policies cannot be determined precisely, how will the economic analysis be used to develop the Administration's specific positions on a**

target and a timetable? Can the relative costs of different policies be evaluated with confidence by the Interagency Team?

No one model, or even a small set of models, can give a definite estimate of the effects of a policy on the economy 20 or 30 years into the future. The existence of modeling difficulties does not mean that we can abandon rigorous economic analysis. Rather, we must employ a broad set of economic tools and incorporate insights from the existing body of research on climate change policies, as we analyze the policy options. Some of these may have strengths on issues where the models used in the Interagency Analytical Team (IAT) analysis were weak.

Drawing on this broad array of analytic tools allows an intelligent evaluation of policy alternatives. I am confident that the analytic tools and perspectives available to the Administration can provide us with sufficient information to generate ranges of estimated economic effects so that the Administration can make informed policy decisions.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:25-SEP-1997 12:09:06.00

SUBJECT: updated answers to Senate questions

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
I've incorporated everyone's previous comments in the version of Senate answers attached.

Janet and Jeff: please pass back your final comments and we'll send this thing out. Thanks.

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D30]MAIL42535476A.216 to ASCII,
The following is a HEX DUMP:

Responses to Senator Chafee's Questions

1. **Dr. Yellen, you indicate at the beginning of your testimony that the Administration, "has not settled on a particular set of new policies to reduce greenhouse gas emissions." We are now twenty weeks away from Kyoto. When will it? Is there still time for informed public review and debate on the options?**

   The President, Members of the Cabinet and Senior White House officials have been meeting with a wide range of parties interested in the issue of global climate change. We have been consulting with representatives from business and labor, environmental groups, scientists, economists and others about the best, most cost-effective way to reduce greenhouse gas emissions. On October 6, the White House will hold a conference to discuss the scientific evidence, the economic impact and the international implications of global climate change. These discussions are intended to inform the Administration's decision-making process, which will culminate in a U.S. policy position for the international negotiations in Kyoto in December of this year.

   With the lessons we have learned so far, the Administration has established a broad framework within which this policy position will be developed. For example, we support the use of flexible approaches, such as international emissions trading. We support the requirement that non-Annex I countries, as they become wealthier, abide by binding emissions goals that are formulated in international treaty negotiations. And, for domestic implementation, we support the use of flexible, market based approaches.

2. **You also say in your prepared remarks that, "the effort to develop a model or set of models that can give us a definite answer to the economic impacts of a given climate change policy is futile." How are we to respond? What reliable tools do we have to determine what, if any, agreement is best for the United States?**

   No one model, or even a small set of models, can give a definite estimate of the effects of a policy on the economy 20 or 30 years into the future. The existence of modeling difficulties does not mean that we can abandon rigorous economic analysis. Rather, we must employ a broad set of economic tools to analyze the policy options. Some of these may have strengths on issues where the models used in the Interagency Analytical Team (IAT) analysis were weak.

   The analytic tools the Administration is employing include models of the energy sector and economy over the next 25 years, including but not limited to the models that were used by the IAT earlier in the year and models that are designed to operate on the longer time frame that is relevant for thinking about climatological effects. Other tools include simple relevant statistics, "meta-analyses" of existing models, historical and sectoral examples and basic economic reasoning. For example, we know that a market-based approach to reducing carbon emissions will be less costly than a command and control approach. Drawing on this broad array of analytic tools allows an intelligent evaluation of policy alternatives. I am confident that the analytic tools and perspectives available to the

Administration can provide us with sufficient information to generate ranges of estimated economic effects so that the Administration can make informed policy decisions.

3. **Is the Administration considering some form of new energy tax to administer a new treaty, domestically?**

At this time, the Administration has not settled on a particular set of policies. The Administration is considering an array of market-based approaches to implement climate policy.

4. **What advantages or disadvantages (economically or environmentally) might a trading system have over energy taxes?**

Tradeable emissions permits and energy taxes share several important characteristics. First, they both send a price signal to markets that would encourage energy conservation and stimulate the development and adoption of energy efficient technologies. Second, they both provide flexibility to achieve emissions goals. In the case of tradeable permits, firms that find it very costly to reduce emissions may purchase permits from firms that find it less costly. In the case of taxes, firms would reduce their energy use until it became more costly than the tax. These both achieve emissions reductions at substantially lower costs than through command and control approaches.

Tradeable emissions permits would provide greater certainty than energy taxes of attaining a specified emissions cap. By specifying a number of permits and allowing firms to trade these permits, the country can ensure that it is meeting an agreed upon carbon emissions goal. A tax, on the other hand, would provide greater certainty than a cap-and-trade approach of limiting costs, since the increase in unit costs would be determined by the tax. Taxes and permits may also differ in their administrative and transactions costs and ease of enforcement, particularly depending on how a permit trading system is implemented.

5. **In order to use flexibility instruments like the proposed joint implementation and emissions trading, do we need to have a cap on nations' emissions?**

To what extent can these instruments reduce the cost of implementation of greenhouse gas emissions reductions for the United States and others? Is there reliable data available?

For international emissions trading, all countries participating in the trading scheme will need to have their emissions capped.

International permit trading allows emission reductions to occur in areas where the costs of those reductions are lowest. If some of the emissions reductions necessary to achieve the U.S. goal can be undertaken in other countries at lower costs, then U.S. emissions control

costs will fall, by some estimates as much as two-thirds. While every country is better off when it can voluntarily buy or sell permits according to its respective emissions reduction costs, the ultimate permit price and traded quantities depend heavily on the degree of participation by developing countries and economic growth in Russia and Eastern Europe.

6. **Some have argued that innovation toward less greenhouse-intensive technologies will occur in the absence of any market signal. Do you agree? Why or why not? If a market signal is needed, how should it be provided?**

Some shift towards a less energy-intensive economy occurs in the absence of deliberate government influences on price, some believe because of the changing composition of the U.S. economy towards less energy-intensive sectors. Many studies suggest that energy use relative to GDP falls each year, regardless of the price signal, by 0.5 to 1.25 percent. To the extent that energy use is associated with climate change effects, and in turn causes damages not reflected in market prices, the business-as-usual decline in energy use relative to GDP is unlikely to be sufficient. Additional incentives to innovation, such as price signals or support for R&D may be needed.

7. **Many are concerned that caps on industrialized nations' emissions, without similar caps on developing nations' emissions, will simply promote the flight of jobs, capital, and polluting activity to developing nations. Is this a valid concern? How should it be addressed? Would joint implementation help?**

Certainly the participation of developing countries is key to the long term success and cost-effectiveness of a global reduction in greenhouse gas emissions. In the next century, developing countries will likely reach and surpass currently developed countries in their share of global emissions. Any emissions reductions that Annex I countries achieve can be undone by others who do not so carefully address the problem. In addition, the important opportunities for low cost reductions created by developing countries' participation could reduce the overall cost of achieving a given environmental goal by more than a half by some estimates.

Some observers of the climate change issue have suggested that capping only developed countries' emission will result in "leakage": the escape of jobs, capital, and polluting activity to developing countries. Even if caps are not initially placed on developing countries' emissions, the economic evidence does not support the argument that climate policy will adversely affect overall U.S. economic competitiveness.

First, non-tradeable sectors account for a substantial share of carbon emissions. Transportation and residential and commercial buildings account for approximately two-thirds of U.S. carbon emissions. For these sectors, the "competitiveness" argument does not appear applicable. Second, energy costs comprise only a small percentage of total manufacturing costs. According to the 1995 Annual Census of Manufactures, energy costs for manufacturing industries averaged just 2.2% of total costs. Given the small share of energy in total costs, differential shifts in existing energy prices are unlikely

to have substantial effects on location decisions and trade flows. Third, our experience in this country with environmental regulation has been that it does not cause significant leakage. Firms that decide to relocate to other countries do so because of international differences in labor costs, capital costs, material costs, and exchange rate changes that all swamp the costs of complying with environmental regulations.

In conclusion, we should do climate policy smart. If we do it dumb, it will cost our economy a lot. By doing it smart, through flexible, market-based approaches, we will make the costs of complying with an emissions goal much lower. In addition to using market-based approaches domestically, international emissions trading by all countries would also lower the costs of climate policy. These lower costs associated with a smart climate policy would decrease the economic rationale for industries to move to developing countries.

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The costs of reducing emissions in the U.S., and in Europe and Japan, depend on how all of these countries implement their policies. If the U.S. employs a market based approach, the costs will not be that high relative to Europe and Japan. Regardless of the implementation approaches used in these countries, the costs of emissions reductions are not likely to affect U.S. competitiveness. As noted above, energy costs comprise a small share of total manufacturing costs (2.2%). Further, two-thirds of carbon emissions occur in non-tradeable sectors. The evidence on energy price differentials across countries suggests that they are not sufficient to spur firm relocation to other countries.

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example, the recent report by the World Resources Institute) that smart climate policy can actually lead to net benefits in the long term. For example, the IAT analysis found that auctioning off tradeable permits and using the proceeds of the auction to lower income and corporate taxes would help the economy grow faster in the future than without climate policy.

4. **We heard last week that the longer we wait to implement our reductions, the more costly it will be in practically all sectors -- health, environment, and jobs. This reminds me of the commercial where the grizzled mechanic says, "You can pay me now, or you can pay me later." What did your analysis find in terms of the costs of delaying action?**

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RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Peter R. Orszag (CN=Peter R. Orszag/OU=OPD/O=EOP [OPD])

CREATION DATE/TIME:26-SEP-1997 14:37:40.00

SUBJECT: Memo as it stands now. Comments welcome.

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
PS: The carbon reductions from the $500 million program are incremental,
and at a price of zero! What a bargain! If only I could have DOE balance
my checkbook!========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D80]MAIL43473586V.216 to ASCII,
The following is a HEX DUMP:

DRAFT #5: CLOSE HOLD

September 26, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
DANIEL TARULLO
KATHLEEN McGINTY

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 SO_2 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 (CO_2) accounts for more than 85 percent of U.S. greenhouse gas emissions. Roughly one-third of CO_2 emissions are from transportation, one-third from buildings and one-third from industry.[1] U.S. CO_2 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. CO_2 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 CO_2 emissions

Source	Emissions in millions of tons	As % of transportation emissions
Automobiles	152	34.9%
Light trucks	101	23.2%

[1] In this accounting, the CO_2 produced to generate electricity is charged to the sector using the electricity. Taken together, emissions from all electricity production amount to 36 percent of CO_2 emissions.

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. CO_2 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 CO_2 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 CO_2 emissions. Emissions from this source are expected to increase at 0.8 percent per year (4 million tons). About 80 percent of all industrial CO_2 emissions come from petroleum refining, chemicals, paper, lumber and other forest products, and metals.

Industry: Sources of CO_2 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 CO_2 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 CO_2 emissions.

The table below shows that coal accounts for 50 percent of electricity generated in the U.S., but 77 percent of CO_2 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 CO_2 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 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.

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 to be overly optomistic 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 SO_2 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 (SO_2) allowance trading program. The SO_2 permit program evolved out of the Clean Air Act Amendments of 1990, which required a 50 percent reduction in SO_2 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 SO_2 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 SO_2 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 SO_2 program. Similarly favorable factors may or may not emerge with respect to a carbon trading program.

- 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 SO_2 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 SO_2 comparison is inappropriate, because in the SO_2 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 SO_2 program: Whereas the annual stock of permits under the SO_2 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:

<u>AUCTIONS</u>

- 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 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 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 that 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 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 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 emmissions in 2050 to stabilizing emissions in 2020, the effect on the temperature in 2100 is *less than 0.3 degrees.*

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 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 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.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:26-SEP-1997 08:44:29.00

SUBJECT: Re: fast-track language on L&E

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Boskin said he would not support our fast track bill and Stein was dubious and wanted to know more. Schultze was supportive. I have not chatted with any others. My original mandate was to invite them all to a White House event but we are still uncertain of the date, even though it is to be week after next, and Boskin, for example, said he wouldn't come even if he supported the bill. In light of all of this, I have been told to stop making calls, and I have done just that. However, in response to your question, I think it would be worthwhile to talk with Bhagwhati and see if he could support the bill. That might be quite helpful. Remember, though, that we are not supposed to lobby outsiders.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:27-SEP-1997 17:27:38.00

SUBJECT: International aspects of Escape Clause

TO: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Lisa D. Branch (CN=Lisa D. Branch/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
A (slightly revised) copy of my Escape Clause memo, giving the plan features regarding int.-trading/domestic implementation/selling-authority that seem to me relatively workable.

Let's try again to talk about this (Is Monday a.m. possible?)

JF========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D77]MAIL42283696R.216 to ASCII,
The following is a HEX DUMP:

9/27/97

ESCAPE CLAUSE: INTERNATIONAL ASPECTS

Multilateral version:

- A *supranational authority*, presumably the same one that is to monitor countries' emission levels under any sort of agreement, stands ready to sell permits (beyond the basic agreed-to target levels) to whatever *national governments* wish to purchase them at a pre-determined price P.

- In the basic agreement, countries agree to emission targets, but reserve the right to whatever manner of domestic implementation they desire (as in current US position against "common policies and measures").

- Parties would have to agree in advance how to divide up the revenue.

- International trade in permits is superfluous in this case, but would do no harm.

Why couldn't individual firms also buy permits from the supra-national authority? In the multilateral version, it is suggested that only national governments be allowed to buy permits from the supra-national authority. Only they can be held internationally responsible for meeting their countries' aggregate emissions commitment. If permits could be purchased by individual firms, the government might be able to explain away any excedence of its target by claiming that domestic firms might have paid for the extra permits in private transactions.. (This is also an argument why, aside from escape clauses, international trading probably needs to be done via national governments.) It might work for governments to act as the agents for individual firms in making international purchases.

National version:

- *National governments* stand ready to sell additional permits *to their own citizens* at a predetermined price P.

- In the basic agreement, countries agree to a common plan for domestic implementation: a scheme of tradable permits.

- It does not matter whether the initial allocation of permits in a particular country is done by auction or arbitrary allocation, insofar as the workability of the escape clause is concerned. All that matters is that the initial allocation is the quantity agreed to in the treaty.

- Each government would get to keep the revenue raised.

- International trade in permits is again superfluous in this case. Indeed, it might be necessary to rule it out. Otherwise an irresponsible government (think "transition

economies") could flood the market with permits, which it prints at the cost of the paper while receiving real money for them. (Of course such a country would be grossly out of compliance with the international treaty. But one does not wish to structure a treaty in such a way that a single irresponsible government can result in the breaching of intended emission limits, not just by its own economy, but worldwide.)

Why couldn't countries retain their own domestic implementation schemes? If some countries implemented their emission limits by means other than tradable permits, whether taxes or regulation, then it would be difficult to enforce the principle that the country's total emissions are to be limited by their initial allocation plus those demanded at the marginal cost P. The "marginality" becomes suspect. There would be nothing to stop a country from abolishing its existing energy taxes and regulations (or even adding energy subsidies!) and selling a lot of permits to its citizens because the true marginal cost of emission overruns would be far below P.

Versions giving special treatment to the U.S.

The two versions described above pre-suppose a desire for an honest and workable system. It is possible that the multilateral version would be viewed as unacceptable because of aversion to supra-national authorities, and the national version as unacceptable because of aversion to insistence on a common domestic implementation measures. Is there some other way that the U.S. could tell its businesses they will be protected against a price higher than P?

(1) The U.S. could insist that the U.S. government be the only one with the right to sell additional permits at price P. If this were accepted, it would have the desirable efficiency properties, while simultaneously transferring potentially huge amounts of money from other countries to the U.S. It is hard to see why any other country would be willing to consider this.

(2) The U.S. (and other countries if they wished) could assure its citizens that if the price were to rise above P, with scope for buying emission permits internationally already having been exploited, then *the country would borrow, as agreed to internationally, however many permits were necessary* to keep the domestic (and world) price from rising above P. This is perfectly workable institutionally. But it is hard to see why, if the 2010 targets have turned out to be prohibitively expensive to meet, it would be any easier to attain quantity targets in 2015 and simultaneously pay back past borrowings.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:28-SEP-1997 21:52:34.00

SUBJECT: My speech on trade

TO: Jeremy B. Rudd (CN=Jeremy B. Rudd/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Lael Brainard (CN=Lael Brainard/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jon D. Haveman (CN=Jon D. Haveman/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: HOPKINS_M (HOPKINS_M @ A1 @ CD @ LNGTWY [UNKNOWN]) (CEA)
READ:UNKNOWN

CC: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

Lisa D. Branch (CN=Lisa D. Branch/OU=CEA/O=EOP [CEA])
READ:UNKNOWN

TEXT:
Next week, October 7, I am talking to the National Economists Club on "How to Gauge the Importance of Trade to the U.S. Economy." I attach a draft of the talk (it is only a bit revised from the 8/15 version that some of you have seen). I would like to hear any comments you all might have.

Especially if the comments can come by first thing Tuesday, because that is when I hope to circulate a revised draft to NEC, USTR, Commerce, State and Treasury. My reason for doing so is not just regular bureaucratic prudence. I also wouldn't mind provoking a little thought on the subject of the title. And particularly on the key three paragraphs on the second page ("more jobs or better jobs"); my fondest hope would be that this might nudge the offical Adminstration line on trade in a good direction.

The first two paragraphs need some more language on our current policy, esp. fast track. Jeremy: if you have such language from Janet's recent speech, could you e-mail it to me? (Also, I could use an update of the chart "Trade-weighted Foreign Growth and U.S. Growth.") Thanks.

JF========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:

Unable to convert ARMS_EXT:[ATTACH.D41]MAIL420597076.216 to ASCII,
The following is a HEX DUMP:

[revised version of Notes for Address to Conference of Business Economists May 8, 1997]

Draft; not yet circulated rev 9/28/97

How to Gauge the Importance of Trade to the U.S. Economy

Speech to the National Economists Club, Oct. 7, 1997

J. Frankel, Member, Council of Economic Advisers

One of the President's highest priorities is working to open markets around the world. The Administration negotiated some 200 agreements in the first four years, counting all of them -- large and small -- multilateral, regional and bilateral. We hope and expect to continue this momentum in the second four years. Major successes in the last year include the Information Technology Agreement and a global telecommunications agreement. We hope to have a Multilateral Agreement on Investment before long, and to continue to make progress in civil aviation, and a host of other areas.

Currently, our single most important objective in the area of international economics is obtaining from Congress the authority to negotiate trade agreements on a fast-track basis. We would hope to use fast track authority both for regional initiatives, such as expanding NAFTA to include Chile and negotiating the Free Trade Area of the Americas, and multilateral initiatives [including such potential sectors as agriculture, government procurement, medical equipment, chemicals, and environmental and energy equipment]. ...MORE, E.G., FROM JY SEPT. SPEECH

What is the proper way of thinking about or measuring the role or benefits of trade to the U.S.? In public policy discourse, the most common measure is the trade balance and its implications for jobs. Like most economists, I think this choice of emphasis can be misguided.

Instead of focusing on the <u>difference</u> between exports and imports, I would prefer to gauge the effects and benefits in terms of increases in the <u>levels</u> of trade. U.S. exports, for example, increased at an annual average rate of growth of 7.8% (goods and services; merchandise alone was 8.6%) over the years 1992-96. Thus trade has grown much more rapidly than income. This has been the pattern throughout most of the world, throughout most of the post-war period (and also during the century preceding 1914. The collapse of trade during the two world wars and the period between them were the exception). It was not the pattern in the rest of the world in 1996, when other countries uncharacteristically registered growth in trade that was slower than their growth in income.

In theory, one wants to look at the effect of trade on a measure of economic welfare, such as real income. It can be difficult, however, to sort out the effects of specific trade agreements, from other forms of liberalization and globalization, such as declining transportation costs or the rise of high-exporting countries in Asia and elsewhere. This is true even when trying to sort out

the effects on trade flows. To estimate the effects of trade agreements on real income, one has to take into account myriad other influences on the economy. Statistical estimates are prone to a fair range of uncertainty. The public instinctively knows this, and often distrusts confident assertions from Washington that a particular agreement or program raised economic welfare by a particular amount.

To take a recent example, the legislation implementing NAFTA required that we send a report to Congress on its progress and effects this past July.[i] To isolate the effects of NAFTA, one has to adjust both the effects of the 1994-95 Mexican peso crisis, which were negative, and the effects of the 1993-97 expansion of the U.S. domestic economy, which were positive. Making such adjustments is not easy, given only a few years of post-NAFTA data. Drawing on existing academic research, as well as new research commissioned by the government, we felt we were able to conclude that NAFTA taken in isolation clearly had (modest) positive effects, both on U.S. trade and real income. Nevertheless, poll results show that not all Americans agree with that interpretation of events. Many mix together the effects of NAFTA with the effects of the peso crisis.

In the political arena, the public demands measures that are more tangible than econometrically-estimated effects on real income or other theoretical constructs of economists. For better or worse, we are stuck with having to think about jobs and the trade balance. In my remarks I am going to talk about both approaches, the economist's preferred focus on the level of trade and real income, as well as the public's focus on the trade deficit and employment.

More jobs, or *better* jobs?

Let me start with my most important message. The opening of foreign markets raises demand for our goods, which raises our real income. The increase in real income can take different forms. When there is a lot of slack in the economy, as there was when President Clinton first took office, the increase in demand for American goods shows up as higher output and employment in exporting industries. The rapid growth in exports over the last five years has contributed importantly to the 12 million jobs that were created during the first Clinton Administration.

But now, in 1997, the economy is close to full employment. The pool of unemployed workers is sufficiently small that jobs created in one sector tend to pull workers away from other sectors. They tend to add little to total employment. But they still add to American real incomes. The improvement shows up in the statistics that export jobs pay higher wages than other jobs.[ii] It might also show up as a real appreciation of the dollar.

In other words, market opening consistently raises real income. In the first Clinton Administration, much of the effect showed up in the form of **more** jobs. In the second Clinton Administration, the effect is showing up primarily in the form of **better** jobs. That's the message.

Recent external deficits

Just as job-creation is less of a concern once we are close to the constraints of full employment, so the trade balance is less of a concern when we are up against the constraints of potential output. Nevertheless, I will talk a bit about recent external deficits.

The trade deficit on Goods & Services is still well below the 1987 peak of $153 billion, especially as a share of GDP. But it has been rising since its 1991 low-point of $30 billion, and in

1996 reached $114 billion.

The current account deficit likewise remains slightly below the 1987 peak of $167 billion, especially as a share of GDP. But it too is well up from its 1991 low-point of $10 billion, reaching $165 billion in 1996.

What have been the causes of these movements over the last ten years? The 1985-87 depreciation of the dollar was a major cause of the subsequent trade balance improvement. The 1990-91 recession was another clear source of "improvement," by depressing imports. (The current account deficit actually disappeared in early 1991 because, on top of the recession, we received transfers from Japan, Saudi Arabia, Kuwait, and others, in association with the Gulf War.)

I think that the most important reason why the trade deficit and current account deficit have grown over the last year, or for that matter over the last six years, is that the US has grown more rapidly than our trading partners. [See chart.]

As a share of GDP, the current account deficit is about the same as in 1989, the last time that unemployment was almost this low. [If even a small share of the statistical discrepancy is judged to belong in the current account, then it is currently better than 1989.] As a matter of pure macroeconomics, I am not too worried about the "deterioration" of the last six years. That it represents rapid growth sucking in imports is good. Better yet, both national saving and investment have increased steadily as shares of GDP. [See chart.] The reason for the widening current account deficit evidently is that investment is increasing more rapidly than national saving. This is not a bad thing. (National saving and investment rates generally rise during expansions, but in this case they have been increasing even on a cyclically adjusted basis. See chart.)

The recent situation is very different from the much larger current account deterioration between the 1970s and 1980s. This was a fall in the national saving rate: the famous fiscal profligacy of the first Reagan Administration, and a continued fall in private saving in the 2nd Reagan and Bush Administrations. The declines in National Saving and Investment were grounds for concern, especially because they had already been low in the 1970s. Our low rates of National Saving and Investment are leading candidates to explain our low rate of productivity growth since 1973, and so the recent improvements are good news. So far in the 1990s we have made up a little of the earlier decline, but only a little. [See table.]

Prognosis: Houtakker-Magee and Current account sustainability

What about 1997 and the future? The trend is likely to continue this year: growth was strong in the first two quarters of the year, and shows little sign of slowing down in the third. The trade deficit so far this year is running 3.7% above last year [Jan.-July]. The budget deficit this year is also continuing its strong improving trend, so it is quite possible that national saving, investment, and the current account deficit will continue to increase.

Longer-term forecasts regarding the trade balance seem to be divided over whether or not there will be a strong deterioration in the coming years. Differences in assumptions about exchange rates and income levels account for much of that. But differences in assumptions about income elasticities of import demand are also making a difference.

Some models have the property that the U.S. elasticity of demand for imports is much higher than the elasticity of the Rest of the World's imports from the U.S. with respect to their income. This property goes back to Houthakker-Magee (1969). The implication is that, holding constant relative growth rates and other determinants, the U.S. trade balance will get steadily worse over time. Indeed, the observation of long-term secular decline in U.S. trade drives the empirical finding and also gives it its only real intuitive plausibility.

These doomsday forecasts certainly merit thinking about. But I have my reservations. It is hard to interpret the hypothesis in terms of saving-investment, even if one does not demand it meet the full rigors of the academically-fashionable intertemporal-optimization theory of the current account. My critique starts from the observation that an equation in which imports are determined solely by the size of the importing economy, with no constraint from the size of the exporting economy, only makes sense for a short-term time series, e.g., over the course of one or two business cycles. It will not do for the long run. Consider U.S. imports from Asia. Within any one decade, it is fine to estimate imports from Asia as a function of U.S. income and relative prices. But does anyone think that this equation, if estimated for the 1960s, would still fit in the 1990s, when Asian economies are many times larger and the U.S. imports correspondingly more goods from them? One needs some measure of the size of the exporting economy in the equation, some notion of supply. I fear that models that lack such supply-side elements may be inadequate for thinking about the long run.

A technical aside

Paul Krugman, in an insufficiently studied 1989 article, argued several propositions: (1) There is a remarkable pattern in which, despite the high import elasticities in some countries (like the U.S.), which would seem to portend secularly declining trade balances, these countries coincidentally seem to grow more slowly than their trading partners, with the result that their trade balances don't deteriorate as much as expected. (2) If one derives a trade equation from the modern theory of trade in imperfect substitutes, then the exporting country's income belongs in the equation, alongside the importing country's income. (3) If one nevertheless omits the exporting country's income, it can be shown that econometric estimates will (spuriously) make it look as if slow-growing countries have higher elasticities than they in fact do. [The missing effect of foreign growth is appropriated by the domestic term]. Thus the first paradox, the apparent correlation between export elasticities and growth rates, is explained.

Krugman did not undertake a full-fledged test of his hypothesis by estimating a global gravity model of bilateral trade. I have now done this (with Shang-Jin Wei of Harvard University), and the results seem to bear out his prediction. When one includes the output (and income per capita) of the exporting country, along with those of the importing country, the coefficient on the exporting country's income is highly significant, and is almost as high as the coefficient on the importing country's income. (The sample is 1970, 1980, 1990 and 1992 pooled, on data for pairs among 63 countries, yielding 2245 observations. See Table 2.) The key question, for the question of the sustainability of the U.S. current account deficit, is whether the U.S. elasticities are different from those for other countries (and higher on the import side than the export side). The answer is "no." This applies regardless whether the whether the equations are estimated in levels or first differences. (In the latter case, the coefficient elasticity is very slightly

lower for U.S. exports than for other countries', and slightly higher for U.S. imports than for other countries; but the differences are not at all significant statistically.) More research is required. But this piece of evidence suggests that the Houthakker-Magee finding is an artifact; at least that it should not be used to think about the long run or to conclude that the U.S. current account deficit is not sustainable.

High levels of exports and imports are good

The trade balance can of course be equivalently regarded as saving minus investment, income minus spending, and exports minus imports. I have explained why I would rather focus on the level of National Saving and Investment rather than the difference (and the same is true for the level of income and spending rather than the difference). But I'd now like so say something about focusing on the level of exports and imports, rather than the difference.

In negotiating reductions of trade barriers, the Clinton Administration is continuing the policies of other post-war Administrations. These pro-trade policies have succeeded in promoting the degree of integration of the world economy. I mentioned earlier that, as a result, trade has increased more rapidly than income. [Some other factors in addition to government free-trade policies have also played a role: declining transport costs due to technological and economic innovation, and also the rise of Newly Industrializing Countries in East Asia and elsewhere.]

How do we know that increases in the level of trade are good? The classical theory of comparative advantage tells us that there are gains from trade. Modern "New Wave" theories of trade tell us the same thing. The classical theory of course goes back to Adam Smith and David Ricardo. It assumes constant returns to scale, perfect competition, and fixed technology, assumptions that are not very realistic. As is well known, the classical theory concludes that all countries gain from trade. Less well-known is that the "New Wave" theory -- which more realistically assumes increasing returns to scale, imperfect competition, and changing technology -- can be viewed as providing equally strong, or stronger, support for the sort of free-trade policies that the U.S. has followed throughout the post-war period, that is, multilateral and bilateral negotiations to reduce trade barriers. To be sure, these theories say that, under certain very special conditions, one country can get ahead by interventions (e.g., subsidies to strategic sectors), provided the actions of other countries are taken as given. But these theories also tend to have the property that a world in which everyone is subsidizing at once is a world in which everyone is worse off, and that we are all better off if we can agree to limit subsidies or other interventions.

Bilateral or multilateral agreements where other sides make concessions to our products, in addition to whatever concessions we make, are virtually the only sorts of trade agreements we have made. Indeed, most recent trade agreements [like NAFTA] have featured much larger reductions in import barriers on the part of our trading partners than we are required to make. The reason for this is that their barriers were higher to start with than ours. But the natural implication is that such agreements raise foreign demand for our products by more than they raise our demand for imports. Hence we are likely to benefit from a positive terms of trade effect. This just adds to the usual benefits of increased efficiency of production and gains to consumers from international trade.

Citing theory is not a complete answer to the question, "How do we know that growth in the level of trade is good?" So I would like to add a piece of empirical evidence. There is a large literature testing the determinants of countries' growth. Investment in physical capital and investment in human capital are the two determinants that emerge the most strongly. But other factors matter as well. Estimates of growth equations have found a role for openness, measured for example as the sum of exports and imports as a share of GDP. But major concerns of simultaneous causality between growth and trade have been expressed. Some research a co-author and I completed just before entering the government -- Frankel and Romer (1996) -- aimed to deal with the endogeneity of trade by using as instrumental variables the exogenous determinants from the aforementioned gravity model of bilateral trade, such as proximity to trading partners. We look at a cross-section of 100 countries during the period since 1960. We find that the effect of openness on growth is even stronger when we correct for the endogeneity of openness than in standard OLS estimates.

****

revisions to be made for October speech

(1) (DONE) Explain that

The opening of foreign markets raises demand for our goods, which raises our real income. The increase in real income can take different forms. When there is a lot of slack in the economy, as there was when President Clinton first took office, the increase in demand for American goods shows up as higher output and employment in exporting industries. The rapid growth in exports over the last five years has contributed importantly to the 12 million jobs that were created during the first Clinton Administration.

But now the economy is close to full employment. The pool of unemployed workers is sufficiently small that jobs created in one sector tend to pull workers away from other sectors. They tend to add little to total employment. But they still add to American real incomes. The improvement shows up in the statistics that export jobs pay higher wages than other jobs (even after adjusting for various factors). It might also show up as a real appreciation of the dollar.

In other words, market opening consistently raises real income. In the first Clinton Administration, much of the effect showed up in the form of **more** jobs. In the second Clinton Administration, the effect is showing up primarily in the form of **better** jobs.

(2) update trade policy, especially footnote 1.

References

Frankel, Jeffrey, and David Romer, "Trade and Growth: An Empirical Investigation" NBER Working Paper No. 5476, March 1996. Revised, December 1996.

Frankel, Jeffrey, with Ernesto Stein and Shang-Jin Wei,
Regional Trading Blocs, Institute for International Economics, Washington DC, forthcoming 1997.

Houthakker, Hendrik, and Stephen Magee, "Income and Price Elasticities in World Trade," Review of Economics and Statistics 51, 2, May 1969, 1041-1105.

Krugman, Paul, "Differences in Income Elasticities and Trends in Real Exchange Rates," European Economic Review 33, 5, May 1989, 1031-1046.

Richardson, J.David, and Karin Rindahl, 1996, Why Exports Matter: **More!** Institute for International Economics and The Manufacturing Institute, Washington, DC.

The White House, 1997, Study on the Operation and Effects of the North American Free Trade Agreement, Washington DC, July.

Notes

White House (1997).

Richardson and Rindal (1996) find that jobs in plants that export pay 10 percent higher wages than other jobs, after correcting for plant size, industry, and location.

The gravity model is fully explained in Frankel, Stein and Wei (1997).

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:29-SEP-1997 10:53:40.00

SUBJECT: Current draft of the memo to POTUS on GCC

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Janet,
Larry and Jon Gruber and you and I still have many concerns with the current draft of the letter. But it appears that NEC's assessment is that if anyone still has major objections, the only alternative might be to kill the memo completely; i.e., that agreement on language is not possible. So we may face a decision on how we feel about that. (Larry, for example, apparently would rather remove the SO2 discussion entirely, then have it go in as it is.)
JF
---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/29/97 10:48 AM ----------

Peter R. Orszag
09/29/97 08:58:24 AM
Record Type: Record

To: See the distribution list at the bottom of this message
cc:
Subject: Current draft of the memo

Attached is the most recent draft of the memo. Please give me your comments.

Thanks,
Peter

Message Sent

To:_____
JONATHAN.GRUBER @ MS01.DO.treas.sprint.com @ INET @ LNGTWY
Daniel K. Tarullo/OPD/EOP
David B Sandalow/CEQ/EOP
Janet L. Yellen/CEA/EOP
Jeffrey A. Frankel/CEA/EOP

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D60]MAIL45600417V.216 to ASCII,
The following is a HEX DUMP:

September 28, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
DANIEL TARULLO
KATHLEEN McGINTY

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 on September 18. We also held a principals meeting on Friday, and will hold another one tomorrow, 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 several aspects of a tradeable permits system, including:
  - →The benefits of a permit trading system relative to traditional regulation;
  - →The lessons offered by the SO_2 trading program; and
  - →Direct allocation versus auctioning with revenue recycling;
- Explores some of the costs and benefits of a gradual versus aggressive approach; 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 (CO_2) accounts for more than 85 percent of U.S. greenhouse gas emissions. Roughly one-third of CO_2 emissions are from transportation, one-third from buildings and one-third from industry.[1] U.S. CO_2 emissions are now approximately 10 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.

In addition to the discussion below, the appendix -- produced by Jack Gibbons -- presents more detailed data and figures on the sources of emissions.

TRANSPORTATION

Transportation contributes 31 percent of of U.S. CO_2 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 CO_2 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%

[1] In this accounting, the CO_2 produced to generate electricity is charged to the sector using the electricity. Taken together, emissions from all electricity production amount to 36 percent of CO_2 emissions.

BUILDINGS

Residential buildings produce 19 percent of U.S. CO_2 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 CO_2 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 CO_2 emissions. Emissions from this source are expected to grow at 0.8 percent per year (4 million tons). About 80 percent of all industrial CO_2 emissions come from petroleum refining, chemicals, paper, lumber, and metals.

Industry: Sources of CO_2 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 CO_2 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 CO_2 emissions.

The table below shows that coal accounts for 50 percent of electricity generated in the U.S., but 77 percent of CO_2 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 CO_2 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. 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 pollution for 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 mentioned the specific case of fuel efficiency standards. The CAFE standard for automobiles was introduced in 1978 at a level of 18 mpg, and tightened until it reached 27.5 mpg in 1985. Fuel efficiency rose significantly during the same

period, with average miles per gallon increasing by roughly 50 percent between 1975 and 1985. But it is difficult to determine whether fuel efficiency rose because of the CAFE standards or because of higher fuel prices: The two oil shocks in the 1970's increased consumer demand for more efficient vehicles.

Since 1985, fuel efficiency has remained stagnant. Since real gasoline prices have fallen steadily in the 1980's and 1990's, fuel economy would likely have fallen -- rather than remained stagnant -- over this period if not for the CAFE standards. Technology relevant to fuel economy has continued to improve at a rate that would allow fuel efficiency to climb about 2 percent per year, but auto makers are using this improved technology to add features such as increased vehicle horsepower and size, not fuel economy. Indeed, the past decade has seen a dramatic rise in sales of fuel-inefficient light trucks -- first minivans and pick-ups, then sport utility vehicles -- which now account for nearly half of all passenger vehicle sales.

Proponents of fuel efficiency standards argue that further increases in CAFE standards could re-route this trend of technical improvement to greater mileage. Some have proposed modifications to CAFE to make it more flexible and cost-efficient, such as allowing trading between companies, or (as part of a broader emissions trading program) with other sectors. Fuel-efficiency standards could also be used to promote commercial introduction of PNGV vehicles with double or triple current fuel economy. (At present, our PNGV partners have pledged only to develop prototypes, but have not committed to sell them.)

Raising CAFE standards, however, can entail substantial -- albeit hidden -- costs. First, consumers have revealed their preference to use technology for improved features rather than fuel efficiency -- and forcing them to reverse this preference would be both unpopular and costly. For example, several studies have estimated the cost of reducing carbon emissions with CAFE standards. One 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; another estimated that raising CAFE standards to 40 miles per gallon would be equivalent to a carbon price of $104 per ton. Second, improving fuel efficiency doesn't necessarily reduce total fuel consumption, since it *reduces* the cost per mile travelled and thus encourages people to drive more. Third, because standards apply only to new cars and vehicles, an increase in CAFE takes a decade or more to work its way fully through the vehicle fleet -- so the impact of any CAFE increase would not be fully effective by 2010. Furthermore, increasing CAFE standards would be politically difficult. Auto-makers will resist efforts to increase standards, especially for sport-utility vehicles -- where the Big 3 make much of their profits (up to $10,000 per vehicle).

The SO_2 Example: How Much Can We Learn From It?

The United States has more experience than any other country with emissions trading programs. The leading example is probably the sulphur dioxide (SO_2) emissions allowance trading program, part of the Clean Air Amendments of 1990. This statute required a 50 percent reduction in SO_2 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.) A natural question is whether the experience under the SO_2 programs

provides insight into a carbon emissions trading system.

The SO_2 experience demonstrates three things:

- First, a tradeable permit system is an attractive system for reducing the cost of meeting some environmental problems. Especially relative to the previous command-and-control approach to reducing SO_2 emissions, the tradeable permits program is widely hailed as a success in producing cost-effective environmental protection.

- Second, the cost estimates before the trading system began operations were too high. Around the time that the 1990 Amendments were enacted, a commonly held view was that achieving the targeted reduction in SO_2 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 SO_2 allowances ranges between $90 and $120 per ton -- despite the fact that SO_2 emissions from utilities in 1995 and 1996 were 3 million tons lower than required.

- Third, a grandfathered permit program may not be viewed as a tax -- even if it raises energy prices. We are not aware of anyone who has charged that the tradeable SO_2 permits represent a tax.

There are several important caveats, however, that may raise questions about the applicability of the lessons from the SO_2 program:

- A carbon emissions program would be *substantially* larger than the SO_2 program: The annual stock of permits under the SO_2 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. And a significant reduction in carbon emissions will require much more fundamental changes in the structure of the American economy than the SO_2 program. Treasury and CEA argue that any emissions trading system for carbon will be substantially more difficult -- and perhaps even impossible -- to administer than is the case for SO_2, while EPA does not believe that the difference in scale would make much difference in administering the program.

- Simple price comparisons -- showing that the actual permit prices are much lower than predicted -- are somewhat misleading. Most of the early price estimates conflated the two phases of the program (we're still in the first phase), and were based on inaccurate guesses as to the provisions of the final bill. The last pre-enactment estimate -- the one with the best information about the legislation that would actually be passed -- projected that the permit price would be between $170 and $200 per ton. The degree of true prediction error was thus significantly smaller than some have suggested.

- The remaining discrepancy between predicted and actual permit prices under the SO_2 program partially reflects the

deregulation of the freight-carrying railroads -- a development that had nothing to do with the SO_2 program -- which facilitated increased use of low-sulphur coal. By definition, it is impossible to know whether similar unexpected future policy actions will affect a carbon trading program.

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 allocating does not in any way avoid the role of higher energy prices in reducing carbon emissions.

To summarize the pros and cons:

DIRECT ALLOCATION

PROS

- Not characterized as a tax: An allocation program does not involve directly raising revenue. Previous allocation programs -- such as the SO_2 program -- have not been viewed as a tax, although that could be because they were sufficiently small to avoid being a target for demagoguery.

- Corporate support: Our outreach effort suggests that an allocation system could be crucial to generating corporate support -- or at least minimizing opposition -- for the effort to reduce greenhouse gas emissions.

- Historical precedent: The SO_2 program would serve as a precedent for a grandfathered permit system.

CONS

- Regressivity: Even with allocated permits, companies are likely to pass most of the higher energy costs on to consumers. Any program that involves direct allocation to businesses 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.

- Corporate welfare: One way to think about the difference between direct allocation and auctioning is to recognize that 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. The optics of "giving away" to companies as much as $50 to $100 billion per year, which represents about *10 to 20 percent of total after-tax corporate profits,* may be difficult.

- Inefficiency: Treasury and CEA have grave reservations about the efficiency -- and indeed even the feasibility -- of an allocation system, especially if the permit requirement is 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 the cutoff level).

AUCTIONS

PROS

- 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, $50 billion raised from auctioning permits could be used for one of the following:

  →Exclude over $3,000 of payroll from both parts of the 12.4 percent OASDI tax;

  →Cut the employees' OASDI payroll tax (currently 6.2 percent) by 25 percent; or

  →Reduce the 15 percent income tax rate in the lowest bracket to 12.7 percent.

CONS

- 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.

- An auction would be more easily characterized as a tax than an allocation program. Although we could emphasize the

differences between an auction and a tax, the auction would be scored by budget experts as a revenue flow to the Treasury.

III. THE COSTS AND BENEFITS OF A GRADUAL APPROACH

Absent policy interventions, atmospheric greenhouse gas concentrations will increase during the next century to levels unknown on this planet for 50 million years. Some of your advisers argue that, 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.

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.[2] The heart of the debate among your advisers is over the degree of deflection from the business-as-usual path: whether it is better to start small and grow over time, or whether it is crucial to begin with a more "front-loaded" reduction. The sections below briefly summarize the relevant arguments, which will be presented in more detail in the decision memorandum we submit to you next week.

The case for a front-loaded approach

Those in favor of a more "front-loaded" approach -- such as implied by reaching 1990 levels by 2010 -- argue that if the United States delays emissions reductions, it seems likely that other developed countries will do so too. It will be much longer, as well, before developing countries take any steps to reduce emissions. A slow start on our part therefore increases the carbon emitted into the atmosphere, and forces more dramatic emissions reductions later to achieve the same ultimate CO_2 concentration.

- **Effect of delay on later emissions reductions.** For example, if our goal were to stay below 550 ppm of CO_2 in the atmosphere, a ten-year delay in starting emissions reductions would require emissions reductions to proceed twice as fast in later decades. Even assuming steep reductions in greenhouse gas emissions in distant decades (which our children and grandchildren may or may not be able to achieve), reductions must begin soon to avoid serious environmental damage.

[2]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 in Washington, D.C. 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), global emissions must deflect from this "business-as-usual" path by 2020.

The case for a gradual approach

Other advisers are extremely concerned that a target anywhere close to 1990 emissions levels by 2010 would be excessively costly, mirroring the oil shocks of the 1970s and imposing a reduction in the living standards of the average family of about $1,000 -- equivalent to a tax on consumers at least five times as large as the Administration's 1993 BTU tax proposal. These advisers argue that 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 two major reasons that a more rapid approach raises overall costs:

- ***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.

Responding to the concern that a more gradual approach may delay the pace of emissions reductions in the developing countries, Treasury and CEA argue that even if 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.

On the other hand, the comparison of 1990 by 2010 to the oil shocks may be misleading because the oil shocks were sudden and unanticipated, whereas businesses would have a decade or more to plan for a climate change regime. There would be no climate change "shock," in the sense that term is used to describe the experience of the 1970's -- since markets would have many years for orderly adjustment.

IV. 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, 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 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 constituencies 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 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.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:29-SEP-1997 19:16:57.00

SUBJECT: principals meeting on superfund Thursday

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Michele Jolin (CN=Michele Jolin/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Alice H. Williams (CN=Alice H. Williams/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

CC: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
I'm told there will be a principals meeting on superfund on Thursday, mainly to update everyone on the status of the negotiations on the reauthorization bill. I'm not sure yet where and when exactly.

I've been to four superfund meetings so far, and my sense is that all sides (Administration, and Senate Republicans and Democrats) are very, and probably unnecessarily, entrenched and a bill this session is unlikely. I don't see any really big CEA issues currently hotly debated. I think the things we wanted most are in there, although perhaps not in optimal form. Mainly I think that the Administration should compromise a bit here and there to get resolution and not have the important reforms wait anoth er year.

If you'd like to attend the meeting, let me know and I'll prepare to brief you about the specifics.
(I'll be out Tuesday at the science summit on climate change, but I'll be back Wednesday.)

Adele

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Peter R. Orszag (CN=Peter R. Orszag/OU=OPD/O=EOP [OPD])

CREATION DATE/TIME:29-SEP-1997 08:58:32.00

SUBJECT: Current draft of the memo

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Daniel K. Tarullo (CN=Daniel K. Tarullo/OU=OPD/O=EOP @ EOP [OPD])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: David B Sandalow (CN=David B Sandalow/OU=CEQ/O=EOP @ EOP [CEQ])
READ:UNKNOWN

TO: JONATHAN.GRUBER (JONATHAN.GRUBER @ MS01.DO.treas.sprint.com @ INET @ LNGTWY [UNKNOWN])
READ:UNKNOWN

TEXT:
Attached is the most recent draft of the memo. Please give me your comments.

Thanks,
Peter========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D39]MAIL423823175.216 to ASCII,
The following is a HEX DUMP:

September 28, 1997

MEMORANDUM FOR THE PRESIDENT

FROM: GENE SPERLING
DANIEL TARULLO
KATHLEEN McGINTY

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 on September 18. We also held a principals meeting on Friday, and will hold another one tomorrow, 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 several aspects of a tradeable permits system, including:
  - →The benefits of a permit trading system relative to traditional regulation;
  - →The lessons offered by the SO_2 trading program; and
  - →Direct allocation versus auctioning with revenue recycling;
- Explores some of the costs and benefits of a gradual versus aggressive approach; and

- Explores a possible escape clause mechanism to limit the costs of a permit system.

[Automated Records Management System Hex-Dump Conversion]

I. SOURCES OF EMISSIONS IN THE UNITED STATES

Carbon dioxide (CO_2) accounts for more than 85 percent of U.S. greenhouse gas emissions. Roughly one-third of CO_2 emissions are from transportation, one-third from buildings and one-third from industry.[1] U.S. CO_2 emissions are now approximately 10 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.

In addition to the discussion below, the appendix -- produced by Jack Gibbons -- presents more detailed data and figures on the sources of emissions.

TRANSPORTATION

Transportation contributes 31 percent of of U.S. CO_2 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 CO_2 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%

[1] In this accounting, the CO_2 produced to generate electricity is charged to the sector using the electricity. Taken together, emissions from all electricity production amount to 36 percent of CO_2 emissions.

BUILDINGS

Residential buildings produce 19 percent of U.S. CO_2 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 CO_2 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 CO_2 emissions. Emissions from this source are expected to grow at 0.8 percent per year (4 million tons). About 80 percent of all industrial CO_2 emissions come from petroleum refining, chemicals, paper, lumber, and metals.

Industry: Sources of CO_2 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 CO_2 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 CO_2 emissions.

The table below shows that coal accounts for 50 percent of electricity generated in the U.S., but 77 percent of CO_2 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 CO_2 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. 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 pollution for 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 mentioned the specific case of fuel efficiency standards. The CAFE standard for automobiles was introduced in 1978 at a level of 18 mpg, and tightened until it reached 27.5 mpg in 1985. Fuel efficiency rose significantly during the same

period, with average miles per gallon increasing by roughly 50 percent between 1975 and 1985. But it is difficult to determine whether fuel efficiency rose because of the CAFE standards or because of higher fuel prices: The two oil shocks in the 1970's increased consumer demand for more efficient vehicles.

Since 1985, fuel efficiency has remained stagnant. Since real gasoline prices have fallen steadily in the 1980's and 1990's, fuel economy would likely have fallen -- rather than remained stagnant -- over this period if not for the CAFE standards. Technology relevant to fuel economy has continued to improve at a rate that would allow fuel efficiency to climb about 2 percent per year, but auto makers are using this improved technology to add features such as increased vehicle horsepower and size, not fuel economy. Indeed, the past decade has seen a dramatic rise in sales of fuel-inefficient light trucks -- first minivans and pick-ups, then sport utility vehicles -- which now account for nearly half of all passenger vehicle sales.

Proponents of fuel efficiency standards argue that further increases in CAFE standards could re-route this trend of technical improvement to greater mileage. Some have proposed modifications to CAFE to make it more flexible and cost-efficient, such as allowing trading between companies, or (as part of a broader emissions trading program) with other sectors. Fuel-efficiency standards could also be used to promote commercial introduction of PNGV vehicles with double or triple current fuel economy. (At present, our PNGV partners have pledged only to develop prototypes, but have not committed to sell them.)

Raising CAFE standards, however, can entail substantial -- albeit hidden -- costs. First, consumers have revealed their preference to use technology for improved features rather than fuel efficiency -- and forcing them to reverse this preference would be both unpopular and costly. For example, several studies have estimated the cost of reducing carbon emissions with CAFE standards. One 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; another estimated that raising CAFE standards to 40 miles per gallon would be equivalent to a carbon price of $104 per ton. Second, improving fuel efficiency doesn't necessarily reduce total fuel consumption, since it *reduces* the cost per mile travelled and thus encourages people to drive more. Third, because standards apply only to new cars and vehicles, an increase in CAFE takes a decade or more to work its way fully through the vehicle fleet -- so the impact of any CAFE increase would not be fully effective by 2010. Furthermore, increasing CAFE standards would be politically difficult. Auto-makers will resist efforts to increase standards, especially for sport-utility vehicles -- where the Big 3 make much of their profits (up to $10,000 per vehicle).

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deregulation of the freight-carrying railroads -- a development that had nothing to do with the SO_2 program -- which facilitated increased use of low-sulphur coal. By definition, it is impossible to know whether similar unexpected future policy actions will affect a carbon trading program.

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 allocating does not in any way avoid the role of higher energy prices in reducing carbon emissions.

To summarize the pros and cons:

DIRECT ALLOCATION

PROS

- Not characterized as a tax: An allocation program does not involve directly raising revenue. Previous allocation programs -- such as the SO_2 program -- have not been viewed as a tax, although that could be because they were sufficiently small to avoid being a target for demagoguery.

- Corporate support: Our outreach effort suggests that an allocation system could be crucial to generating corporate support -- or at least minimizing opposition -- for the effort to reduce greenhouse gas emissions.

- Historical precedent: The SO_2 program would serve as a precedent for a grandfathered permit system.

CONS

- Regressivity: Even with allocated permits, companies are likely to pass most of the higher energy costs on to consumers. Any program that involves direct allocation to businesses 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.

- Corporate welfare: One way to think about the difference between direct allocation and auctioning is to recognize that 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. The optics of "giving away" to companies as much as $50 to $100 billion per year, which represents about *10 to 20 percent of total after-tax corporate profits,* may be difficult.

- Inefficiency: Treasury and CEA have grave reservations about the efficiency -- and indeed even the feasibility -- of an allocation system, especially if the permit requirement is 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 the cutoff level).

AUCTIONS

PROS

- 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, $50 billion raised from auctioning permits could be used for one of the following:

  →Exclude over $3,000 of payroll from both parts of the 12.4 percent OASDI tax;

  →Cut the employees' OASDI payroll tax (currently 6.2 percent) by 25 percent; or

  →Reduce the 15 percent income tax rate in the lowest bracket to 12.7 percent.

CONS

- 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.

- An auction would be more easily characterized as a tax than an allocation program. Although we could emphasize the

differences between an auction and a tax, the auction would be scored by budget experts as a revenue flow to the Treasury.

III. THE COSTS AND BENEFITS OF A GRADUAL APPROACH

Absent policy interventions, atmospheric greenhouse gas concentrations will increase during the next century to levels unknown on this planet for 50 million years. Some of your advisers argue that, 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.

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.[2] The heart of the debate among your advisers is over the degree of deflection from the business-as-usual path: whether it is better to start small and grow over time, or whether it is crucial to begin with a more "front-loaded" reduction. The sections below briefly summarize the relevant arguments, which will be presented in more detail in the decision memorandum we submit to you next week.

The case for a front-loaded approach

Those in favor of a more "front-loaded" approach -- such as implied by reaching 1990 levels by 2010 -- argue that if the United States delays emissions reductions, it seems likely that other developed countries will do so too. It will be much longer, as well, before developing countries take any steps to reduce emissions. A slow start on our part therefore increases the carbon emitted into the atmosphere, and forces more dramatic emissions reductions later to achieve the same ultimate CO_2 concentration.

- **Effect of delay on later emissions reductions.** For example, if our goal were to stay below 550 ppm of CO_2 in the atmosphere, a ten-year delay in starting emissions reductions would require emissions reductions to proceed twice as fast in later decades. Even assuming steep reductions in greenhouse gas emissions in distant decades (which our children and grandchildren may or may not be able to achieve), reductions must begin soon to avoid serious environmental damage.

[2]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 in Washington, D.C. 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), global emissions must deflect from this "business-as-usual" path by 2020.

The case for a gradual approach

Other advisers are extremely concerned that a target anywhere close to 1990 emissions levels by 2010 would be excessively costly, mirroring the oil shocks of the 1970s and imposing a reduction in the living standards of the average family of about $1,000 -- equivalent to a tax on consumers at least five times as large as the Administration's 1993 BTU tax proposal. These advisers argue that 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 two major reasons that a more rapid approach raises overall costs:

- ***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.

Responding to the concern that a more gradual approach may delay the pace of emissions reductions in the developing countries, Treasury and CEA argue that even if 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.

On the other hand, the comparison of 1990 by 2010 to the oil shocks may be misleading because the oil shocks were sudden and unanticipated, whereas businesses would have a decade or more to plan for a climate change regime. There would be no climate change "shock," in the sense that term is used to describe the experience of the 1970's -- since markets would have many years for orderly adjustment.

IV. 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, 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 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 constituencies 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 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.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:29-SEP-1997 11:28:27.00

SUBJECT: Passell and Escape Clause

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Janet,
See below. Let's talk about whether we would want to comment off the record to Passell about proposals (made by academics) for an escape clause.
JF
---------- Forwarded by Jeffrey A. Frankel/CEA/EOP on 09/29/97 11:26 AM ----------

pizer @ rff.org
09/29/97 11:16:00 AM
Record Type: Record

To: Jeffrey A. Frankel
cc:
Subject: Re: [Fwd: OP Ed Piece]

Jeff,

The op-ed piece (believe it or not) got rejected as being too technical. However, Peter Passell at the New York Times picked it up and is planning to use it in his column Thursday. He called us this morning asking for names of people in the administration who he could talk to -- off the record -- about the permit-fee idea. Based on your interest, we gave him your name. I thought it best to mention ahead of time that he might call you.

Billy

--
Billy Pizer
Resources for the Future
202-328-5039
pizer@rff.org

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
RFC-822-headers:
Received: from conversion.pmdf.eop.gov by PMDF.EOP.GOV (PMDF V5.0-4 #6879)
id <01IO7OCKYR9C00FSY7@PMDF.EOP.GOV> for "Jeffrey A. Frankel"@oa.eop.gov; Mon,

29 Sep 1997 11:15:12 -0400 (EDT)
Received: from storm.eop.gov (storm.eop.gov)
by PMDF.EOP.GOV (PMDF V5.0-4 #6879) id <01IO7OCI6K0G006BDP@PMDF.EOP.GOV> for
Jeffrey_A._Frankel@oa.eop.gov; Mon, 29 Sep 1997 11:15:10 -0400 (EDT)
Received: from elmo.rff.org ([204.176.103.4])
by STORM.EOP.GOV (PMDF V5.1-7 #6879)
with ESMTP id <01IO7OBX5WD6006B15@STORM.EOP.GOV> for
Jeffrey_A._Frankel@oa.eop.gov; Mon, 29 Sep 1997 11:14:43 -0400 (EDT)
Received: from rff.org ([204.176.103.223])
by elmo.rff.org (Post.Office MTA v3.1 release PO203a ID# 0-34915U200L100S0)
with ESMTP id AAA183 for <Jeffrey_A._Frankel@oa.eop.gov>; Mon,
29 Sep 1997 11:10:17 -0400
Organization: Resources for the Future
X-Mailer: Mozilla 4.02 [en] (WinNT; I)
========== END ATTACHMENT 1 ==========

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeremy B. Rudd (CN=Jeremy B. Rudd/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:30-SEP-1997 16:02:29.00

SUBJECT: Two EPC meeting topics

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Dr. Yellen:

1. The TUAC/BIAC meetings have been set up per usual; they will take place between the close of the first day of the EPC meeting and the supper that evening (they will be two hours long).

2. Ignazio Visco (Shigehara's replacement) will be contacting you soon in order to give you a "broad outline" of the issues that will be discussed at the EPC meeting. If possible, I would very much like to listen in to this conversation, mainly in order to be able to give Ellen Meade (at the Fed.) an overview so that she can begin briefing Governor Meyer.

Thanks.

- Jeremy

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:30-SEP-1997 11:26:02.00

SUBJECT: latest version of the Europe memo

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
I cleaned up the Europe memo so it is in a form that can be circulated.
Let me know if there are any other issues you would like included or
better addressed.

Joe

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D44]MAIL40613427M.216 to ASCII,
The following is a HEX DUMP:

MEMORANDUM

DATE:9/30/97

RE: The effects of aggressive targets and timetables on the U.S. and Western Europe

Aggressive reductions in carbon emissions have substantial economic costs to both the U.S. and Western Europe, and the costs appear to be greater for the Europeans. Western Europe uses less energy per capita and per GDP than the U.S., and has fewer opportunities to make substantial cuts in carbon emissions. Under aggressive emissions paths, GDP losses would be greater in Europe, and both the U.S. and Europe would experience welfare losses in excess of a trillion dollars over the next half century. The U.S. would bear permit prices between $100 and $200, while Western Europe would bear permit prices nearly double those. These economic losses for Europe presume an EU bubble -- without a bubble and EU trading, they would be greater. Full Annex I trading does lower the costs for both, as they purchase carbon permits from Russia, with transfers from the U.S. ranging between $8 and $16 billion in 2010 and increasing thereafter.

U.S. and European Energy Use

The United States uses nearly double the energy per capita and generates more than twice the carbon emissions per capita than Western Europe. This is largely the result of Western Europe's long history with substantially higher energy prices, which are presently about double the U.S. energy prices. Western Europe requires less energy in part because of its higher population density (yielding lower total transportation costs) and long-run adaptations to high energy prices. 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. Since the Europeans already use less energy, and are more reliant on non-carbon energy (e.g., nuclear) than the U.S., opportunities for reducing carbon emissions are more limited for Western Europe than for the U.S.

Descriptions of Aggressive Paths

To assess the relative impacts to the U.S. and Western Europe of aggressive climate policies, we analyzed the results of SGM model runs on two targets and timetables:

1) 1990 in 2010, and
2) -10% of 1990 in 2010.

For both, we review runs with and without Annex I trading. Note that all runs assume that Eastern Europe and the Former Soviet Union can sell paper tons in Annex I trading. Further, SGM models Western Europe as one region, essentially analogous to the EU bubble proposal (although this region includes four non-EU bubble participants). The SGM model projects that both U.S. and Western Europe will experience emissions growth such that, in business as usual, they are 28% above their 1990 emissions levels in 2010. However, more recent projections by the Energy Information Administration indicate that the U.S. will still be about 28% above 1990 levels in 2010, but Western Europe will likely be only about 18% above.

GDP and Consumption Losses Under Aggressive Paths

An aggressive path would lead to a substantial departure from business as usual emissions growth. This constraint on the energy use in the economy can lead to negative economic impacts. The following chart indicates that the GDP losses in 2010 to both the U.S. and Western Europe are significant, but are larger in Europe. These are absolute differences from their BAU GDP level -- as a percentage of their GDP, the losses in Europe are even greater than the U.S. losses.

1. 2010 GDP Losses Relative to BAU for U.S. and Western Europe

	BAU GDP	1990 in 2010, No Trading	1990 in 2010, Annex I Trading	-10% in 2010, No Trading	10% in 2010, Annex I Trading
Western Europe	$6,942 billion	$81 billion	$24 billion	$151 billion	$52 billion
U.S.	$9,185 billion	$20 billion	$13 billion	$36 billion	$30 billion

The present discounted value of foregone consumption provides a welfare measure for the impact of climate policy on both the U.S. and Western Europe.[1] In the 1990 in 2010 scenarios, Western Europe bears consumption losses 25% greater than the U.S. without trade and 30% more with trade. However, Western Europe bears substantially more consumption losses under the -10% case without trade -- summing to more than $7 trillion, Western Europe's losses are 560% greater than the losses borne by the U.S. With trade, Western Europe's losses are much lower, but still 12% greater than those in the U.S.

Permit Prices Under Aggressive Paths

The large losses in GDP and consumption reflect a significant premature turning over of the capital stock stimulated by high carbon permit prices. The following table illustrates that Western Europe has higher marginal costs of abatement reflected in the permit prices. Also note that both Western Europe and the U.S. would face lower permit prices under Annex I trading and would thus be net buyers of permits.

2. Permit Prices in 2010

	1990 in 2010, No Trading	1990 in 2010, Annex I Trading	-10% in 2010, No Trading	-10% in 2010, Annex I Trading
Western Europe	$160/ton	$42/ton	$354/ton	$91/ton
U.S.	$110/ton	$42/ton	$175/ton	$91/ton

[1] These calculations of the present discounted value of foregone consumption assume a time horizon of 2000-2050 and a 5% discount rate.

International Trading of Permits Under Aggressive Paths

Under Annex I trading, the U.S. and Western Europe would buy a substantial number of permits from Eastern Europe and the Former Soviet Union.

3. International Trade of Permits in 2010

	1990 in 2010, Annex I Trading	1990 in 2010, Annex I Trading	10% in 2010, Annex I Trading	10% in 2010, Annex I Trading
	MMTCE	Value of Trades	MMTCE	Value of Trades
Western Europe	-156	$6.6 billion	-166	$15.1 billion
U.S.	-202	$8.5 billion	-180	$16.4 billion

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: DAVID.WILCOX@MS01.DO.treas.sprint.com@INET@LNGTWY (
DAVID.WILCOX@MS01.DO.treas.sprint.com@INET@LNGTWY [UNKNOWN])

CREATION DATE/TIME:30-SEP-1997 22:58:46.00

SUBJECT: targets and timetables

TO: Janet L. Yellen@eop (Janet L. Yellen@eop [CEA])
READ:UNKNOWN

TEXT:
Date: 09/29/1997 08:46 am (Monday)
From: David Wilcox
To: janet
Subject: targets and timetables

<WP Attachment enclosed>

Janet:

The body of the paper looks in good shape, to my eyes. There are still a few instances in which you say "agents" will do something; I've indicated those occurrances where I spotted them.

There was just one instance, at the end of section V, in which it seemed to me you might be vulnerable to being quoted out of context. I suggested a possible remedy.

The "model results" section still seems a bit heavy going for something that you hope the President might read; in the previous draft, I suggested some pruning there, and so have not repeated here.

Given how good the body of the memo is, I didn't think the executive summary did it justice. So, putting my money where my mouth is, I tried crafting something myself. Attached is the result. Use or dispose as you please.

Hope this is more help than hindrence.

Regards,
David Wilcox========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D92]MAIL45240037E.216 to ASCII,
The following is a HEX DUMP:

This memo assesses the economic consequences for the U.S. economy of a program to attain 1990 CO2 emissions levels by 2010. It concludes that such a program would impose emormous costs on the economy while yielding little environmental benefit. However, the memo also has a positive message: It argues that a more back-loaded approach that delays attainment of 1990 levels of emissions until 2040 would impose much lower economic costs (by a factor of between 3 and 10) while capturing nearly as much environmental benefit as the more aggressive approach.

The economic costs of 1990 by 2010

• In the absence of any scheme for international permits trading, "1990 by 2010" would entail a greater reduction in energy use than was achieved during the decade of the oil shocks, and would impose correspondingly greater damage on the economy. Accomplishing this objective would require a tax (or its economic equivalent) on carbon emissions of at least $100 per ton. This would translate into increases of at least 26 cents per gallon on the price of gasoline, x percent in coal prices, and y percent on natural gas prices.

• An idealized system of international permit trading among Annex I countries could cut the required price of permits in half, putting it in the range of $50 to $X per ton. Permit prices in this neighborhood would cause increases in gasoline prices of about 12 to 15 cents per gallon (?), x percent in coal prices, and y percent on natural gas prices. Joint implementation with non-Annex I countries could further reduce the required price of permits in the United States.

•However, a serious problem that has not been adequately addressed either domestically or internationally is that both international permit trading and joint implementation would raise 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.

•The high costs of "1990 by 2010" would stem from two primary causes: First, that program would force a large fraction of the capital stock to be scrapped prematurely -- that is before it had served out its intended lifetime. Second, it would forego the opportunity to wait for the development of carbon-lean technologies.

•The costs to the domestic economy also depend importantly on the method of domestic implementation. The above estimates are derived under the assumption that an efficient mechanism is used -- either a tax on carbon emissions, or a system of tradeable permits that are distributed by auction. Any alternative mechanim (such as performance standards or other forms of "command and control") would multiply the costs to the economy.

The environmental benefits of 1990 by 2010

•The environmental benefits of an aggressive program of emissions abatement would be modest. *Regardless of whether an aggressive or delayed program of emissions reduction is adopted, a significant amount of global warming will occur over the*

next century. The best current estimate is that in the absence of any policy intervention, the average atmospheric temperature will rise about 2-1/2 degrees celsius; even the more aggressive policy approach would only trim this increase to 1-3/4 degrees.

Thus, "1990 by 2010" would impose severe economic costs while yielding little environmental benefit.

A more efficient alternative

•There is a better alternative available to the Administration. Specifically, a program designed to return carbon emissions to 1990 levels by 2040 would attain nearly all of the environmental benefits of its more aggressive cousin, while imposing much lower economic costs.

→Global average atmospheric temperature under the less aggressive approach would *at no time* be more than 0.05 degree Celsius higher yhan under the more aggressive approach. A difference of this magnitude is universally agreed to be utterly irrelevant.

→Economic costs would be lower under the less aggressive approach, by a factor of between 3 and 10.

The body of the memorandum lays out the rationale for these conclusions.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:30-SEP-1997 17:26:00.00

SUBJECT: Japanese GCC proposal that I sent around

TO: Zachary M. Candelario (CN=Zachary M. Candelario/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
The reason not to circulate it is that I think it is a confidential document (in the GoJ, that is). The fact that the proposal is too complicated bears on its practicality.
JF

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:30-SEP-1997 16:35:35.00

SUBJECT: 1996 vs 1990 carbon emissions -- 12% is not correct

TO: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
I spoke with Arthur Rypinski at EIA today about our confusion regarding the many different estimates of 1990 carbon emissions. Here is the bottom line:

1990 carbon emissions (energy related CO2): 1344 MMTCE
1990 carbon emissions (total CO2): 1372 MMTCE

1996 carbon emissions (energy related CO2): 1463 MMTCE
1996 carbon emissions (total CO2): 1496 MMTCE

1996 vs 1990 (energy related CO2): 8.8% higher
1996 vs 1990 (total CO2): 9.0% higher

My estimate of 1996 emissions being 12% above 1990 emissions is based on a comparison of total CO2 carbon emissions with energy related CO2 carbon emissions. I was wrong.

The 1990 estimate changes basically every year because EIA is constantly refining its methodology and because it finds doublecounting errors -- it then goes back and revises the historical estimates based on these modifications. Note that the non-energy related CO2 emissions result primarily from cement manufacturing (~10 MMTCE), accounting for all (energy and non-energy) emissions in the U.S. territories (~10 MMTCE), and odds and ends (~10 MMTCE), such as flare gas.

Rypinski said that EIA's numbers are really only precise to about 0.5% (~7-8 MMTCE).

Joe

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:30-SEP-1997 16:18:44.00

SUBJECT: summary of Borjas paper, as requested.

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Summary by Jon Haveman. As I mentioned, the paper is more about
immigration than tradel========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D52]MAIL40069527G.216 to ASCII,
The following is a HEX DUMP:

How Much Do Immigration and Trade Affect Labor Market Outcomes?

Borjas, Freeman and Katz

Summary

This paper sets out to examine the extent to which immigration and trade have exacerbated the wage differential between skilled and unskilled workers since 1980. The approach is a factor content/factor proportions approach. That is, by looking at the factor content of immigration and trade flows, and correlating that with the factor proportions used in US manufacturing industries you can infer changes in relative wages. Their basic finding is that both immigration and trade have contributed to the expanding wage gap between high school graduates and dropouts and between college graduates versus high school graduates. The influence of trade was narrowed to be the result of trade with LDCs. That is, the impact of changes in trade volumes with developed countries had a negligible impact on factor supplies and hence relative wages.

High School Grad v. Dropouts

Combined, immigration and trade account for roughly half of the increasing differential. Immigration is contributes substantially more than does trade. The differential increased by .109 log points. Immigration accounted for .048 of that number while trade accounted for .009.

College Grad. V. High School Grad

Combined, immigration and trade account for less than 10% of the increased in the wage gap of .191 log points. Immigration accounts for .019 of the change while LDC trade accounts for .010 log points.

The bottom line is that other factors, such as an acceleration of skill-biased technological change, a slowdown in the relative growth of the relative supply of college graduates and institutional changes in the labor market are probably more important that trade and immigration in explaining the widening US wage gaps.

Methodology

In assessing the impact of international trade, the approach is to estimate the implicit labor supply (in efficiency units) of each skill group embodied in trade in manufactures. Imports by source country and exports by receiving country at the 3-digit industry level are examined. Key assumptions in the analysis include the wage elasticity, the elasticity of consumer demand, and the technology used by the domestic industry in replacing the LDC imports in the counter factual. Consumer demand assumed to be inelastic. The wage elasticity is permitted to vary between -.2 and -.4. The results spelled out above are for the preferred specification of inelastic consumer demand (which they admit is extreme), wage elasticity of -.322 and 10 to 15 year old technology used to replace imports. *When the most extreme assumptions are made, trade still explains at most 12% of the HS/dropout differential and less than 10% of the college/HS differential.*

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Peter R. Orszag (CN=Peter R. Orszag/OU=OPD/O=EOP [OPD])

CREATION DATE/TIME:30-SEP-1997 11:34:05.00

SUBJECT: FYI: RFF seems to be proposing an escape clause

TO: Kathleen A. McGinty (CN=Kathleen A. McGinty/OU=CEQ/O=EOP @ EOP [CEQ])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: DAVID.WILCOX (DAVID.WILCOX @ MS01.DO.treas.sprint.com @ INET @ LNGTWY [UNKNOWN])
READ:UNKNOWN

TO: Daniel K. Tarullo (CN=Daniel K. Tarullo/OU=OPD/O=EOP @ EOP [OPD])
READ:UNKNOWN

TO: Todd Stern (CN=Todd Stern/OU=WHO/O=EOP @ EOP [WHO])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: David B Sandalow (CN=David B Sandalow/OU=CEQ/O=EOP @ EOP [CEQ])
READ:UNKNOWN

TO: JONATHAN.GRUBER (JONATHAN.GRUBER @ MS01.DO.treas.sprint.com @ INET @ LNGTWY [UNKNOWN])
READ:UNKNOWN

TO: Gene B. Sperling (CN=Gene B. Sperling/OU=OPD/O=EOP @ EOP [OPD])
READ:UNKNOWN

TEXT:
Something for Everyone:
A Better Policy for Climate Change

By Raymond Kopp, Richard Morgenstern
and William Pizer

SEPTEMBER 29, 1997 -- Over the next few months big business and environmental advocates will bombard the American public with high dollar, slick advertisements reflecting the deep disagreement that exists within the U.S. and across the world regarding global warming and what ought to be done -- or not done. The motivator for this media blitz is the upcoming December meeting of the United Nation's Conference of the Parties in Kyoto, Japan to consider climate change policy options. Environmental advocates hope the U.S. will agree to binding targets and timetables for reductions in the emissions of greenhouse gases (GHG) which may be linked to disastrous changes

in the world's climate. Many in the business community would like nothing better than to see no agreement at all. We propose a policy approach that can make everyone at least somewhat satisfied.

About the only thing the protagonists in this debate can agree upon is that there exists great uncertainty about the two pieces of information that are crucial to the development of a reasonable climate policy: the gains from reducing GHG emissions and the costs of attaining those reductions. While acknowledging our lack of precise information, environmental advocates believe the risks to our planet posed by climate change are so great that aggressive action must be taken now. By the same token they see the cost of that action as relatively low. In contrast, many in the business community see the climate risks as too uncertain and the costs too high to warrant drastic action. They would prefer a wait-and-see policy or, at most, a limited expenditure on GHG emission reductions.

As a compromise, we propose an alternate policy. Recent research using a climate policy model developed at Resources for the Future by Pizer suggests that a hybrid system coupling an emissions target with a relief mechanism for unexpectedly high costs goes a long way towards addressing each groups, concerns. In particular, the policy (1) fixes emissions targets that are binding as long as costs remain reasonable and (2) allows the target to rise somewhat if costs are unexpectedly high.

Consider the position of those concerned about the environment. Their policy of choice is a tradable permit system where each permit gives the holder the right to emit a specified amount of GHG into the atmosphere. By limiting the number of permits, one can precisely control GHG emissions and guarantee they remain below the threshold for disastrous climate change. In contrast, while GHG emissions can be set with certainty using a permit system -- and by implication the benefits of GHG control obtained with certainty-- the cost of control is highly uncertain. That is, the cost to society, in terms of higher prices for fuel and reduced productivity, varies greatly under a permit system.

Within the business community, as well as among consumers in general, the ideal climate policy is one that sets an upper limit on climate related expenditures. Businesses are interested in maintaining a

stable environment for planning and investment. The risk of unexpectedly high compliance costs under a strict permit system thwarts that stability. For that reason, most businesses would prefer some sort of contingent policy that would keep costs low and predictable.

The hybrid system we propose would establish a fixed number of tradable permits based on an emission target. It would then provide additional permits at a pre-specified trigger price. As long as the cost of controlling a ton of GHG emissions remains below the trigger level, the emission target would be attained.

For environmental advocates, the hybrid approach guarantees that emissions will not exceed the tradable permit limit as long as the price of the tradable permits (i.e., the marginal cost of GHG control) does not rise above the trigger price. Based on their belief that the cost of reducing GHG emissions is low) and assuming these beliefs turn out to be correct -- the permit price will never reach the trigger level and emissions will remain capped.

For businesses, the policy guarantees that the cost of control per unit of GHG emitted can never exceed the specified trigger price that would be charged for additional permits (and could always be less). Thus, while business leaders may still feel the benefits of GHG control are not commensurate with costs, they can at least make business plans based on the knowledge of a well-specified cost structure.

The hybrid approach proposed here is not entirely new. Aficionados of U.S. air pollution policy will remember that the 1990 Amendments to the Clean Air Act, which established the sulfur permit trading system, also had a provision that enabled industry to buy additional permits at a pre-specified fee. This option was never exercised because the price of the permits (the cost of sulfur control) began low and has fallen over time. Similar mechanisms have been employed to regulate imports and domestic agricultural production. More recently, economists McKibbin and Wilcoxen went on record as favoring a hybrid policy for GHG controls based on their concern about

enforcement, monitoring and international trade) important issues, but distinct from our focus on benefit and cost uncertainties.

A final advantage of the hybrid policy is its enhanced credibility relative to a straight permit alternative. The idea that binding targets and timetables will remain inflexible in the face of unexpectedly high costs is unrealistic. By providing an automatic mechanism to relieve cost pressure, the hybrid policy stands a much greater chance of remaining in force and consequently convincing businesses to take action immediately (instead of waiting to see if the policy is eventually abandoned).

The current choice of policies facing both environmental advocates and the business community are too tightly drawn. What we propose is a more flexible policy with the potential to address the substantive concerns of both groups, i.e., uncertainties about both benefits and costs. The hybrid policy does just that. By implementing a tradable permit system where the pool of available permits remains fixed as long as the price remains below a reasonable threshold, the risk of catastrophic climate damages is greatly diminished. By capping the potential expenditure on GHG abatement and allowing additional permits to be purchased if costs turn out to be particularly high, the policy protects against runaway costs for business and consumers, enabling sound business planning.

This may not be fully satisfactory from the perspective of an environmental advocate, but if the cost of GHG control is as low as suggested by both the environmental community and our experience with the sulfur trading program, these concerns are unwarranted. Similarly, the business community may be unhappy with the level of required expenditures -- but at least those expenditures remain capped. While a hybrid policy does not address all the thorny issues of GHG control, we believe it provides a valuable degree of freedom to bring the sides together and it may, indeed, be a valuable approach

for the Clinton Administration in Kyoto.

Raymond Kopp is director of, and a senior fellow in, the Quality of the Environment Division at Resources for the Future (RFF). William Pizer is a fellow and Richard Morgenstern is a visiting scholar in the same division.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Joseph E. Aldy (CN=Joseph E. Aldy/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME:30-SEP-1997 18:41:21.00

SUBJECT: comments on technology proposal

TO: Randall W. Lutter (CN=Randall W. Lutter/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Jeffrey A. Frankel (CN=Jeffrey A. Frankel/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Adele C. Morris (CN=Adele C. Morris/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TO: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP @ EOP [CEA])
READ:UNKNOWN

TEXT:
Here is a revised version given the final copy of the 5 Labs study. I
still need to talk to Peter about this.

Joe

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D42]MAIL40718627J.216 to ASCII,
The following is a HEX DUMP:

Comments on $500 million/year Technology Proposal

DOE's response does not appear to have answered the request of the Principals for a detailed description of the "technology option" in terms of specific policies (dollars spent on R&D, dollars spent on diffusion, imposition of standards, price measures, and moral suasion) and their best-guess estimated effects. At first DOE seems to say that the predicted effects are pure R&D, and then it turns out that there are hidden assumptions about public awareness changing or standards being changed. We continue to believe that much, if not all, of the R&D is probably worth doing, particularly along the lines of the PCAST report. But we also continue to believe in a pessimistic bottom line for the odds of incremental payoffs in terms of carbon reductions by 2010. As John Holdren said in his 9/28 presentation, the time lag for the payoff, even to applied R&D, is simply too long to expect that by 2010 we would get more than "diddly" from new spending.

DOE stated that this proposal is based on the efficiency case in the 5 Labs Study. In a review of the proposal presented on 9/29, it appears that there are numerous divergences from the 5 Labs Study efficiency case. In light of the inconsistencies apparent in the proposal, and the substantial methodological flaws in the 5 Labs Study, it seems imprudent to base significant policy decisions on information received thus far. The point was raised at the 8/19/97 meeting on the 5 Labs Study that this study should not go to or be used by principals. To date, there appears to be insufficient justification to modify this view.

General Comments

- The 5 Labs Study indicates that government programs, utility programs, and state programs cost 15% of technology costs (p. 1.13). Since DOE apportions all carbon savings in their proposal to the federal programs listed in the summary chart, we assume that all costs accrue to the federal government. In the "optimistic" assessment of the costs and benefits, DOE claims that government programs will likely only cost about 7% of technology costs, because half of emissions reductions occur through standards (see below). Assuming that this is true, and that the technology costs of the efficiency case range between $26 - $49 billion/year in the optimistic assessment (p. 1.14), then government programs should cost between $1.82 - $3.49 billion/year. However, using a 13.5% government cost stipulation (based on a 15% government program cost, minus 10% [instead of 50%] of these costs because of standards), the costs of government programs would range between $3.51 - $6.62 billion/year. The proposal presented on 9/29 costs 3 to 13 times less than projected by the 5 Labs Study, and yet generates greater carbon savings.

- The proposal employs standards to a much lesser extent than the 5 Labs Study. In the Study, "at least half of the efficiency occurs as a result of federal policies (e.g., standards and carbon permit charges)" (p. 1.13). Since the efficiency case does not include a carbon permit system, we assume that half of the carbon savings in the efficiency case result from standards. However, in this proposal, only about 10% of the emissions

reductions occur due to standards (on the high ends of the ranges, 20 MMTCE out of 206 MMTCE).

- The projected carbon savings for 2010, while indicated as approximately 155 MMTCE, has a range of 127-206 MMTCE. Note that this large range does not overlap with the 5 Labs Study projection of 126 MMTCE (p. 1.12).

- The efficiency case is portrayed in the 5 Labs Study as carbon savings that occur because of already available and cost-effective technologies. In effect, government policies are only necessary to overcome market barriers. However, this proposal appears to be more reliant on R&D than on deployment and diffusion of existing technologies. Using the upper bounds of the ranges of carbon savings, we find that more than half of emissions reductions (104 of 206 MMTCE) result from R&D programs.

Specific Comments

Buildings Sector

Two programs claim to achieve 17-29 MMTCE. Note that under the 5 Labs efficiency case, 25 MMTCE of potential reductions were identified (p. 1.12), with a different penetration assumption than the one provided in the summary chart. The Study employed a 35% penetration rate assumption (p. 3.3), while this summary chart claims to be based on a 15-25% assumption for equipment efficiency and a 25% assumption for 21st Century Housing. With the lower penetration rate assumed in this proposal, we would assume that the carbon savings would be less than those found in the 5 Labs Study -- instead, they are greater. Based on these assumptions and the information provided by the 5 Labs Study, we would expect carbon savings to range between 11-18 MMTCE.

Equipment Efficiency: The 5 Labs Study indicates that a total of 25 MMTCE can be reduced in residential and commercial buildings under the efficiency case. The 9/26 memo describes this set of programs to include fuel cells, even though fuel cells are not in the 5 Labs efficiency case (they only come into play in high efficiency case, although the text is very unclear about whether fuel cells actually generate any benefits prior to 2020).

21st Century Housing: There is insufficient detail provided in the 9/26 memo to identify the appropriate carbon savings in the 5 Labs Study.

Transportation Sector

The 5 Labs Study projects 73 MMTCE reductions in emissions under the efficiency case (p. 1.12), while this proposal estimates carbon savings ranging between 65 - 87 MMTCE. Note that this upper bound is almost equivalent to the high efficiency case with a $25/ton permit fee in the Study (88 MMTCE).

Two PNGV Categories: The 5 Labs Study indicates that annual PNGV funding is approximately $250 million/year (p. 5.2). The two categories of increased PNGV programs would sum to $140 million/year in FY99 and $260 million/year in FY03. This increase is much less than believed necessary to achieve the goals of the PNGV program. The authors of the 5 Labs Study note that for PNGV to be successful, "substantial additional funding for R&D will be required, perhaps two to ten times what is presently being spent" (p. 5.7). The proposal increases funding to just the lower end of this required spending level.

Industry Sector

The 5 Labs Study projects 28 MMTCE of carbon emissions reductions under its efficiency case (p. 1.12). This proposal estimates carbon savings under three categories of programs ranging between 30 - 65 MMTCE. Note that the upper end of this range is 11 MMTCE more than the high efficiency case with a $25/ton permit fee in the 5 Labs Study.

Industries of the Future: In the 5 Labs Study, the list of heavy manufacturing industries in table 4.6 (p. 4.10) corresponds to the list of the Industries of the Future on the DOE webpage (http://www.oit.doe.gov/iof/industry.html). In this table, these industries account for only 9 MMTCE in the efficiency case and 21 MMTCE in the high efficiency case ($50/ton permit system). However, the proposal notes that Industries of the Future programs can achieve carbon reductions ranging between 10 - 20 MMTCE.

Utilities Sector

Three categories of programs claim to generate carbon savings of 15-25 MMTCE. However, the efficiency case in the 5 Labs Study does not project any reductions in carbon emissions in this sector (p. 1.12). Further, the carbon sequestration R&D category of programs is not described in the 9/26 memo.

For additional review of the methodological flaws in the sectoral analyses, refer to earlier memos that provide comments on the 5 Labs Study.

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: DAVID.FISCHER@MS01.DO.treas.sprint.com@INET@LNGTWY (
DAVID.FISCHER@MS01.DO.treas.sprint.com@INET@LNGTWY [UNKNOWN])

CREATION DATE/TIME: 1-OCT-1997 10:28:59.00

SUBJECT: draft of summers climate change memo

TO: Janet L. Yellen@eop (Janet L. Yellen@eop [CEA])
READ:UNKNOWN

TEXT:
Date: 10/01/1997 10:18 am (Wednesday)
From: David Fischer
To: EX.MAIL."yellen_j@a1.eop.gov"
Subject: draft of summers climate change memo

Attached is the latest draft of the Summers climate change memo.========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Error reading attachment 34322272

Attachment name: CCLHS3.WPD
========== END ATTACHMENT 1 ==========

========== ATTACHMENT 2 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
RFC-822-headers:
Received: from conversion.pmdf.eop.gov by PMDF.EOP.GOV (PMDF V5.0-4 #6879)
id <01IOAF2N5JFK00FSCX@PMDF.EOP.GOV> for yellen_j@a1.eop.gov; Wed,
01 Oct 1997 10:22:16 -0400 (EDT)
Received: from storm.eop.gov (storm.eop.gov)
by PMDF.EOP.GOV (PMDF V5.0-4 #6879) id <01IOAF2JOF6O00LX6R@PMDF.EOP.GOV> for
yellen_j@a1.eop.gov; Wed, 01 Oct 1997 10:22:12 -0400 (EDT)
Received: from reston-mx1.telemail.net ([206.229.206.20])
by STORM.EOP.GOV (PMDF V5.1-7 #6879)
with SMTP id <01IOAF2E5AWI006M9M@STORM.EOP.GOV> for yellen_j@a1.eop.gov; Wed,

01 Oct 1997 10:22:03 -0400 (EDT)
X400-Received: by /PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/; converted (ia5-text)
; Relayed; Wed, 01 Oct 1997 10:18:25 -0400
X400-Received: by /PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/; converted (ia5-text)
; Relayed; Wed, 01 Oct 1997 10:18:25 -0400
X400-Received: by /PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/; converted (ia5-text)
; Relayed; Wed, 01 Oct 1997 10:18:25 -0400
X400-Content-type: P2-1984 (2)
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[/PRMD=GOV+TREAS/ADMD=TELEMAIL/C=US/;62710110017991/1290219@TREAS]

X400-Originator: DAVID.FISCHER@MS01.DO.treas.sprint.com
X400-Recipients: yellen_j@a1.eop.gov
========== END ATTACHMENT 2 ==========

RECORD TYPE: PRESIDENTIAL (NOTES MAIL)

CREATOR: Janet L. Yellen (CN=Janet L. Yellen/OU=CEA/O=EOP [CEA])

CREATION DATE/TIME: 1-OCT-1997 20:24:25.00

SUBJECT: Revisions of the Summers memo

TO: David.wilcox (David.wilcox @ treas.sprint.com @ inet [UNKNOWN])
READ:UNKNOWN

CC: David.fischer (David.fischer @ treas.sprint.com [UNKNOWN])
READ:UNKNOWN

TEXT:
Attached is a revised version of the Summers memo.

========== ATTACHMENT 1 ==========
ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
Unable to convert ARMS_EXT:[ATTACH.D95]MAIL43778737A.216 to ASCII,
The following is a HEX DUMP:

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.