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Subseries: Global Climate Change Files - Conferences/Meetings

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Global Change: Strategy Task Force Meeting - 5/22/90

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THE WHITE HOUSE

WASHINGTON

May 21, 1990

MEMORANDUM FOR FRED BERNTHAL
CHRIS DAWSON
THERESA GORMAN
BOB GRADY
BOYDEN GRAY
HENSON MOORE
BILL REILLY
DICK SCHMALENSEE

FROM: ALLAN BROMLEY *Allan*
STEPHEN DANZANSKY

SUBJECT: Meeting of Global Change Strategy Task Force

The Global Change Strategy Task Force will meet Tuesday, May 22 at 4:30 p.m. in Room 340 of the Old Executive Office Building. An agenda is attached.

Our work will focus principally on the upcoming meetings of the IPCC working groups, which begin with Working Group 1 (Science) this week. Each working group is preparing a policymakers summary, which will in turn be incorporated into the summary document to be discussed at the next IPCC plenary meeting in August. Attached you will find the summary of Working Group 3 on Response Strategies, which is chaired by the U.S. The summary was the subject of a meeting of the Working Group on Climate at the State Department last Friday, and we should have available for tomorrow's meeting a compilation of the preliminary comments of the various agencies. Please review the summary and provide any comments at tomorrow's meeting.

Also attached you will find a statement of the U.S. Policy Overview on Global Change. It was prepared by the State Department in anticipation of the White House Conference on Science and Economics Research Related to Global Change, based on prior statements of U.S. policy, but was not subjected to interagency or White House Review at that time. It has subsequently been revised slightly. This document was also the subject of review by the Working Group on Climate, and we should have a compilation of comments on it available tomorrow also. Although this document will not be discussed at the Response Strategies Working Group meeting in Geneva which begins June 4, it will be helpful to have it as support for the positions of the U.S. delegation.

Please call Marcy Anderson at 6630 to advise of your attendance at tomorrow's meeting.

GLOBAL CHANGE STRATEGY TASK FORCE

AGENDA

May 22, 1990

- I. Status of IPCC Working Groups and Process Overview
- II. Negotiation of Global Climate Change Convention - Comprehensive Approach on Greenhouse Gases, Timing, Chairman and Level of Participation
- III. Review of Statement of U.S. Global Climate Change Policy
- IV. Review of Response Strategies Working Group Policymakers Summary
- V. Future of IPCC and Response Strategies Working Group

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Dick Stewart

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Bmtb

Timing
of
Negotiations on a Framework Convention on Climate Change

Issue to be Decided

When and where to initiate preparatory meetings for negotiations on a Framework Convention on Climate Change and when to hold the first formal session of the negotiations, which President Bush has offered to host in the United States.

Essential Information

One of the main objectives of the June 8 WMO/UNEP Joint Bureau meeting will be to decide when and how negotiations on a framework convention on climate change should be carried out. U.S. policy supports the early negotiation of a framework convention to be followed, if appropriate, by negotiation on specific protocols. The WMO/UNEP decision on timing of negotiations of the framework convention will take the form of a joint resolution instructing the heads of each organization how to prepare for the negotiations. An early draft of the proposed resolution legitimizes such action by noting and recalling key resolutions and/or decisions previously passed by the UNGA, WMO, and UNEP. The proposed resolution then authorizes the WMO Secretary General and the UNEP Executive Director to convene jointly:

"... immediately after the fourth session of the IPCC, an open-ended ad hoc legal and technical group to prepare a plan of action to negotiate a framework convention on climate taking into account preparatory work for the Second World Climate Conference (SWCC) and the work of the Preparatory Committee for the UN Conference on Environment and Development."

The draft further authorizes the heads of WMO and UNEP:

"to initiate formal negotiations on a framework convention through an intergovernmental meeting as soon as possible after the Second World Climate Conference taking into account the outcome of the Conference and discussions and recommendations of the forty-fifth session of the General Assembly."

An annex attached to the draft resolution contains a timetable which shows the first preparatory meeting of experts taking place in October and the first negotiating session on the Framework Convention being held in the United States in December. We assume the latter date refers to December 3 - 7 and/or December 10 - 14. This would position the opening negotiating session about a month after the SWCC Ministerial, which ends November 7, and before the close of the UN General Assembly, which normally occurs just before Christmas.

Proposed U.S. Position On Timing

The U.S. should concur with the view that preparatory meetings for the negotiations ought to begin in October in Geneva. Convoking an experts group preparatory meeting in October would help deflect efforts by the UNGA and the SWCC to influence negotiations, since we could then point out that the negotiating process is already underway under the auspices of WMO and UNEP. The IPCC, also located in Geneva and jointly sponsored by WMO and UNEP, would be available to provide secretariat support and technical advice as needed, thus reinforcing the link between the IPCC and the framework convention negotiations.

The U.S. should make a counterproposal on the timing of the first formal negotiating session, favoring early February rather than December, as proposed by WMO and UNEP. Since the U.S. would be hosting this event, it is unlikely that WMO and UNEP would contest our preference. Their only objection is likely to be that by holding the session in December, we could probably avoid having to contend with an UNGA resolution directed at the negotiations. The U.S. would take the position that once the negotiation prepcom process is underway, further comment or direction from other bodies is inappropriate.

Early February would remain our preferred date because February would give us more lead time to handle sight selection and other organizational and financial concerns. With this later date we could also expect to see more progress at the expert level in the preparatory process. It also eliminates the need to compete with Thanksgiving, Christmas, and the holiday season.

Recommendation

1.) That we propose to start the Framework Convention Preparatory process with an experts meeting in Geneva in October.

2.) That we propose to hold the first formal negotiating session on the Framework Convention on Climate Change in the United States in early February.

Withdrawal/Redaction Sheet

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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. List	Clearances (1 pp.)	5/21/90	(b)(6)	

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P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

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(b)(9) Release would disclose geological or geophysical information

III
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U.S. GLOBAL CLIMATE CHANGE POLICY

Overview:

The United States recognizes that climate change presents a potentially serious threat to the global environment and that the international community should cooperate on measures to address this concern. We support the negotiation of a framework convention on climate change to provide the basis for enhanced international cooperation in addressing this issue.

There remain, however, significant scientific uncertainties regarding the magnitude, timing, and regional impacts of climate change. Furthermore, our understanding of the potential economic consequences of measures to limit or adapt to climate change is very limited. We thus support enhanced efforts to improve international understanding of the scientific and economic aspects of this issue.

Given the significant remaining scientific and economic uncertainties, we believe it is premature at this time to implement stringent measures for limiting greenhouse gas emissions solely to mitigate potential climate change. However, while we take steps to refine our understanding of the scientific and economic issues, we support implementing now those measures which are justified in their own right and which might also provide climate change benefits. Should an improved understanding of the climate change issue indicate that further mitigation efforts are warranted, these can be addressed through a protocol(s) to the framework convention.

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U.S. Position on Specific Issues

o International Cooperation:

-- We support international cooperation to assess all aspects of climate change. The United States has been a major supporter and contributor to the activities of the Intergovernmental Panel on Climate Change (IPCC), the primary international forum for addressing this issue.

-- We support the negotiation of a framework convention on climate change. President Bush has offered the United States as the venue for the first round of such talks. We believe the negotiations should begin as soon as feasible after completion of the IPCC's first assessment report.

-- Like the Vienna Convention for the Protection of the Ozone Layer, the framework convention on climate change should include general obligations, cooperation in research and monitoring, exchange of information, conference of the parties, secretariat, and provision for possible subsequent adoption of protocols.

-- Specific agreements on measures for limiting or adapting to climate change should be addressed in a subsequent protocol(s) to the convention as our scientific/economic understanding develops.

o Scientific Understanding:

-- Climate change is arguably the most complex international science policy issue the world has faced. Because there remain significant uncertainties about the timing, magnitude, and regional effects of climate change, further research is essential.

-- This research effort must be international and encompass all the regions of the world. To address this issue the USG is undertaking by far the world's largest global change research program (\$1.1 billion in FY1991) and is planning to contribute to the WMO Climate Studies Fund to support increased international efforts in climatology. We urge all countries to increase their research efforts in order to advance the world's understanding of this problem.

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o Economic Aspects of Climate Change:

-- Although various formulas for limiting greenhouse gas emissions have been proposed, very little work has been done on the economic costs of measures to limit or adapt to climate change. Some preliminary studies show that the costs of stringent measures to limit greenhouse gas emissions could be severe.

-- More economic research, comparable to efforts underway in the scientific area, is needed to reduce the uncertainties regarding the economic impacts of limitation measures. The USG is accelerating work on this issue domestically. We support international efforts to address this vital issue, for example within the IPCC, OECD, and other multilateral fora.

-- More work is also necessary on the potential costs and benefits of global greenhouse gas limitation measures on U.S. trade and competitiveness as a result of economic restructuring and the development of new markets for advanced technologies related to global change.

o Interim ("No-Regrets") Measures:

-- While we are pursuing the serious scientific and economic research that is critical to any responsible approach to climate change, we support taking prompt actions that are fully justified on independent grounds and which might also be beneficial from a climate change standpoint.

-- As reflected in the President's February 5 speech, these so-called "no-regrets" measures include: (1) phasing out CFCs by the year 2000; (2) increasing energy efficiency measures, inter alia, through the National Energy Strategy, Clean Air Act, and new technology development; and (3) implementing a major domestic reforestation initiative and seeking to arrest tropical deforestation through multilateral channels.

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o Targets and Timetables:

-- We do not believe there is sufficient evidence at this time to warrant stringent measures, with potentially serious negative economic consequences, to limit greenhouse gas emissions. The global implementation of interim ("no regrets") measures such as those listed above could significantly limit world greenhouse gas emissions without imposing costly and politically divisive formal targets.

-- While we supported the Noordwijk Conference goal of stabilizing greenhouse gas emissions as soon as feasible, the understanding of what greenhouse gas emissions limitations can be achieved without unacceptable negative economic impacts is unclear. Work is continuing domestically and in the IPCC and other fora to assess the economic implications of this and other goals.

-- Should an improved understanding of the climate change issue indicate that specific limitation efforts are warranted, these can be addressed through a protocol(s) to the framework convention. Such a protocol(s) must have the adherence of countries representing much of the world's land mass and population to be effective.

-- Should the international community eventually agree that greenhouse gas targets and timetables are necessary, we would support a comprehensive approach to consider all greenhouse gas sources and sinks collectively. In addition, we would support implementation mechanisms which are economically efficient and market driven.

-- We have thus proposed that any such protocol address all greenhouse gases, their sources and sinks, comprehensively. We have also proposed that the international community consider the economic advantages of a system of international emissions trading.

o Financial Aid and Technology Transfer Issues:

-- Within the IPCC, LDC representatives have called for: (1) the establishment of new funding sources for climate change related projects in LDCs; and (2) the transfer of technology to LDCs on preferential and non-commercial terms.

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-- The U.S. position is that: (1) existing financial assistance mechanisms and levels should be evaluated for their applicability to LDC climate change needs before the establishment of new sources or additional amounts of funding is considered; and (2) intellectual property rights must be protected in technology transfer arrangements, which should rely to the fullest possible extent on commercial exchanges and channels.

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5/22/90

U.S. Agency Comments on RSWG Papers:

Proposed General Comments:

- o As articulated by IPCC Chairman Bolin at the February Plenary Session, both the Policymakers Summary and the RSWG subgroup reports and topic papers should provide "options" rather than "recommendations". The U.S. delegation should thus in the editing sessions call for modifications to the subgroup reports and topic papers to reflect this approach.
- o Discussions related to protocols to a framework convention on climate change should be limited to the discussions in the legal measures paper. Thus the comments on protocols developed for both the AFOS and CZMS reports should be referred to the legal measures topic coordinators for consideration during their meeting.

Proposed Comments on the RSWG Policymakers Summary:

Page 1, line 14 - change "atmospheric concentrations" to "emissions"

Page 1, line 44 - Add at end of title "AND SINKS"

Pages 1-3 - Sections 2 and 3 - A number of comments have been provided regarding descriptions of scientific issues. These are being referred to the U.S. Working Group I participants for comment and for ensuring consistency with the final Working Group I paper. Comments received include:

Page 1, line 46 - add explanation that water vapor is the largest single greenhouse gas source

Page 2, Figure 1 and following discussion - need to use the figures from the final Working Group I report

Page 2, line 30 - add explanation of radiative forcing and explain the difference between atmospheric concentrations and radiative forcing

Page 3, lines 23 and 24 - improve explanation of CO2 equivalency and explain difficulties of determining equivalency

Page 2, line 48 - add new paragraph: "In addition to estimation of the sources of greenhouse gas emissions, response strategies must consider the "sinks" available for removing gases from the atmosphere. These include forests and oceanic phytoplankton. It is net emissions, not simply emissions

-2-

sources, that are of environmental concern if the goal is to limit rising concentrations of greenhouse gases. Sink expansion may often be a less costly means of accomplishing net emissions limitations. Sink expansion may have important side benefits such as protection of biodiversity in forests and protection of phytoplankton from aquatic pollution."

Page 3, line 3 - add "net increases of" after "in"

Page 3, line 34 - Add the following sentences: "Global economic growth rates, based on estimates from the World Bank, were assumed to average around 2.9 percent from 1985-2000, 2.7 percent from 200-2025, and 1.9 percent from 2025-2100. Global population was assumed to reach 9.5 billion in 2050 and 10.4 billion in 2100."

Page 5, line 4 - add new sentence: "The development of estimates for these and other greenhouse gas sources not included in the Reference Case is a priority area for future research."

Page 6, lines 1-9 - change "centrally planned European" to "Eastern European".

Page 6, line 9 - add "(see attached Table __)."

Page 6, line 38 - add following sentences after "longer-term": "Different options may be preferred by different nations, and the identification of these options is not meant to imply that they should necessarily be mandated by governments or by an international instrument. Moreover, in many cases the most effective strategy would be to use economic incentives to encourage environmentally sound behavior and innovative responses, rather than mandating adoption of particular practices."

Page 7, line 32 - add following paragraph: "It should be remembered that the identification of these options indicates their potential usefulness, but does not imply that the particular practices or technologies mentioned should necessarily be mandated by governments or by international instruments. Implementation of each of these options should consider all of the implementation mechanisms discussed by the RSWG (see section 8.0). Many of these options would be most effectively implemented by providing appropriate economic incentives or public education, and different nations may prefer different implementation mechanisms."

Page 9, line 49 - change "15" to "10".

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Page 9, line 53 - add at end of sentence "reductions in CO2 emissions"

Page 10, line 1 - replace "low-emitting" with low-emitting or non-emitting"

Page 10, lines 12-15 - replace last sentence with: "The effectiveness of the electricity system in limiting net emissions could be improved by internalizing cost penalties for emissions into the process of least cost utility planning, whose goal is to meet energy service requirements through the least cost combination of supply additions and demand management."

Page 13, lines 15-17 - replace with "In addition, it appears that the outlook of regions and countries, as reflected in the aggregated results of 20 case studies prepared for the RSWG, varies greatly. The studies included a limited number of national case studies, as well as independent analyses by experts of selected developing and Eastern European countries. Only a few of the national case studies provided cost estimates of response options. Broad generalizations for the energy sector indicate that:"

Page 13, line 38 - add new paragraph: "These results reflect, in most cases, the nature and extent of the case studies submitted, rather than national policies or plans. Significant work remains to be done both to expand the number of country assessments and to undertake analyses of the economic costs of various response options and emissions reduction levels. In addition, the analysis was done only for CO2, not for other important greenhouse gas emissions. Because of the economic advantages of an approach which deals comprehensively with all greenhouse gases and their sources and sinks, future efforts to assess limitation strategies should also deal with gases other than CO2."

Page 14, line 26-27 - delete the reference to 100 meters as this reflects earlier sea level rise estimates.

Page 15, lines 10-12 and 34 - delete the sections referring to a one meter sea level rise since most recent estimates are lower.

Page 19, lines 11-12 - replace sentence with "The RSWG also considered in detail several priority areas which must be addressed in order to adequately implement any limitation or

-4-

adaptation responses which might be adopted and to facilitate broader understanding of climate change and broader deployment of existing policies and technologies."

Page 19, line 29 - add the following sentence: "Views on implementation measures varied by country and, therefore, issues remain on the various measures presented, particularly with regard to possible elements of a framework convention on climate change. Further consideration of these measures will be an important area for the future work of the IPCC."

Page 21, lines 41-42 - rewrite last sentence to read: "It is unlikely that economic instruments will be appropriate to every policy context, but their careful use in a variety of contexts can provide significant environmental and economic advantages over command regulation."

Page 21, line 45 - delete "and/or the achievement of environmental objectives through market mechanisms."

Page 22, line 8 - replace "customary" with "traditional"

Page 22, line 10 - replace "desired outcomes" with "the technological actions of regulated entities."

Page 22, line 12 - add after "efficiency" the phrase "impair the efficient allocation of social resources and thereby impose unnecessary social costs."

Page 23, line 28 - Replace the first phrase with: "In this context, special circumstances in the developing countries..."

Page 23, lines 43-44 - replace sentence after the word "which" with ", in the most resource-efficient manner, provide the greatest net benefits in terms of both limiting net greenhouse gas emissions and promoting economic development."

Page 24, line 8: insert after "considered" the phrase "in terms of their ability to deliver assistance in the most efficient manner."

Page 24, line 13: "Add new sentence: "Other options for generating resources should also be considered."

Page 24, line 35: insert "net" before "emissions"

Page 24, line 38-39: change "contributions" to "role" and "make" to "fulfill".

-5-

Page 26, line 9 - add new paragraph: "The scientific uncertainties are well documented in the reports of Working Groups 1 and 2. The RSWG also found considerable uncertainty about response strategies. Cost and effectiveness, especially of significant responses, is largely unanalyzed at the regional and global level. Only a few countries have developed estimates of cost, adaptation, and emission reduction potential. This is clearly a priority research area for countries and future work of RSWG."

Page 26, line 40 - change "greenhouse gas emissions" to "net emissions of all greenhouse gases"

Page 26, line 41 - add "Of course, the identification of specific technologies and practices does not imply that they should necessarily be mandated by governments or international instruments, but rather that they might be useful and could be encouraged by appropriate implementation mechanisms, including economic incentives."

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Table __

CO₂ Emissions in the Reference Case (Energy Sector)
(billion tons carbon)

	<u>1985</u>	<u>2000</u>	<u>2010</u>	<u>2025</u>
Global Totals	5.15	7.30	9.08	12.43
Developed	3.83	4.95	5.70	6.95
North America	1.34	1.71	1.92	2.37
Western Europe	0.85	0.98	1.06	1.19
OECD Pacific	0.31	0.48	0.55	0.62
Centrally Planned Europe	1.33	1.78	2.17	2.77
Developing	1.33	2.35	3.38	5.48
Africa	0.17	0.28	0.43	0.80
Centrally Planned Asia	0.54	0.88	1.19	1.80
Latin America	0.22	0.31	0.42	0.65
Middle East	0.13	0.31	0.44	0.67
South and East Asia	0.27	0.56	0.89	1.55

EDISON ELECTRIC INSTITUTE

The association of electric companies

1111 19th Street, N.W.
Washington, D.C. 20036-3691
Tel: (202) 778-6400

May 17, 1990

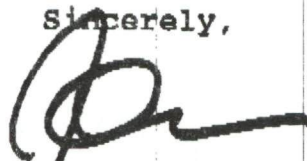
Dear Dr. Bromley:

We understand that there is a new proposal on stratospheric ozone sponsored by Congressmen Bates and Boehlert.

Our industry opposes this proposal and prefers to work with the Administration on their efforts in International forums, such as the United National Environmental Programs.

Our views are attached.

Sincerely,



John B. Shlaes
Director
Government Relations

JBS:cae

REGULATION OF HCFC-22 IS INAPPROPRIATE AT THIS TIME

o HCFCs are chemical alternatives to CFCs that have lower ozone-depleting factors than CFCs. The ozone-depleting factor for HCFC-22 is one-twentieth (1/20th) that of CFC-12, one of the substances currently controlled by the Montreal Protocol.

o HCFC-22 is the principal alternative that is scheduled to be used as a replacement for more damaging CFCs.

o Legislative proposals are inconsistent with the international cooperative efforts of the Montreal Protocol, which has been signed and ratified by 47 countries, including the U.S.

o Legislative proposals are unnecessary and counter to worldwide resolution of the problem of stratospheric ozone depletion.

o Premature adoption of an accelerated unilateral phaseout schedule will have little positive effect on the stratospheric ozone layer and, in fact, could cause maintenance of devices using substances with higher ozone-depleting factors than HCFC-22.

o The potential outcome of legislative proposals is regulated obsolescence: consumers will have no choice but to replace their CFC-12 systems with HCFC-22 and then to replace those systems with an unknown substance, since there are no current replacements for HCFC-22 that have passed toxicity testing and have needed lubricants.

o Research on and development of necessary replacements should be completed prior to regulation.

o Without effective replacements for HCFC-22, consumers are likely to opt for the system that has the longest likelihood of being available, which may promote the use of gas-absorption or ammonia-driven systems. These systems not only are more expensive but also release more greenhouse-gas emissions than HCFC-22 and present potential toxicity problems.

o HCFCs currently are scheduled to be addressed during the June 1990 United Nations Environmental Programme. Unilateral action prior to that international protocol is unnecessary and inappropriate.

**UTILITY INDUSTRY CONCERNS re. ALLOWANCE AUCTIONS
UNDER H.R. 3030 ACID RAIN PROVISIONS**

- Size and permanence of the auctions may undercut the development of an active private emissions trading market
 - Auctions would be annual, with no provision for reducing or eliminating them later if they are no longer needed at that level (S 1630 language preferred)
 - Over 300,000 tons per year may be auctioned (assuming that any allowances offered for sale but not purchased under 503(n) would be sold in the next auction), which is a large share of the total that would likely be traded on an open market basis every year
- Too many types of auctions or sales in the program would complicate the administrative systems and replace normal market flexibility with a mandated set of choices
 - Public auction annually of approximately 200-300,000 allowances under 503(m)
 - Public auction before March 31, 1992, under Section 519, at which owners or operators of units may elect to offer allowances for sale
 - Direct sale of up to 100,000 allowances per year at \$1,500 per ton (503(n))
 - Direct sale of up to 25,000 allowances per year at \$750 per ton for owners or operators of units in a state with an average SO₂ rate of 0.9 lb/mmBtu or less (503(n))
- Administration of the auction requires special expertise and should probably be performed by the Department of Treasury or the Department of Energy, rather than the EPA, which has no experience in running this type of program. Administering it in a different agency would remove the auction from the pressures and potential influences of other aspects of the program
- Disbursement procedures for funds and/or unused allowances are missing from several sections of the bill. These include the First Phase reserve for 2:1 allowances, the direct sales provisions of 503(n), the reserve for units between 1.2 and 1.85 lb/mmBtu (503(n)), and the auction under Section 519

05/15/1990 10:28

TELETYPE: BRAKER & BLUMHE

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Table 1. Summary of the 1980 to 2000 National SO₂ Emission Changes Expected Under H.R. 2030¹

The attached footnotes should be reviewed together with the table

	Emission Changes from 1980 (million tons)					Best Judgment ²
	EPA ³	EEI ⁴	ANL/DOE for NAPAP ⁵	EPA Trends ⁶	NAPAP Inventories ⁷	Plausible Range ⁸
Utility Emissions						
Change: 1980-1985	-1.1 ^h	-1.3 ^h	-1.8 ^l	-1.4 ^h	-1.4 ^h	-1.3 to -1.9 ^m
Change: 1985-2000	-7.9 to -8.1 ^p	-7.7 ^q		NA	NA	-7.7 to -8.1 ^r
Reflected existing units:						
1985-2000 ¹	-0.03 to +0.36	-0.18 to +0.13 ^s	-7.7 ^v	NA	NA	-0.2 to +0.4 ^w
1985-2000 ²						
1985-2000 ³						
1985-2000 ⁴						
1985-2000 ⁵						
1985-2000 ⁶						
1985-2000 ⁷						
1985-2000 ⁸						
1985-2000 ⁹						
1985-2000 ¹⁰						
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TEMPLE, BARKER & SLOANE, INC.

MANAGEMENT AND ECONOMIC COUNSEL

MEMORANDUM

TO: Edward C. Wats, OMB
FROM: T.J. Glauthier for the Edison Electric Institute
DATE: May 10, 1990
RE: EPA Error in Estimate of Acid Rain Program SO₂ Emissions Reduction

This is to follow up our discussion earlier today in the meeting that representatives of the electric utility industry and EEI had with you and Bob Grady. On the subject of SO₂ emissions reductions under a revised Clean Air Act, we pointed out that there is at least one objective basis on which EPA should be willing to acknowledge that reductions will be higher than their earlier estimates. That one basis is the error in their calculations for 1980 that was discovered during the NAPAP investigation of emissions estimates this winter.

The implication of this error is that actual SO₂ emissions reductions under an acid rain control program would really be 0.4 million tons higher than originally estimated by EPA.

The explanation and acknowledgement of the error is contained in four places in Jim Mahoney's letter to Chairman Dingell. Those are:

on page 5 of the letter:

- "6. EPA's original (1989) analysis of the electric utility emissions decrease contained an inadvertent error as a result of an inconsistency in the emissions factors applied for 1980 and 1985. This error was discovered as part of our review. Adjustment of the value to account for the error increased EPA's estimated 1980-1985 emission decline by 0.4 million tons, which accounts for approximately half of the difference between NAPAP OD's current best judgment of the expected 1980-2000 decrease and the value from EPA's 1989 analysis."

On page 14, as part of footnote h to EPA's estimate of electric utility industry emission reductions during 1980-1985 in Table 1:

"(1) Different emission factors, which represent the conversion of sulfur in fuel to SO₂ in the combustion products, were used by ICF for 1980 and 1985. This creates a bias in the estimated trend. Correction of this bias would add approximately 0.4 million tons to the 1.1 million ton decrease (i.e., a corrected decrease of 1.5 million tons)."

On page 16, in footnote m, describing the Plausible Range in the judgment of the NAPAP Office of the Director:

"The value developed by ICF for EPA, when adjusted by 0.4 million tons to correct the bias resulting from the use of different emission factors for the 1980 and 1985 estimates, becomes 1.5 million tons and falls within the plausible range."

And on page 16, in footnote n, describing the Best Judgment estimates, in the judgment of the NAPAP Office of the Director:

"The lower bound is also equal to the ICF estimate for EPA, corrected for the bias in the application of the emission factor ($1.1 + 0.4 = 1.5$)."

The specific error was that ICF used different technical assumptions about the amount of sulfur that is retained in the ash for its 1980 and 1985 estimates. This is strictly a technical characteristic of the boilers, and not subject to actual change between 1980 and 1985 at individual units. However, ICF did use different assumptions for the two years, as documented in Enclosure 3, "Summary of EPA (ICF) Methodology and Supporting Information", on the twelfth page, listing "Assumptions/Data Sources Used in Calculating Utility SO₂ Emissions:

	<u>1980</u>	<u>1985</u>
"Sulfur Retention in Ash	EPA AP-42 Factors:	EPA AP-42 (Fourth Edition September 1985) Factors:
	Bituminous - 5%	Bituminous - 2.5%
	Subbituminous - 15%	Subbituminous - 12.5%
	Lignite - 25%	Lignite - 25%"

By using an ash retention estimate for the 1980 calculations that was about 2.5 % higher than that used for 1985 and later years, their estimate of SO₂ emissions into the air in 1980 was about 2.5 % lower than it should have been relative to the estimates for 1985 and later years.

Based on ICF's own estimates of SO₂ emissions of 16.0 million tons from coal-fired utility units in 1980, that 2.5 % factor would indicate that a consistent estimate of what 1980 emissions really were would be 16.40 million tons. Since the new, lower assumption for ash retention is EPA's best current technical judgment of the way these boilers work, one must conclude that EPA's best current estimate of 1980 SO₂ emissions by electric utilities would be 0.4 million tons higher than the previous estimate. As a result of this higher 1980 base figure, the projected reduction to allowable emissions levels in 2000 will be 0.4 million tons larger than previously estimated by EPA.

EDISON ELECTRIC INSTITUTE

The association of electric companies

1111 19th Street, N.W.
Washington, D.C. 20036-3691
Tel: (202) 778-6400

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- HAVE A NICE DAY -



The Administrator
Washington, D.C. 20460

May 22, 1990

Alan,

I don't know if you
can help on this but if you
can I would appreciate it.

Bill

cc: To Nancy Maynard
S/r

Questions to be Resolved Regarding the
Administration's Policy on Extending the
Montreal Protocol to Fully Phase Out
Ozone-Depleting Chlorofluorocarbons

1. Assuming, as seems increasingly likely, that Congress in the Clean Air Act reauthorization directs the U.S. to fully phase out CFC's, and also authorizes funding to assist developing countries with their phase-out costs, will we acquiesce in providing the funds or oppose the appropriation, even though we would likely lose?
2. If large developing countries, such as India and China carry out their announced intention to decline even to ratify the Montreal Protocol, much less agree to extend it to full phase out of CFC's in London in June, unless the developed countries put up new funds to pay for the costs of the transition, are we prepared to see this happen, recognizing that the Treaty, for which U.S. leadership gained international recognition, will fail?
3. Are we prepared to be the only developed nation represented in London which opposes the financing principles agreed to by other nations in Geneva? These principles commit developed countries to provide new funds for developing countries with contribution shares according to the U.N. formula (U.S. 25%). If these principles are incorporated in the Treaty extension document as a whole, and cannot be voted upon separately, are we prepared to accept the principles and support the Treaty, or vote against extending the Treaty?
4. If Mrs. Thatcher and the other G-7 leaders criticize the U.S., and raise this as an issue at the Houston Summit just two weeks after the London meeting on the Montreal Protocol, are we prepared to see that issue cast a negative pall over the Summit?
5. The major manufacturers of CFC's are DuPont, ICI of the UK, and Allied Signal. Most of the CFC's in use in developing countries were manufactured by these companies, none of which will be permitted to manufacture CFC's after the year 2000. Are we prepared to see developing countries, which do not ratify the Protocol, create CFC industries (China plans to build 300 million new refrigerators in the next 15 years)? This would mean that U.S. corporations will not be able to market their CFC substitutes they are developing at a very large cost in research and development funds. (CFC substitutes will be a multi-billion dollar market.)
6. If other developed countries should decide to cover the \$25 million U.S. share of phase-out assistance over the first three years in order to entice India and China to ratify, are we prepared to let them do it?



**INTERGOVERNMENTAL PANEL ON
CLIMATE CHANGE**

**POLICYMAKERS
SUMMARY**

WORKING GROUP III

RESPONSE STRATEGIES WORKING GROUP

First Draft, May 1, 1990 - For Review Only - Do Not Quote

**REPORT OF THE
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
RESPONSE STRATEGIES WORKING GROUP**

EXECUTIVE SUMMARY

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1 1.0 INTRODUCTION

2
3 Global climate change is an issue which concerns the entire international
4 community. Should significant climate change occur, the effects on the global
5 environment and the resources relied upon by mankind and natural ecosystems
6 could be significant. As described in the IPCC Impacts Working Group report,
7 these could include a rise in the sea level and impacts on agriculture, forestry,
8 ecosystems and biodiversity, hydrology and water resources, oceans, and
9 human settlements.

10
11 The IPCC's Response Strategies Working Group (RSWG) explored
12 possible options for responding to climate change at the national, regional, and
13 international levels. In carrying out this work the RSWG considered the
14 anthropogenic sources of greenhouse gas emissions, a range of measures for
15 limiting the increase in atmospheric concentrations of such gases, and options
16 for adapting to possible climatic changes. The RSWG also reviewed specific
17 mechanisms for implementing response strategies, including a possible
18 framework convention on climate change.

19
20 The RSWG has identified a large number of short and long term response
21 options for consideration by members of the international community in
22 addressing climate change. These include a wide array of options for limiting
23 net greenhouse gas emissions from the energy, industry, agriculture, and
24 forestry sectors through the adoption of a variety of technologies and resource
25 use strategies. Measures have also been identified which may enhance the
26 ability of coastal regions and natural resources to adapt to a changing climate.

27
28 Because of the short time frame involved in the preparation of this report, it
29 was not possible to carry out a complete review of all aspects of climate change
30 response options. The costs, effectiveness, and other economic and social
31 implications of each of these options have not been evaluated and require
32 further analysis. In addition, the effectiveness and desirability of specific
33 options will depend on circumstances which vary substantially from country to
34 country. Hence, much analysis needs to be done on an individual country by
35 country basis.

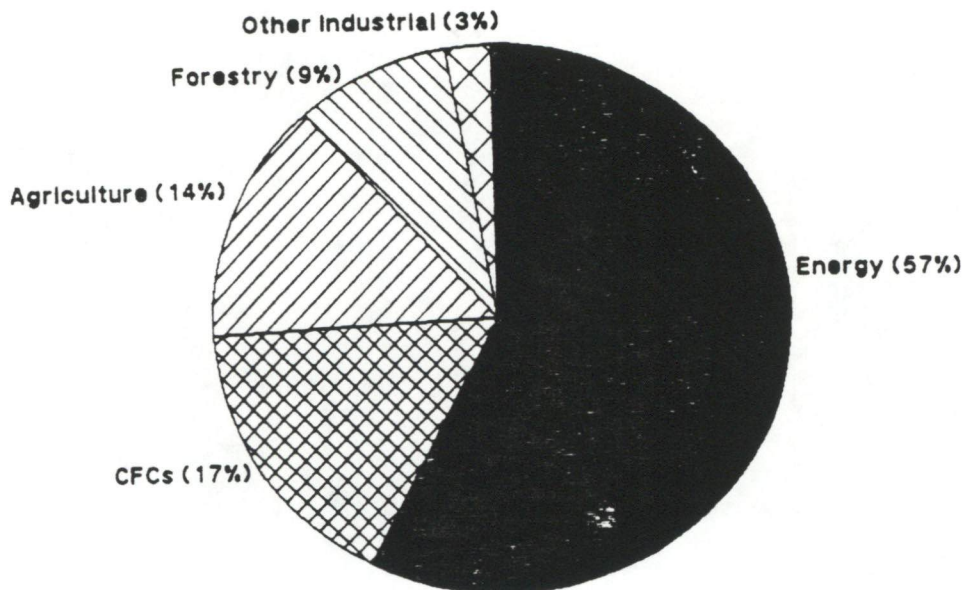
36
37 Nonetheless, this report provides an important interim assessment for
38 policy makers. It identifies the major issues which need to be considered in the
39 development of national, regional, and international climate change response
40 strategies. The report also provides an overview of the main issues which
41 should be considered in future international negotiations related to climate
42 change.

43 44 2.0 ANTHROPOGENIC GREENHOUSE GAS SOURCES

45
46 A wide range of human activities result in the release of greenhouse gases
47 into the atmosphere. Anthropogenic emissions can be categorized as arising
48 from energy production and use, non-energy industrial activities (primarily the
49 production and use of CFCs), agricultural systems, and changes in land-use
50 patterns (including deforestation and biomass burning). The relative
51 contributions of these activities to radiative forcing are shown below in Figure 1
52 (see Science Working Group report for further explanation of the radiative
53 forcing of the various greenhouse gases).

Figure 1

Current Anthropogenic Contributions to Radiative Forcing by Sector



The largest anthropogenic source of radiative forcing is energy production and use. The consumption of energy from fossil fuels (coal, petroleum, and natural gas) for industrial, commercial, residential, transportation, and other purposes results in large emissions of CO₂ and other gases and accounts for an estimated 57 percent of the radiative forcing resulting from human activities. Industrial activities not related to energy use comprise another 20 percent of anthropogenic contributions. The vast majority of these emissions result from the production and use of CFCs and other halocarbons in various industrial processes.

Agricultural systems account for about 14 percent of the radiative forcing resulting from human activities. Significant amounts of methane are released in the process of rice cultivation and from livestock systems, while nitrous oxide is released during the use of nitrogenous fertilizers. Approximately 9 percent of anthropogenic contributions are the result of deforestation, biomass burning, and other land-use patterns which release CO₂, methane, and nitrous oxide.

Estimates of current greenhouse gas emissions, however, are imprecise because of uncertainties regarding both total emissions and emissions from each source. Emissions from certain sources are particularly difficult to measure. For example, estimates of CO₂ emissions from deforestation and of methane emissions from rice cultivation, livestock systems, and biomass burning vary by factors of two or more.

3.0 FUTURE GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions from most sources are likely to increase significantly in the future. As economic and population growth continues,

1 in particular in the developing countries, there is expected to be an increase in
2 energy use, industrial and agricultural activity, deforestation, and other activities
3 which result in greenhouse gas emissions. Although some controls have been
4 put in place under the Montreal Protocol for certain CFCs and halons, emissions
5 of CO₂, methane, nitrous oxide, and other greenhouse gases are likely to
6 increase under current patterns of economic activity and growth.

7
8 However, there are significant limitations on our ability to estimate future
9 rates of population and economic growth, individual behavior, technological
10 innovation, and other factors which are crucial for determining emission rates
11 over the course of the next century. This lends very great uncertainty to
12 projections of greenhouse gas emissions over several decades or longer.
13 Reflecting these inherent difficulties, the RSWG's work on emissions scenarios
14 is incomplete and preliminary.

15 16 3.1 Emissions Scenarios

17
18 One of the RSWG's first tasks was to prepare some initial scenarios of
19 possible future greenhouse gas emissions for the use of the three IPCC Working
20 Groups. An experts' group was formed which looked at four hypothetical future
21 patterns of greenhouse gas emissions and their effect on the atmosphere. The
22 cumulative effect of these emissions was calculated using the concept of
23 equivalent CO₂ concentrations (e.g. the contributions of all greenhouse gases to
24 radiative forcing are converted into their equivalent in terms of CO₂
25 concentrations).

26
27 The scenarios assumed future emissions patterns which would result in: (1)
28 the equivalent of a doubling of atmospheric concentrations of CO₂ from
29 pre-industrial levels* by about 2030, with continued increases throughout the
30 century; (2) the equivalent of a CO₂ doubling by approximately 2060, with
31 continued increases; (3) the equivalent of a CO₂ doubling by about 2090, with
32 stabilization of atmospheric concentrations of greenhouse gases thereafter; and
33 (4) the stabilization of atmospheric concentrations of greenhouse gases at a
34 level less than a CO₂ equivalent doubling.

35
36 The first of the scenarios, called the 2030 High Emissions Scenario,
37 assumes that few or no steps are taken to limit greenhouse gas emissions.
38 Energy use and clearing of tropical forests continues and fossil fuels, in
39 particular coal, remain the world's primary energy source. The Montreal
40 Protocol comes into effect but without strengthening and with less than 100
41 percent compliance. Under this scenario, the equivalent of a doubling of
42 pre-industrial CO₂ levels occurs by around 2030.

43
44 The second of the scenarios, the 2060 Low Emissions Scenario, assumes
45 that a number of environmental and economic concerns result in steps to reduce
46 the growth of greenhouse gas emissions. Energy efficiency measures, which

47
48
49 -----
50 * The total radiative forcing at any time is the sum of those from the individual
51 greenhouse gases. For simplicity, total forcing is expressed in terms of the
52 amount of CO₂ which would give that forcing; this is termed the equivalent
53 carbon dioxide concentration (see the Science Working Group report).

1 might only be possible with government intervention, are implemented,
2 emissions controls are adopted globally, and the share of the world's primary
3 energy provided by natural gas increases. Full compliance with the Montreal
4 Protocol is achieved and tropical deforestation is halted and reversed. Under
5 this scenario, the cumulative effect of such measures is a CO₂ equivalent
6 doubling around 2060.

7
8 The remaining two scenarios reflect futures where steps in addition to those
9 in the 2060 Low Emissions Scenario are taken to reduce greenhouse gas
10 emissions. These steps include rapid utilization of renewable energy sources,
11 strengthening of the Montreal Protocol, and adoption of agricultural policies to
12 reduce emissions from livestock systems, rice paddies, and fertilizers.

13
14 All of the above scenarios, while hypothetical and based on highly variable
15 assumptions, provide a conceptual basis for considering possible future patterns
16 of emissions and the broad responses that might affect those patterns.
17 However, they represent assumptions rather than cases derived from specific
18 studies. In addition, no assessment was made of the economic costs,
19 technological feasibility, or market potential of the underlying policy assumptions.

20 21 **3.2 Reference Case**

22
23 In addition to these scenarios, the RSWG obtained a limited amount of data
24 from various sources on possible greenhouse gas emissions from a number of
25 countries over the next several decades, under the assumption that no specific
26 efforts are made to limit such emissions. Estimates of future emissions of CO₂
27 and methane from the energy sector were developed based on the work of
28 analysts from over 21 countries and submissions from various international
29 organizations. Future emissions of CO₂ from tropical deforestation represent
30 the average of two scenarios adopted by RSWG agriculture and forestry experts.

31
32 Global estimates of greenhouse gas emissions over the next several
33 decades were derived from these studies through a process of integration. This
34 has been labelled the "Reference Case". However, the various studies used
35 differing assumptions and methodologies, thus complicating the integration
36 process. As a result, the final emissions estimates are subject to considerable
37 uncertainty.

38
39 The Reference Case, which was projected to the year 2025, contains higher
40 emissions of CO₂ and methane than any of the emissions scenarios discussed
41 in Section 3.1 above. It indicates a sharp increase in CO₂ emissions from fossil
42 fuel combustion, from 5.2 billion tons of carbon (Bt C) in 1985 to 12.2 Bt C in
43 2025. Methane emissions from coal mining and natural gas production and
44 transport also increase rapidly as fossil fuel use increases. The mid-range
45 estimate of CO₂ emissions from deforestation increases from 1.7 Bt C in 1985 to
46 2.6 Bt C in 2025. Emissions from the agriculture sector, on the other hand, grow
47 more slowly than from the energy sector or from deforestation.

48
49 CO₂ emissions in the Reference Case are nearly 20 percent greater than
50 those in the 2030 High Emissions Scenario, while methane emissions are more
51 than 10 percent higher. The emissions projected under the

1 Reference Case, with the comparable figures from the 2030 High Emissions
2 Scenario, are shown in Table 1. Nitrous oxide and CFC emissions, as well as
3 methane emissions from biomass sources, are not shown since such estimates
4 were not developed for the Reference Case.

5
6
7
8 **Table 1**
9
10 **Greenhouse Gas Emissions from the RSWG Scenarios**

	<u>Reference Case</u>		<u>2030 High Emissions Scenario</u>	
	<u>1985</u>	<u>2025</u>	<u>1985</u>	<u>2025</u>
CO₂ Emissions (Bt C)				
Energy	5.2	12.4	5.3	10.2
Deforestation	1.7	2.6	0.7	1.4
Cement	0.1	0.2	0.1	0.2
Total	7.0	15.2	6.1	11.8
CH₄ Emissions (Tg CH₄)				
Coal Mining	44	126	35	85
Natural Gas	22	59	45	74
Rice	110	149	110	149
Enteric Ferm.	75	125	74	125
Animal Wastes	37	59		
Landfills	30	60	40	71
Subtotal	318	577	304	503
Biomass Burning			57	79
Natural			179	179
Total			541	761

36
37
38
39
40
41
42
43 At the IPCC Second Plenary Session in June 1989 participants agreed that
44 the 2030 High Emissions Scenario should be labelled the "business-as-usual"
45 scenario, i.e. the level of atmospheric concentrations of greenhouse gases which
46 might occur in the absence of policies to limit emissions. The Reference Case
47 was developed after the IPCC's Second Plenary Session. At least for emissions
48 of CO₂ and methane, the Reference Case is closest to the 2030 High Emissions
49 Scenario. As noted above, however, all of these figures are subject to
50 considerable uncertainty. They thus cannot be considered to be predictions of
51 future emissions patterns. Research on future emissions is an important area
52 for further cooperative work.

1 The Reference Case also indicates that future emissions patterns by world
2 region may be significantly different than those which exist at the present time.
3 It is estimated that, of global CO₂ emissions in 1985, emissions from the OECD
4 countries accounted for nearly 50 percent of global emissions, emissions from
5 centrally planned European countries about 25 percent, and emissions from the
6 rest of the world the remaining 25 percent. The Reference Case indicates that
7 by 2025, under the assumptions used in the case studies, these ratios of global
8 CO₂ emissions could be around 33, 22, and 44 percent, respectively, for the
9 OECD, centrally planned Europe, and the rest of the world.

10

11

12 **4.0 RESPONSE STRATEGIES FOR ADDRESSING CLIMATE CHANGE**

13

14 Because climate change could potentially result in significant impacts on the
15 global environment and human activities, it is important to begin considering now
16 what measures might be taken in response. The RSWG identified a wide range
17 of options for the international community to consider. These include measures
18 both to limit net greenhouse gas emissions and to increase the ability of society
19 and ecosystems to adapt to a changing climate.

20

21 The consideration of climate change response strategies, however, presents
22 formidable difficulties for policy makers. On the one hand, the information
23 available to make sound policy analyses is inadequate because of: (a) remaining
24 scientific uncertainties regarding the magnitude, timing, rate, and regional
25 consequences of potential climate change; (b) uncertainty with respect to how
26 effective specific response options or groups of options would be in actually
27 averting potential climate change; and (c) uncertainty with respect to the costs,
28 effects on economic growth, and other economic and social implications of
29 specific response options or groups of options. On the other hand, the
30 potentially serious consequences of climate change on the global environment
31 may support implementation of some response strategies even in the face of
32 such significant uncertainties.

33

34 Recognizing these factors, a large number of options were preliminarily
35 assessed. It appears that some of these options may be economically and
36 socially feasible for implementation in the near-term while others, because they
37 are not yet technically or economically viable, may be more appropriate for
38 implementation in the longer-term. In general, the RSWG found that the most
39 effective response strategies, especially in the short-term, are those which are:

40

- 41 o Beneficial for reasons other than climate change and justifiable in their own
42 right, for example increased energy efficiency, better management of forests
43 and other natural resources, and reductions in emissions of CFCs and other
44 ozone depleting substances that are also radiatively important gases;
- 45 o Economically efficient and cost effective, in particular those that use
46 market-based mechanisms;
- 47 o Able to serve multiple social, economic, and environmental purposes;
- 48
- 49

- 1 o Flexible, so that they can be easily modified to respond to increased
2 scientific and economic understanding of climate change;
- 3
- 4 o Compatible with the concept of sustainable economic growth and
5 development;
- 6
- 7 o Administratively practical and effective in terms of application, monitoring,
8 and enforcement; and
- 9
- 10 o Which reflect obligations of both developed and developing countries in
11 addressing this issue, while recognizing the special needs of developing
12 countries.
- 13

14 The degree to which options are viable will also vary considerably
15 depending on the region or country involved. For each country, the
16 socioeconomic implications of specific options will depend on its social,
17 environmental, and economic context. Only through careful analysis of all
18 available options will it be possible to determine which are best suited to the
19 circumstances of a particular country or region.

20
21

22 5.0 OPTIONS FOR LIMITING GREENHOUSE GAS EMISSIONS

23 The RSWG reviewed potential measures for mitigating climate change by
24 limiting net emissions of greenhouse gases from the energy, industry,
25 transportation, forestry, agriculture, and other sectors. These measures include
26 those which limit emissions from greenhouse gas sources (such as energy
27 production and use) as well as those which increase the use of natural sinks
28 (such as forests and other biomass) for sequestering greenhouse gases. A
29 discussion of both short and long term options for each major emissions sector
30 is provided below.

31
32
33

34 5.1 Limitation of Net Emissions from the Energy Sector

35 The energy sector plays a vitally important role in economic well-being and
36 development for all nations. At the same time, because energy production and
37 use accounts for an estimated 57 percent of current anthropogenic greenhouse
38 gas emissions, energy policies need to ensure that sustained economic growth
39 occurs in a manner that, globally, conserves the environment for future
40 generations. However, there is no single, quick-fix technological option for
41 limiting greenhouse gas emissions from energy sources. A comprehensive
42 strategy is necessary which deals with improving efficiency on both the demand
43 and supply sides as a priority and emphasizes technological research,
44 development, and deployment.

45 Various potential options have been identified for reducing greenhouse gas
46 emissions from energy systems. The most relevant categories of options appear
47 to be:

- 48
- 49
- 50
- 51 o efficiency improvements and conservation in energy supply, conversion, and
52 end-use¹;
- 53
- 54 o fuel substitution by energy sources which are lower emitters of greenhouse
55 gases² (e.g. natural gas, nuclear, and renewable sources); and

1 o reduction of greenhouse gas emissions by removal, fixation, or the
2 maintenance and enhancement of sinks³.

3
4 From an analysis of the technologies in these categories, it appears that
5 some technologies are available now or in the short-term with at least some
6 economic and market potential while others need further development to lower
7 costs or to improve their environmental characteristics. Tables 2 and 3 provide
8 various examples of technological options within each of the broad categories
9 defined above, and their possible application in the short, medium, and
10 longer-term.

11
12 This distinction among time frames is used in order to reflect the remaining
13 technological needs in each category and to assist in formulating technological
14 strategies. Short-term technologies are those which apparently are or will be
15 both technically and economically ready for introduction and/or demonstration up
16 to the year 2005 and beyond. Mid-term technologies are those which, while
17 technically available now, are not yet economic and thus may not be
18 implemented until the period from 2005 to 2030. Longer-term technologies are
19 not yet available but may emerge after 2030 as a result of research and
20 development.

21
22 The technical, economic, and market potential of technological options will
23 vary depending upon the sector in which they are to be applied. The technical
24 potential of an energy technology is its capacity to reduce potential emissions,
25 irrespective of the costs involved, and is largely a function of technical feasibility
26 and resource availability. Economic potential refers to whether the application of
27 the options is economically efficient and cost-effective - it may be significantly
28 less than technical potential where there are positive resource costs. Market
29 potential refers to whether the consumer or user is likely to adopt the option - it
30 might be even less than economic potential due to market imperfections,
31 attitudes to risk, and the presence of non-monetary costs.

32
33 There is, in general, extensive information available on the technical
34 potential of the many technological options listed. The economic and market
35 potential, however, depends on the specific circumstances (national, local and
36 even sectoral) in which the option is to be applied and thus can only be analyzed
37 on a country by country basis. Hence, much important analysis can be done
38 only on an individual country by country basis.

39
40 The short-term technological potential of particular relevance to the
41 developed world is discussed by sector below. Technological potential for
42 developing countries has not been developed in the same detail due to a lack of
43 information.

44 45 Transportation Sector:

46
47 Substantial technical potential exists for fuel substitution through the use of
48 fuels derived from natural gas, ethanol, or other fuels from biomass sources⁴.
49 Substantial technical potential also exists for electric or hydrogen-fueled
50 vehicles, which could also reduce emissions with appropriate primary energy
51 sources. Presently, however, the economic and market potentials of most of
52 these options are very low because (a) petroleum fuels are relatively cheap; (b)
53 alternative non-CO2 producing fuels are relatively costly; and (c) some
54 alternative vehicular technologies have performance drawbacks.

1 The technical potential for vehicle efficiency improvements is significant
2 despite the substantial improvements already made. Economic and market
3 potentials are constrained, however, by replacement rates of vehicles, consumer
4 demand and preference for larger, more powerful and better equipped cars, and
5 higher incremental costs. Improved driver behavior, vehicle maintenance, traffic
6 management, and promotion of public transportation could also reduce CO2
7 emissions.

8
9 Buildings Sector:

10
11 The technical potential for energy efficiency gains in the residential and
12 commercial sectors is substantial⁵. Energy requirements for heating and cooling
13 new homes could be roughly half the current average. Retrofitting existing
14 homes could reduce energy requirements an average of around 25 percent. In
15 addition, reductions of energy use in existing commercial buildings of at least 50
16 percent may be technically feasible, while new commercial buildings could be up
17 to 75 percent more efficient than existing commercial buildings.

18
19 However, market potential is lower and depends on the building's
20 replacement rate. The realization of significant gains in this sector requires the
21 involvement of government, the many concerned institutions, and ultimately the
22 individual residential or commercial consumer. This sector therefore requires
23 special efforts in order to achieve substantial levels of market penetration of
24 energy efficient technologies which are also economic. Institutional barriers
25 must be removed and careful attention given to the design of research and
26 development programs for this sector.

27
28 Industry Sector:

29
30 The technical potential for efficiency improvements in the industry sector
31 ranges from 13 percent in some sub-sectors to over 40 percent in others⁶. The
32 most dramatic efficiency improvements over the last 15 years have been in the
33 energy-intensive industries. Technical options exist for accelerating this trend
34 and for achieving similar savings in other industries. Such options stem mainly
35 from recent improvements in process technologies, as well as better design and
36 materials. Considerable opportunities for energy savings exist in the industrial
37 sector by the recycling of energy-intensive waste. There may also be significant
38 technical potential for reducing greenhouse gas emissions through industrial fuel
39 switching, especially since many industrial boilers are already dual-fuel capable
40 with natural gas being the fuel typically substituted for fuel oil under present
41 circumstances. Combined heat and power, cogeneration, combustion of
42 biomass wastes, methane from landfills, and other renewable energy sources
43 also have potential to reduce growth in emissions.

44
45 Electricity Sector:

46
47 Under current price conditions, both efficiency and fuel substitution are
48 largely dependent on the rate of retirement of existing power plants, the growth
49 in demand for electricity, and the cost of the replacement plant⁶. The technical
50 potential for greater efficiency in electricity generation can be in the range of 15
51 to 20 percent (with lower gains for plants which are already relatively efficient).
52 Fuel substitution could achieve in the range of 30 percent (from oil to natural
53 gas) to 40 percent (from coal to natural gas). Much greater

1 reductions would be possible with greater penetration of low-emitting sources
2 such as nuclear power, hydroelectric, or other renewable energies⁷. In addition,
3 the electricity sector has the technical potential to substantially increase its
4 efficiency where cogeneration of electricity and heat or combined cycle power
5 generation can be applied.

6
7 The economic potential for greater fuel efficiency is considerably lower and
8 for substitution from coal or oil to natural gas or non-fossil fuel is critically
9 dependent on the relative prices and availability of the fuels in question. In
10 evaluating switching between fossil fuels it is necessary to account for potential
11 increases in methane emissions from the production and transmission of the
12 fuels in calculating the net benefit of such strategies. Overall, efficiency of the
13 electricity system can be improved through the use of least cost utility planning,
14 whose goal is to meet energy service requirements through the least cost
15 combination of supply additions and demand management.

16 17 **5.2 Limitation of Net Emissions from the Industry Sector**

18
19 The most significant source of greenhouse gases associated with industrial
20 activity not related to energy use is the production and use of CFCs and other
21 halocarbons. CFCs represent a very important source of greenhouse gas
22 emissions, about 17 percent of global contributions to radiative forcing.
23 However, the RSWG did not consider control strategies for these gases since
24 this issue is already addressed under the Montreal Protocol on Substances that
25 Deplete the Ozone Layer.

26 27 **5.3 Limitation of Net Emissions from the Agriculture Sector**

28
29 About 14 percent of anthropogenic greenhouse gas emissions can be
30 attributed to the agricultural sector, in particular livestock systems, rice
31 cultivation, and the use of nitrogenous fertilizers. Limitation of emissions from
32 this sector presents a challenge because the processes by which greenhouse
33 gases, in particular methane and nitrous oxide, are released in agricultural
34 activities are not well understood. In addition, response options in the
35 agricultural sector must be designed to ensure maintenance of food supply.
36 There appear, however, to be a number of short-term response options, some
37 economically viable in their own right, which could contribute to a limitation of net
38 emissions from agricultural sources. In addition, there are a number of
39 promising technologies and practices which, in the longer-term, could
40 significantly reduce greenhouse gas emissions.

41 42 **Short-Term Options:**

43
44 **Livestock systems:** Methane emissions could be reduced through improved
45 management of livestock wastes; expansion of supplemental feeding
46 practices; and increased use of production and growth enhancing agents⁸.

47
48 **Fertilizer use:** Nitrous oxide emissions may be reduced by using improved
49 fertilizer formulations and application technology and practices.

50
51 **Marginal lands:** Areas marginally suitable for annual cropping systems may
52 be shifted to perennial cover crops for fodder or pastoral land uses, or
53 forests if soils are suitable. Such actions would increase carbon uptake,
54 both in the vegetation and soil, and would yield other benefits.⁹

1 Sustainable agricultural practices: Where appropriate, minimum or no-till
2 systems should be introduced for those countries currently using tillage as
3 part of the annual cropping sequence, thus increasing soil organic matter
4 and reducing CO2 emissions.

5
6 Longer-Term Options:

7
8 Rice cultivation: A comprehensive approach, including management of
9 water regimes, improvement of cultivars, efficient use of fertilizers, and other
10 management practices, could lead to a 10 to 30 percent reduction in
11 methane emissions from flooded rice cultivation, although substantial
12 research is necessary to develop and demonstrate these practices.¹⁰

13
14 Livestock: Through a number of technologies it appears that methane
15 emissions may be reduced from livestock systems by 25 to 75 percent per
16 unit of product in dairy and meat production, although many uncertainties
17 exist.

18
19 Fertilizers: Fertilizer-derived emissions of nitrous oxide potentially can be
20 reduced (although to what extent is uncertain) through changes in practices
21 such as using fertilizers with controlled nitrogen conversion rates, improving
22 fertilizer-use efficiency, and adopting alternative agricultural systems.

23
24 **5.4 Limitation of Net Emissions from Forestry and Other Activities**

25
26 Forestry practices and other human activities associated with land-use, such
27 as biomass burning and landfills, account for about 9 percent of anthropogenic
28 greenhouse gas emissions. A number of short and long term response options
29 for limiting net emissions from these sectors have been identified.

30
31 Short-Term Options:

32
33 Forestry: Development and implementation of policies to reduce
34 deforestation and forest degradation and to ensure the health and
35 sustainable management of existing forests in order to enhance CO2
36 sinks.¹¹

37
38 -- Substitution of wood for high energy input materials and further recycling
39 of forest products in order to enhance long term CO2 storage.

40
41 -- Strengthening and extension of existing international institutions and
42 programs such as the Tropical Forestry Action Plan process and the
43 International Tropical Timber Organization.

44
45 -- Development of a global network of remote sensing data collection and
46 analysis stations to provide the real-time data on deforestation and biomass
47 burning patterns necessary for national forestry plans and fire management.

48
49 -- Conversion of marginal agricultural land to forests in order to enhance
50 CO2 sequestering.

-- Replacement of fossil energy sources with wood through the use of managed sources of biomass, such as greater or more efficient fuel-wood plantations, in particular in temperate and boreal regions.

Biomass Burning: Reduction of biomass burning through fire management programs and widespread use of alternative sustainable agricultural practices.

Waste Management: Development of landfill methane recovery systems and flaring and biogas systems to treat wastewater in order to reduce methane emissions.¹²

Longer-Term Options:

Forestry: Development and implementation of improved silvicultural measures and genetically improved trees to increase wood production and thus foster carbon fixation.

-- Enhancement of forest protection through the incorporation of strategies for fire, insects, and diseases into future management plans and through the development of silvicultural adjustment and stress management strategies.

-- Development of national plans to expand temperate forest biomass which are intensively managed, thereby providing specific opportunities to limit net CO₂ emissions.

-- Integration of agriculture and forestry plans in a manner which reconciles the demands on tropical forests for the expansion of agriculture.

Biomass burning: Widespread adoption of sustainable agricultural practices, use of biomass as a fuel, and improved fire management and protection systems in order to reduce trace gas emission from biomass burning and other land use practices.

Waste Management: Use of gas collection and flaring to reduce methane emissions from landfills and development of biogas plants to reduce methane emissions from wastewater treatment. Demonstration, training, and technology transfer are necessary to realize these potentials, which may range from 30 to 90 percent for landfills and up to 100 percent for wastewater treatment.

6.0 TARGETS AND TIMETABLES FOR GREENHOUSE GAS EMISSIONS

There has been considerable international discussion of targets for specific greenhouse gas emissions, in particular CO₂, which is the most abundant of the gases. At the November 1989 Noordwijk Conference on Atmospheric Pollution and Climatic Change, the final declaration called on the IPCC to examine possible quantitative targets for greenhouse gas emissions, including a stabilization of CO₂ emissions by the year 2000 and a 20 percent reduction in CO₂ emissions by 2005. The Conference also called for assessing the feasibility of increasing net global forest growth by 12 million hectares per year.

1 The RSWG has made consideration of the feasibility of quantitative targets
2 a priority task, although it was not possible to complete such an analysis by the
3 time of this report's publication. The primary constraint on conducting this
4 analysis is the serious lack of data on the economic and social costs of the
5 various response options for limiting net greenhouse gas emissions. While the
6 technical potential of a number of options has been demonstrated, there is very
7 little information available on the actual economic costs associated with
8 implementation of such options. An adequate understanding of the benefits, in
9 terms of changes in climate variables that are avoided, is also seriously lacking.
10 It is imperative that further work on the cost and benefit implications of response
11 strategies be undertaken. These issues have been identified as one of the most
12 important areas for future research by the RSWG, concerned international
13 organizations, and individual countries.

14
15 In addition, it appears that the capacity of regions and countries varies
16 greatly. Using a scenario based on 20 country studies submitted to the RSWG,
17 some broad generalizations are possible for the energy sector:

- 18
19 o West European countries, including the European Community, may be able
20 to stabilize or reduce CO2 emissions by early in the next decade through a
21 variety of measures including taxes, energy efficiency programs, nuclear
22 power, natural gas, and renewables.
- 23
24 o East European countries and the USSR may be able to slow the growth of
25 or stabilize CO2 emissions over the next two decades, if policies to
26 restructure their economies, increase efficiency, and promote economic
27 development and substitution are successfully implemented.
- 28
29 o Developing countries may be able to reduce the annual growth in CO2
30 emission from over 3 percent to around 2 percent, while maintaining
31 economic growth. The largest opportunities in developing countries appear
32 to be increased efficiency in both energy supply and demand.
- 33
34 o North American and Pacific OECD countries may be able to slow the growth
35 in CO2 emissions by increased efficiency in energy supply and demand, fuel
36 switching to nuclear, natural gas and renewables, and other measures.

37 38 39 **7.0 MEASURES FOR ADAPTING TO CLIMATE CHANGE**

40
41 In addition to the limitation options discussed above, the RSWG reviewed
42 measures for adapting to potential climate change. The consideration of
43 adaptation options is critical for a number of reasons. First, because it is
44 believed that there is likely to be a lag time between emissions and subsequent
45 climate change, the climate may already be committed to a certain degree of
46 change. Implementation of adaptation measures may thus be necessary
47 regardless of any limitation actions which may be taken. Secondly, natural
48 climatic variability itself necessitates adaptation.

49
50 Furthermore, should significant adverse climate change occur, it would be
51 necessary to consider limitation and adaptation strategies as part of an
52 integrated package in which policies adopted in the two areas complement each
53 other so as to minimize costs. Limitation and adaptation options

1 should be developed and analyzed recognizing the relationship between the
2 timing and costs of limitation and adaptation. For example, the slower the rate
3 of climate change, the easier it would be to adapt, and vice versa. It is similarly
4 important to address those cases where limitation and adaptation policies may
5 work at cross purposes. A truly comprehensive approach should recognize that
6 controlling the different gases might have different effects on the adaptive
7 capacity of natural resources.

8
9 The RSWG explored two broad categories of adaptation options:

- 10
11 o Coastal zone management, or options which maximize the ability of coastal
12 regions to adapt to possible sea level rise and increased frequency and
13 severity of storms; and
14
15 o Resource use and management, or options which address the potential
16 impacts of climate change on food security, water availability, natural and
17 managed ecosystems, land, and biodiversity.

18 19 7.1 Coastal Zone Management

20
21 Global climate change is projected to raise sea level by as much as [Note:
22 figure to be obtained from WGI] and, in some areas, to increase the frequency
23 and severity of storms. Although there remain substantial uncertainties
24 regarding the possible rate and magnitude of sea level rise, hundreds of
25 thousands of square kilometers of coastal wetlands and other lowlands could be
26 inundated, while ocean beaches could erode perhaps as much as one hundred
27 meters over the next century. Flooding could threaten lives, agriculture,
28 livestock, and structures, while saltwater could advance inland into aquifers,
29 estuaries, and soils, thus threatening water supplies, ecosystems, and
30 agriculture in some areas.

31
32 Some nations would be particularly vulnerable to such changes. Eight to
33 ten million people live within one meter of high tide in each of the unprotected
34 river deltas of Bangladesh, Egypt, and Vietnam. Half a million people live in
35 various coral atoll nations that lie almost entirely within three meters of sea level,
36 such as the Maldives, the Marshall Islands, Tuvalu, Kiribati, and Tokelau. Even
37 in nations that are not, on the whole, particularly vulnerable to sea level rise,
38 some low-lying areas or regions dependent on fisheries resources could be
39 threatened.

40
41 Available responses to sea level rise fall broadly into three categories:

- 42
43 o Retreat: Under this option no actions would be taken to protect the land
44 from the sea - the focus would instead be on providing for people and
45 ecosystems to shift landward in an optimal fashion. This choice could be
46 motivated by either excessive costs of protection or by a desire to maintain
47 ecosystems.
48
49 o Accommodation: Under this strategy, while no attempt would be made to
50 protect the land at risk, measures would be taken to allow for continued
51 habitation of the area. Specific responses under this options would include
52 erecting flood shelters, elevating buildings on pilings, converting agriculture
53 to fish ponds, or growing flood- or salt-tolerant species.

1 o Protection: A protection strategy uses site-specific features such as sea
2 walls, dikes, dunes, and vegetation to protect the land from the sea so that
3 existing land uses can be retained.

4
5 There are varying socio-economic implications for each of these options.
6 Retreat could lead to a loss of property, potentially costly resettlement of
7 populations, and, in some notable cases, refugee problems. Accommodation
8 could result in declining property values, increased damage from storms, and
9 costs for modifying infrastructure. The protection option would involve the
10 considerable economic costs of building sea walls and other structures (even
11 ignoring the impacts of flooding and salt water intrusion, a one meter rise would
12 require 360,000 kilometers of coastal defenses) and could have negative
13 impacts on fisheries, wildlife and recreation. The loss of traditional environments
14 could potentially disrupt family life and create social instability.

15
16 Actions to Prepare for Possible Sea Level Rise:

17
18 A number of response options are available which not only enhance the
19 ability of coastal nations to adapt to sea level rise, but are also beneficial in their
20 own right. Implementation of such options would be most effective if undertaken
21 in the short-term, not because there is an impending catastrophe, but because
22 there are opportunities to avoid adverse impacts by acting now - opportunities
23 which may not be as effective if the process is delayed. These options include:

24
25 National Coastal Planning:

26
27 o Development and implementation in the short term of comprehensive
28 national coastal zone management plans which (a) deal with both sea level
29 rise and other impacts of global climate change and (b) ensure that risks to
30 populations are minimized while recognizing the need to protect and
31 maintain important coastal ecosystems.

32
33 o Identification of coastal areas at risk. National efforts are needed to (a)
34 identify functions and resources at risk from a one meter rise in sea level
35 and (b) assess the implications of adaptive response measures on them.

36
37 o Provisions to ensure that coastal development does not increase
38 vulnerability to sea level rise. Actions in particular need of review include
39 river levees and dams, conversions of mangroves and other wetlands for
40 agriculture and human habitation, and increased settlement in low-lying
41 areas. In addition, while structural measures to prepare for sea level rise
42 are not yet warranted, the design and location of coastal infrastructure and
43 coastal defenses should include consideration of sea level rise and other
44 impacts of climate change. It is sometimes less expensive to design a
45 structure today, incorporating these factors, than to rebuild it later.

46
47 o Review and strengthening of emergency preparedness and coastal zone
48 response mechanisms. Efforts are needed to develop emergency
49 preparedness plans for reducing vulnerability to coastal storms through
50 better evacuation planning and the development of coastal defense
51 mechanisms that recognize the impact of sea level rise.

1 International Cooperation:

- 2
- 3 o Maintenance of a continuing international focus on the impacts of sea level
4 rise. An international organization for focusing attention and awareness of
5 sea level change and climate impacts on the coastal zone may be required
6 to encourage the nations of the world to develop appropriate responses.
7
- 8 o Provision of technical assistance to developing nations. Institutions offering
9 financial support should take into account the need for technical assistance
10 in developing coastal management plans, assessing coastal resources at
11 risk, and increasing a nation's ability - through education, training, and
12 technology transfer - to address sea level rise.
13
- 14 o Support by international organizations for national efforts to limit population
15 growth in coastal areas. In the final analysis, rapid population growth is the
16 underlying problem with the greatest impact on both the efficacy of coastal
17 zone management and the success of adaptive response options.
18

19 Research, Data, and Information:

- 20
- 21 o Strengthening of research on the impacts of global climate change on sea
22 level rise. International and national climate research programs need to be
23 directed at understanding and predicting changes in sea level, extreme
24 events, precipitation, and other impacts of global climate change on coastal
25 areas.
26
- 27 o Development and implementation of a global ocean observing network, for
28 example through the efforts of the IOC, WMO, and UNEP to establish a
29 coordinated international ocean observing network that will allow for
30 accurate assessment and continuous monitoring of changes in the world's
31 oceans and coastal areas, particularly sea level change.
32
- 33 o Dissemination of data and information on sea level change and adaptive
34 options. An international mechanism could be identified for collecting and
35 disseminating important data and information on climate change and its
36 impact on sea level and the coastal zone and on various adaptive options.
37 Sharing this information with developing countries is critically important for
38 preparation of coastal management plans.
39
40

41 **7.2 Resource Use and Management**

42

43 Global climate change could have significant impacts upon the very
44 resources that humans and other species rely on to live. These resources
45 include water, agriculture, livestock, fisheries, land, forests, and wildlife. The
46 RSWG addressed these resource issues in the context of considering options for
47 ensuring food security; conserving species diversity; maintaining water supplies;
48 and using land rationally for managed and unmanaged ecosystems.
49

50 The potential impacts of climate change on natural resources and human
51 activities are very poorly understood. First, credible regional estimates of
52 changes in critical climatic factors, such as temperature, soil moisture,

1 annual and seasonal variability, and frequencies of droughts, floods and storms,
2 are simply not available. For many of these critical climatic factors even the
3 direction of change is uncertain. Secondly, methods for translating these
4 changes into effects on the quantity and quality of resources are generally
5 lacking. While it is clear that some of the impacts of climate change on
6 resources could be negative and others positive, a more specific quantification of
7 those impacts is not possible at this time. In general, however, it can be said
8 that: (a) those resources which are managed by humans (e.g. agriculture,
9 forestry) are more suited to successful adaptation than unmanaged ecosystems;
10 and (b) the faster the rate of change, the greater the impact.

11
12 It should be noted that there already exists a large reservoir of experience
13 and knowledge to help formulate and implement adaptation response strategies
14 in the event of climate change. Through the ages societies and all living things
15 have developed the capability, and a suite of responses, to adapt to the
16 climate's natural variability and to extreme events (e.g. droughts, floods).
17 Several climatic zones span the globe, and resource use and management is an
18 ongoing challenge in each of these zones. Therefore, society could borrow from
19 these experiences in developing policies to adapt to possible climate change. In
20 addition, expected future economic and technological progress should provide
21 the financial and technical resources required to better adapt to a changing
22 climate.

23
24 In recognition of the uncertainties regarding the impacts of climate change
25 on resource use and management, the following sections provide general, rather
26 than specific, options in three categories. The appropriateness of these options
27 for individual countries may vary depending on the specific social, environmental
28 and economic context.

29
30 Short-Term Research Related Options:

31
32 There are a number of actions which would augment our knowledge base
33 for making reasoned judgments about response strategies. These include:

- 34
35 o Developing inventories, data bases, monitoring systems, and catalogues of
36 the current state of resources and resource use and management practices.
37
38 o Improving our scientific understanding of and predictive tools for critical
39 climatic factors, their impacts on natural resources, and their
40 socio-economic consequences.
41
42 o Undertaking studies and assessments to gauge the resilience and
43 adaptability of resources and their vulnerability to climate change.
44
45 o Encouraging research and development by both public and private
46 enterprises directed toward more efficient resource use and
47 biotechnological innovation (with adequate safeguards for health, safety,
48 and the environment), including allowing innovators to profit from their work.
49
50 o Continuing existing research and development of methods to cope with the
51 potentially worst consequences of climate change, such as developing more
52 drought- or salinity-resistant cultivars or using classical and modern
53 breeding techniques to help keep farming and forestry options open.

- 1 o Increasing research on the preservation of biological resources in situ and
2 ex situ, including investigations into the size and location of protected
3 natural areas and conservation corridors.

4
5 Short-Term Policy Options:

6
7 Some response strategies are available which are probably economically
8 justified under present-day conditions and which could be undertaken for sound
9 resource management reasons, even in the absence of climate change. In
10 general, these relate to improving the efficiency of natural resource use, fuller
11 utilization of the "harvested" component of resources, and waste reduction.
12 Measures that could be implemented in the short-term include:

- 13
14 o Increased emphasis on the development and adoption of technologies
15 which may increase the productivity or efficiency (per unit of land or water)
16 of crops, forests, livestock, fisheries, and human settlements, consistent
17 with the principles of sustainable economic growth and development. Such
18 efficiencies reduce the demand for land for human activities and could also
19 help reduce emissions of greenhouse gases. Examples of specific options
20 include more efficient milk and meat production; improved food storage and
21 distribution; and better water management practices.
- 22
23 o Increased promotion and strengthening of resource conservation and
24 sustainable resource use -- especially in highly vulnerable areas. Various
25 initiatives could be explored for conserving the most sensitive and valuable
26 resources, including strengthening conservation measures, managing
27 development of highly vulnerable resources, and promoting reforestation
28 and afforestation.
- 29
30 o Acceleration of economic development efforts in developing countries.
31 Because these countries often have largely resource-based economies,
32 efforts at improving agriculture and natural resource use would be
33 particularly beneficial. Such efforts would also promote capital formation,
34 which would generally make adaptation to climate change and sustainable
35 development more feasible.
- 36
37 o Developing methods whereby local populations and resource users gain a
38 stake in conservation and sustainable resource use, for example by
39 investing resource users with clear property rights and long-term tenure,
40 and allowing voluntary water transfer or other market mechanisms.
- 41
42 o Decentralizing, as practicable, decision-making on resource use and
43 management.

44
45 Longer-Term Options:

46
47 There are also a number of other possible responses which are costly or
48 otherwise appear to be more appropriate for consideration in the longer-term,
49 once uncertainties regarding climate change impacts are reduced. Options in
50 this category include:

- 51
52 o Building large capital structures (such as dams) to provide for enhanced
53 availability of water and other resources.

- 1 o Strengthening and enlarging protected natural areas and establishing
2 conservation corridors to enhance the adaptation prospects for unmanaged
3 ecosystems.
- 4
- 5 o Reviewing and possibly eliminating direct and indirect subsidies and
6 incentives for inefficient resource use.
- 7

8 8.0 MECHANISMS FOR IMPLEMENTING RESPONSE STRATEGIES

10 The RSWG also considered in detail several priority areas which must be
11 addressed in order to adequately implement limitation or adaptation responses.
12 These "implementation mechanisms" represent the primary vehicles through
13 which national and international responses to climate can be brought into force.
14 The specific implementation mechanisms considered were:

- 15
- 16
- 17 o Public information and education;
- 18
- 19 o Technology development and transfer;
- 20
- 21 o Economic (market) mechanisms;
- 22
- 23 o Financial mechanisms;
- 24
- 25 o Legal and institutional mechanisms, including possible elements of a
26 framework convention on climate change.

27 The results of the RSWG's deliberations on these issues are provided below.

29 30 8.1 Public Information and Education

31 A well informed global population is essential for addressing and coping with
32 an issue as complex as potential climate change. Because climate change has
33 the potential to affect, either directly or indirectly, almost every sector of society,
34 broad global understanding of the issue will facilitate the adoption and
35 implementation of such response options as may be necessary and appropriate.
36 The dissemination of information also represents a powerful economic
37 instrument for ensuring that markets accurately take into account potential
38 consequences and/or opportunities of climate change.

39

40 The core aims of public education and information programs are to:

- 41
- 42
- 43 o Promote awareness and knowledge of climate change issues;
- 44
- 45 o Encourage positive practices to limit and/or adapt to climate change; and
- 46
- 47 o Encourage wide participation by all countries, both developed and
48 developing, in addressing climate change issues and developing
49 appropriate responses.

50 Given the importance of a well-informed population, the RSWG developed
51 suggestions and approaches for improving international awareness of the
52 potential causes and impacts of climate change. In this process it was
53 recognized that, while broad-based understanding is essential,
54

1 no single mechanism can work for every group or in every culture or country.
2 The social, economic, and cultural diversity of nations will likely require
3 educational approaches and information tailored to the specific requirements
4 and resources of particular locales, countries, or regions.

5
6 A number of national and international actions could be taken to
7 disseminate broadly information on climate change. These include the:

- 8
9 o Establishment of national committees or clearing houses to collect, develop,
10 and disseminate accurate information on climate change issues. This could
11 help provide focal points for information on issues such as energy efficiency,
12 energy savings, forestry, agriculture, etc.
13
14 o Use by international organizations (UNESCO, UNEP, WMO, etc.) of IPCC
15 reports in developing and providing to all countries an adequate
16 understanding for future actions.
17
18 o Use of an existing international institution, or development of a new
19 institution, to serve as a clearinghouse for informational and educational
20 materials.
21

22 **8.2 Technology Development and Transfer**

23
24 The development and transfer of technologies is vital to any effort to
25 address global climate change. The development of new technologies may
26 provide the means by which societies can meet their energy, food, and other
27 needs in the face of changes in global climate, while at the same time
28 minimizing emissions of greenhouse gases. Prompt transfer of technologies,
29 especially to developing countries, is likewise an important aspect of any effort
30 to limit or adapt to climate change.

31 **Technology Research and Development Issues:**

32
33 Technological development is needed to limit or reduce anthropogenic
34 greenhouse gas emissions; absorb such gases by protecting and increasing
35 sinks; adapt human activities and resource use and management to the impacts
36 of climate change; and detect and predict climate change and its impacts.
37 Technology development could be pursued in a wide range of activities such as
38 energy, industry, agriculture, transport, water supply, coastal protection, and
39 management of natural resources. Some of the primary areas where further
40 technology research and development is needed include:

- 41
42
43 o **Energy**, in particular those technologies which provide for using fossil
44 energy resources more efficiently and which promote the use of non-fossil
45 energy sources (e.g. renewable energy sources and safe nuclear power).
46
47 o **Natural Resources**, including technologies and practices for increasing
48 yields of forests and other greenhouse gas sinks, reducing emissions from
49 agricultural sources, and measures for enhancing the ability of resources to
50 adapt to climate change.
51
52 o **Monitoring**, in particular those technologies which enhance our ability to
53 make accurate predictions about the magnitude, timing, and regional
54 impacts of climate change.

1 Technology Transfer:

2
3 The fastest rate of increase of greenhouse gases emission is occurring in
4 developing countries. As a result, there is a need for the transfer of technologies
5 for limiting climate change to the developing countries. Such advanced
6 technologies may provide an alternative which would allow developing countries
7 to encourage economic growth and limit greenhouse gas emissions. A number
8 of efforts are currently underway through bilateral and multilateral arrangements
9 which could be further expanded.

10
11 A number of impediments, however, hinder the effective transfer of
12 technologies to developing countries. These include lack of financial resources,
13 necessary institutions, and trained human resources. Existing institutions could
14 be strengthened to finance technology transfers, train human resources, and
15 evaluate, introduce, and operate new technologies.

16
17 Existing legal provisions and restrictive trade practices are also possible
18 constraints. In this context, the issue of intellectual property rights presents a
19 case where international opinion is mixed. Some hold that the universal
20 international protection of such rights will promote the effective development and
21 transfer of technologies, while others hold that provisions for the protection of
22 intellectual property rights should be determined by the recipient countries, in
23 accordance with their particular legal regimes. Because of the importance of
24 technology transfer, this issue should be addressed in the short-term.

25
26 **8.3 Economic Mechanisms**

27
28 It is important that any potential measures to limit or adapt to global climate
29 change be as economically efficient and cost-effective as possible, while taking
30 into account important social implications. In general, environmental objectives
31 can be achieved either through regulations requiring the use of a specific
32 technology or attainment of specified goals, or economic instruments such as
33 emissions fees, subsidies, tradeable permits, or sanctions.

34
35 Economic instruments, through their encouragement of flexible selection of
36 abatement measures, frequently offer the possibility of achieving environmental
37 improvements at lower cost than regulatory mechanisms. Unlike many
38 regulations, they tend to encourage innovation and the development of improved
39 technologies and practices for reducing emissions. Economic mechanisms also
40 have the potential to provide the signals necessary for more environmentally
41 sensitive operation of markets. It is unlikely, however, that economic
42 instruments will be applicable to all circumstances.

43
44 Three factors are considered as potential barriers to the operation of
45 markets and/or the achievement of environmental objectives through market
46 mechanisms. These are: information problems, which can often cause markets
47 to produce less effective or unfavorable environmental outcomes; existing
48 measures and institutions, which can encourage individuals to behave in
49 environmentally damaging ways; and balancing competing objectives (social,
50 environmental, and economic). An initial response strategy may therefore be to
51 address information problems directly and to review existing measures which
52 may be barriers.

1 A general advantage of market based economic instruments is that they
2 encourage limitations or reductions in emissions by those who can achieve them
3 at least cost. They also provide an ongoing incentive for industry and individual
4 consumers to apply the most efficient limitation/reduction measures through, for
5 example, more efficient and cleaner technologies. Such incentives may be
6 lacking in the case of regulations.

7
8 Regulations, are the customary means of controlling pollution in both market
9 and centrally planned economies. An advantage of regulations is that, in certain
10 circumstances, they create more certainty as to desired outcomes, whereas
11 major disadvantages are that they may discourage innovation, introduce
12 inflexibilities in meeting objectives, can discourage resource use efficiency, and
13 offer few or no incentives to reduce emissions below specified levels.

14
15 A number of specific economic instruments were identified that might be
16 used as alternatives or supplements to regulatory actions in meeting
17 environmental goals:

18
19 o A system of tradeable emissions permits: An emission permit system is
20 based on the concept that the economic costs of attaining a given
21 environmental goal can be minimized by allowing for the trading of
22 emissions rights. Once an overall limit on emissions has been set,
23 emissions entitlements amounting to that limit could be provided to emitting
24 sources and free trading of such entitlements allowed. This would reduce
25 the costs of meeting a given emission target because: (a) as in trade,
26 comparative advantages between trading entities would be maximized; and
27 (b) economic incentives would be created for the development of improved
28 greenhouse gas limitation technologies, sink enhancement, and resource
29 use efficiency (energy conservation).

30
31 o A system of emission charges: Emission charges are levied on specified
32 emissions depending on their level of contribution to climate change. Such
33 charges may provide a means of encouraging emitters to limit or reduce
34 emissions and provide an incentive for diverse parties to implement efficient
35 means of limiting or reducing emissions. Another advantage of charges is
36 that they generate revenue which could provide a funding base for further
37 pollution abatement, research, and administration, or allow other taxes to be
38 lowered.

39
40 o Subsidies: Subsidies are aimed at encouraging environmentally sound
41 actions by lowering their costs. Subsidies could be used, inter alia, to
42 encourage the use of energy-efficient equipment and non-fossil energy
43 sources, and the development and greater use of environmentally sound
44 technologies.

45
46 o Sanctions: A final type of economic instrument is the use of economic
47 sanctions for the enforcement of international agreements. This would
48 require an international convention to establish a system of agreed trade or
49 financial sanctions to be imposed on countries not adhering to agreed
50 regimes.

51
52 It has also been suggested that the environmental protection value could be
53 maximized and the economic costs of meeting possible greenhouse gas
54 limitation targets (should such be considered necessary in the future) minimized

1 by considering all greenhouse gas sources and sinks comprehensively. Under
2 this approach individual countries would be assigned an allowable emissions
3 level, in terms of a parameter or "index" such as CO2 equivalency, for all their
4 net greenhouse gas emissions. Countries would then be free to determine what
5 specific measures to implement domestically to meet that target by limiting
6 sources or enhancing sinks of any combination of greenhouse gases. This
7 would avoid ignoring important greenhouse gases, foster sink development, and
8 enable countries to implement the domestic program which allows them to meet
9 a given target at the least cost for their specific economic and social position.

10
11 Each of the approaches outlined above, however, poses potentially
12 significant challenges in terms of implementation and acceptability. There is an
13 incomplete understanding of the economic and social consequences of these
14 various approaches. It is evident that further work is required in all countries,
15 and in ongoing IPCC work, to fully evaluate the practicality of such measures
16 and costs and benefits associated with different mechanisms. It is appreciated
17 that each instrument assessed has a role in meeting greenhouse emission
18 objectives, but the suitability of particular instruments is dependent on the
19 particular circumstances and at this stage no measure can be considered
20 universally superior to all other available mechanisms.

21 22 **8.4 Financial Mechanisms**

23
24 Industrialized and developing countries alike have a common responsibility
25 to address the potential consequences of global climate change. Responses to
26 climate change can not be effective unless there is broad participation from all
27 countries, regardless of their level of development or economic structure.
28 However, the special circumstances of the developing countries, including their
29 vulnerability to the consequences of climate change and their lack of financial
30 resources, must be recognized. Financial assistance to developing countries
31 represents an important mechanism for assisting them in undertaking adequate
32 measures to limit or adapt to climate change.

33
34 Bilateral and multilateral development agencies should be used and could
35 be encouraged to strengthen and expand their fields of competence into new
36 areas that are responsive to environmental necessity. Climate change goals
37 would be furthered by a concerted effort by all of these institutions to formulate
38 coordinated and integrated strategies which assure that all development
39 assistance investments, whether undertaken with existing or additional funds,
40 take into account climate change issues.

41
42 Financial resources channelled to developing countries would be most
43 effective if focused on those activities which contribute both to limiting
44 greenhouse gas emissions and promoting economic development. Areas for
45 assistance could include:

- 46
47 o Efficient use of fossil energy resources and the increased use of low-fossil
48 or non-fossil fuels;
49
50 o Rational forest management practices and agricultural techniques which
51 reduce greenhouse gas emissions;

- 1 o Measures which enhance the ability of developing countries to develop
2 programs to address climate change, including research and development
3 activities and public awareness and education;
- 4
- 5 o Participation by developing countries in international fora on global climate
6 change, such as the IPCC.
- 7

8 A number of possible sources for generating financial resources were
9 considered. These include general taxation, specific taxation on greenhouse
10 gas emissions, and emissions trading. Creative suggestions include using
11 undisbursed official resources, a fixed percentage tax on travel tickets, a climate
12 lottery, and levies on countries that have been unable to meet their obligations.
13 The question has also been raised of whether such financial assistance should
14 only be given to those countries which abstain from activities producing
15 greenhouse gases and whether assistance should be provided for adaptation
16 purposes.

17
18 With respect to institutional mechanisms for providing financial assistance to
19 developing countries, several tracks could be considered:

- 20
- 21 o One track builds on work underway or planned in existing institutions. In
22 this regard, the World Bank, a number of the regional banks, other
23 multilateral organizations, and bilateral agencies have initiated efforts to
24 incorporate global climate change issues into their programs. Bilateral
25 donors could further integrate and reinforce the environmental components
26 of their assistance programs and develop co-financing arrangements with
27 multilateral institutions.
- 28
- 29 o Parallel to this track some have raised the possibility that the creation of
30 new mechanisms and facilities such as a new international fund is already
31 justified. Such new instruments could be located within the World Bank
32 systems (with new rules) or elsewhere.
- 33
- 34 o In addition, individual developing countries could also initiate studies, with
35 donor assistance, on their current and projected emissions levels and
36 assistance needs for limiting such emissions.
- 37
- 38 o Further consideration is also needed of the important contributions which
39 the private sector might make, through technology transfer, foreign direct
40 investment, and other means, to assist developing countries to respond to
41 climate change.
- 42

43 **8.5 Legal and Institutional Mechanisms**

44
45 A number of institutions and international legal mechanisms exist which
46 have a bearing on the climate change issue, in particular those dealing with the
47 environment, science and technology, energy, natural resources, and financial
48 assistance. One of these existing international legal mechanisms, the Vienna
49 Convention on the Protection of the Ozone Layer and its associated Montreal
50 Protocol on Substances that Deplete the Ozone Layer, deals specifically with
51 reducing emissions of important greenhouse gases which also deplete the
52 ozone layer. However, there is a general view that, while existing legal
53 instruments and institutions related to climate change should be fully utilized and
54 further strengthened, they are insufficient alone to meet the challenge.

1 A very broad international consensus has therefore emerged in the RSWG,
2 confirmed notably at the 44th United Nations General Assembly, on the need for
3 a framework convention on climate change. Such a convention should generally
4 follow the format of the Vienna Convention for the Protection of the Ozone Layer
5 in laying down, at a minimum, general principles and obligations. It should
6 further be framed in such a way as to gain the adherence of the largest possible
7 number and most suitably balanced range of countries, while permitting timely
8 action to be taken. In addition, it should contain provisions for the adoption of
9 separate annexes/protocol(s) to deal with specific obligations. As part of the
10 commitment of the parties to action on greenhouse gas emissions and the
11 adverse effects of climate change, the convention should also address the
12 particular needs of the developing countries, the question of the development
13 and transfer of technology, and institutional requirements.

14
15 A number of overarching issues will have to be decided in the negotiation of
16 a convention. These include:

- 17
18 o the political imperative of striking the correct balance: on the one hand,
19 between the arguments for a far-reaching, action-oriented convention and
20 the need for urgent adoption of such a convention so as to begin tackling
21 the problem of climate change; and, on the other hand, between the costs
22 of inaction and the lack of scientific certainty;
23
24 o the extent to which specific obligations, particularly on the control of
25 emissions of greenhouse gases, should be included in the convention itself
26 or be the subject of a separate protocol(s);
27
28 o the timing of negotiation of such a protocol(s) in relation to the negotiations
29 on the convention.

30
31 In addition, specific issues will need to be addressed, such as:

- 32
33 o Financial needs of developing countries: The need for additional resources
34 for developing countries and the manner in which this should be addressed,
35 particularly in terms of the nature, size and conditions of the funding, will
36 have to be considered by the negotiating parties even if detailed
37 arrangements form the subject of a separate protocol.
38
39 o Development and transfer of technology: The basis on which the promotion
40 of the development and transfer of technology and provision of technical
41 assistance to developing countries should take place will need to be
42 elaborated, taking into account considerations such as terms of transfer,
43 intellectual property rights, and the environmental soundness of such
44 technology.
45
46 o Institutions: Views differ substantially on the role and powers of the
47 institutions to be created by the convention, particularly in exercising
48 supervision and control over the obligations undertaken.

49
50 Many countries and international organizations have called for the initiation
51 of international negotiations on a framework convention after completion of the
52 IPCC's first assessment report. The RSWG's analysis of possible elements of a
53 framework convention is intended to provide guidance on the major issues which
54 will likely need to be considered in preparing for such negotiations.

1 9.0 CONCLUSION

2
3 Global climate change is an issue which concerns the entire international
4 community. All countries contribute to the atmospheric concentration of
5 greenhouse gases and, if present trends continue, it is expected that emissions
6 of these gases from all regions of the world will rise through the next century.
7 The potential consequences of global climate change could likewise be felt in all
8 regions of the world.

9
10 A large number of response options have been identified at the national,
11 regional, and international levels to address climate change issues. Actions can
12 be taken both to limit the net quantity of greenhouse gases which are being
13 released into the atmosphere and to adapt to changes in the global climate.
14 While a great many possible response options have been identified in this
15 report, some warrant special attention as being particularly important and
16 feasible for introduction in the short term. These include:

- 17
18 o Implementation of measures which are already economically and socially
19 justifiable in their own right and which also provide benefits from a climate
20 change standpoint. Examples include increased energy efficiency,
21 improved use of forests and other natural resources, and reductions in
22 emissions of CFCs.
- 23
24 o Development by individual countries of national inventories of greenhouse
25 gas emissions and national plans evaluating those measures which could
26 be undertaken to limit greenhouse gas emissions or adapt to the potential
27 impacts of global climate change.
- 28
29 o Strengthening of existing national, regional, and international institutions
30 which have a bearing on climate change, in particular those which improve
31 our scientific and economic understanding of climate change, promote the
32 development of technologies for limiting or adapting to such change, or
33 assist developing countries in addressing this issue.
- 34
35 o Development of a framework convention on climate change which can gain
36 the adherence of the vast majority of the international community and which
37 lays down general principles and obligations for addressing climate change.
- 38
39 o Increased research and development of technologies and practices that
40 reduce greenhouse gas emissions or enhance the ability of countries to
41 adapt to climate change.
- 42
43 o Increased research to reduce the scientific uncertainties regarding the
44 magnitude, timing, and regional impacts of global climate change.
- 45
46 o Increased research with respect to how effective specific response options
47 or groups of options would be in actually averting potential climate change.
- 48
49 o Increased research to understand the economic aspects of specific
50 response options so as to provide an adequate information base for making
51 sound policies.

52
53 The RSWG will continue its work to further define and evaluate the available
54 response options. A number of potential future activities have been

1 identified and are being developed into specific work programs. The
2 participation of the largest possible number of countries in this work is important
3 and is strongly encouraged.
4

5 The efforts of the participating countries in the RSWG process have served
6 to increase international awareness of the climate change issue and possible
7 response strategies. This first assessment report provides important information
8 for policy makers considering national, regional, and international climate
9 change strategies. We believe these efforts have served and will continue to
10 serve to bring the international community closer together in the process of
11 developing a consensus on addressing this vital issue.

Table 2
Examples of Short-Term Options

I. IMPROVE EFFICIENCY IN THE PRODUCTION, CONVERSION AND USE OF ENERGY

Electricity Generation	Industry Sector	Transport Sector	Building Sector
- Improved efficiency in electricity generation - Repowering of existing facilities with high efficiency systems; - Introduction of integrated gasification combined cycle systems; - Introduction of atmospheric fluidised bed combustion; - Introduction of pressurised fluidised bed combustion with combined cycle power systems; - Improvement of boiler efficiency. - Improved system for co-generation of electricity and steam. - Improved operation and maintenance. - Introduction of photovoltaics, especially for local electricity generation. - Introduction of fuel cells.	- Promotion of further efficiency improvements in production process; - Materials recycling (particularly energy-intensive materials); - Substitution with lower energy intensity materials; - Improved electromechanical drives and motors; - Thermal process optimisation, including energy cascading and co-generation. - Improved operation and maintenance.	- Improved fuel efficiency of road vehicles; - Electronic engine management and transmission control systems; - advanced vehicle design; - regular vehicle maintenance; - higher capacity trucks; - improved efficiency in transport facilities; - regenerating units; - Technology development in public transportation; - Intra-city modal shift (e.g. car to bus or metro); - advanced train control system to increase traffic density on urban rail lines; - High-speed inter-city trains; - Better intermodal integration. - Reduced size and weight, with use of lightweight composite materials and structural ceramics; improved aerodynamics, combustion chamber components, better lubricants and tyre design, etc.). - Driver behaviour, traffic management, and vehicle maintenance.	- Improved heating and cooling equipment and systems; - Improvement of energy efficiency of air conditioning; - Promotion of introduction of area heating and cooling including use of heat pumps; - Improved burner efficiency; - Use of heat pumps in buildings; - Use of advanced electronic energy management control systems. - Improved space conditioning efficiency in house/building; - Improved heat efficiency through highly efficient insulating materials; - Better building design (orientation, window, building, envelope, etc.); - Improved air-to-air heat exchangers. - Improved lighting efficiency. - Improved appliance efficiency. - Improved operation and maintenance. - Improved efficiency of cook stoves (in developing countries).

Table 2 (continued)

II. NON FOSSIL AND LOW EMISSION ENERGY SOURCES

Electricity Generation	Other Sectors
- Construction of small-scale and large-scale hydro projects; - Expansion of conventional nuclear power plants; - Construction of gas-fired power plants; - Standardised design of nuclear power plants to improve economics and safety; - Development of geothermal energy projects; - Introduction of wind turbines; - Expansion of sustainable biomass combustion. - Replacement of scrubbers and other energy consuming control technology with more energy efficient emission control.	- Substitution of natural gas and biomass for heating oil and coal; - Solar heating - Technologies for producing and utilising alternative fuels; - Improved storage and combustion systems for natural gas; - Introduction of flexible fuel and alcohol fuel vehicles.
III. REMOVAL, RECIRCULATION OR FIXATION	
Energy/Industry	Landfills
- Recovery and use of leaked or released CH₄ from fossil fuel storage, coal mining; - Improved maintenance of oil and natural gas and oil production and distribution systems to reduce CH₄ leakage; - Improved emission control of CO, SO_x, NO_x and VOCs to protect sinks of greenhouse gases.	- Recycle and incineration of waste materials to reduce CH₄ emissions; - Use or flaring of CH₄ emissions; - Improved maintenance of landfill to decrease CH₄ emissions

Table 3
Examples of Medium-/Long-Term Options

1. IMPROVE EFFICIENCY IN THE PRODUCTION, CONVERSION AND THE USE OF ENERGY

Electricity Generation	Industry Sector	Transport Sector	Building Sector
- Advanced technologies for storage of intermittent energy; - Advanced batteries; - Compressed air energy storage; - Superconducting energy storage;	- Increased use of less energy-intensive materials; - Advanced process technologies; - Use of biological phenomena in processes; - Localised process energy conversion; - Use of fuel cells for co-generation.	- Improved fuel efficiency of road vehicles; - Improvements in aircraft and ship design: - Advanced propulsion concepts; - Ultra high-bypass aircraft engines; - Contra-rotating ship propulsion.	- Improved energy storage systems; - Use of information technology to anticipate and satisfy energy needs; - Use of hydrogen to store energy for use in buildings. - Improved building systems; - New Building materials for better insulation at reduced cost; - Windows which adjust opacity to maximise solar gain. - New food storage systems which eliminate refrigeration requirements

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Table 3 (Continued)

III. NON FOSSIL AND LOW EMISSION ENERGY SOURCES

Other Sectors

Electricity Generation

- | | |
|--|--|
| <ul style="list-style-type: none"> · Nuclear power plants: · Passive safety features to improve reliability and acceptability. · Solar power technologies: <ul style="list-style-type: none"> · Solar thermal; · Solar photovoltaic (especially for local electricity generation). · Advanced fuel cell technologies. | <p>Other technologies for producing and utilising alternative fuels;</p> <ul style="list-style-type: none"> · Improved storage and combustion systems for hydrogen; · Control of gases boiled off from cryogenic fuels; · Improvements in performance of metal hydrides; · High-yield processes to convert lingo-cellulosic biomass into alcohol fuels; · Introduction of electric and hybrid vehicles; · Reduced re-charging time for advanced batteries. |
|--|--|

III. REMOVAL, RECIRCULATION OR FIXATION

- Improved combustion conditions to reduce N₂O emissions.
- Treatment of exhaust gas to reduce N₂O emissions.
- CO₂ separation and geological and marine disposal.

FOOTNOTES

- ¹ Energy and Industry Subgroup Report, Section 4.5.1.1
- ² Energy and Industry Subgroup Report, Section 3.2.2
- ³ Energy and Industry Subgroup Report, Section 3.2.3
- ⁴ Energy and Industry Subgroup Report, Section 4.6.1
- ⁵ Energy and Industry Subgroup Report, Section 3.4.1.
- ⁶ Energy and Industry Subgroup Report, Section 3.6.1
- ⁷ Energy and Industry Subgroup Report, Section 3.2.2.2
- ⁸ Agriculture, Forestry, and Other Activities Report, Section 3.4.2
- ⁹ Agriculture, Forestry, and Other Activities Report, Section 3.4.4
- ¹⁰ Agriculture, Forestry, and Other Activities Report, Section 3.4.1
- ¹¹ Agriculture, Forestry, and Other Activities Report. Section 2.0
- ¹² Agriculture, Forestry, and Other Activities Report. Section 4.2

SUMMARY OF IPCC EVENTS

November 9-11, 1988: Geneva, Intergovernmental Panel on Climate Change (IPCC) organized

- o U.S. delegation successfully seeks chair of Working Group III, the Response Strategies Working Group (RSWG); successfully opposes formation of separate working group on "legal issues".

January 31-Feb. 2, 1989: Washington, First Plenary Meeting, U.S.-Hosted and Chaired, of RSWG

- o Secretary of State Baker delivers opening address.
- o Organizational agenda--U.S. successfully seeks to have chair retain direct responsibility for politically-sensitive "legal issues" (i.e. convention question).
- o Four subgroups of RSWG established: 1) Energy and Industry; 2) Agriculture and Forestry; 3) Coastal Zone Management; 3) Resource Use and Management.

May 10-12, 1989: Geneva, U.S.-Chaired RSWG "Steering Committee"

- o Agenda-setting. Primary focus again on how to handle "legal issues". U.S., backed by developing countries, proposes to consider 1) legal, but also 2) financial, 3) economic, 4) technology development and transfer, and 5) public information and awareness issues in five separate topical papers on "implementation measures" at a subsequent workshop.

June 28-30, 1989: Nairobi, 2nd IPCC Plenary

- o Progress review. U.S. successfully argues to have additional (3rd plenary) meeting in Washington, in February, 1990.

October 2-6, 1989: Geneva, U.S.-Chaired RSWG 2nd Plenary

- o Discussion of five "implementation measures" papers, notably "legal issues" and "elements of a framework convention".

February 5-7, 1990: Washington, 3rd IPCC Plenary

- o President Bush gives opening address.
- o Agenda primarily progress report. Over 60 countries attend.

FUTURE EVENTS

June 5-8: Geneva, U.S.-Chaired 3rd RSWG Plenary

- o Approval of First Interim Report of RSWG (WG-III), including "roadmap" for convention negotiation.

August 27-30, 1990: Sundsvall, Sweden, 4th IPCC Plenary

- o Approval of First Interim Report of IPCC (all three working groups).
- o Future work and program of IPCC.

Late 1990 or Early 1991: U.S. expected to host first round of framework climate convention negotiations, per President's offer.

U.S. POLICY EVOLUTION ON GLOBAL CLIMATE CHANGE

Jan. 31, 1989: Secretary Baker's Opening Statement at First Meeting of U.S.-Chaired Response Strategies Working Group, Washington

- o "We can probably not afford to wait until all of the uncertainties have been resolved before we do act. Time will not make the problem go away.
- o "While scientists refine the state of our knowledge, we should focus immediately on prudent steps that are already justified on grounds other than climate change. These include reducing CFC emissions, greater energy efficiency and reforestation.
- o "Whatever global solutions to global climate change are considered, they should be as specific and cost-effective as they can possibly be.
- o "Those solutions will be most effective if they transcend the great fault line of our times--the need to reconcile the twin requirements for both economic development and a safe environment."

May 12, 1989: Statement by President on Framework Climate Convention

- o "The United States looks forward to playing a significant role in efforts to assess and respond to global climate change. I expect that these efforts will lead to formal negotiations on the establishment of a framework convention on global climate."

July 1989: Environmental Statement of the Paris G-7 Economic Summit

- o "We strongly advocate common efforts to limit emissions of carbon dioxide and other greenhouse gases."
- o "We believe that the conclusion of a framework or umbrella convention on climate change to set out general principles or guidelines is urgently required to mobilize and rationalize the efforts made by the international community.... Specific protocols containing concrete commitments could be fitted into the framework as scientific evidence requires and permits."

December 6, 1989: President's Malta Statement, offers U.S. to host first negotiating session on framework climate convention.

February 5, 1990: President's Speech to IPCC 3rd Plenary, Washington

- o "I have just submitted a budget to our Congress for fiscal 1991.... And underscoring our commitment to your efforts, I am pleased to note that funding for the U.S. Global Change Research Program will increase by nearly 60%, to more than \$1 billion.
- o "Furthermore, even as we wait for the benefits of this research, the United States already has taken many steps in our country that bring both economic and environmental benefits -- steps that make sense on their own merits in terms of responsibility and efficiency, which help reduce emissions of CFCs and carbon dioxide and other pollutants now entering the atmosphere.
- o "...We're crafting a revised Clean Air Act with incentives for our private sector to find creative, market-driven solutions to enhance air quality.
- o "We've launched a major reforestation initiative to plant a billion trees a year on the private land across America.
- o "...Last December at Malta, in my meeting with President Gorbachev, I proposed that the United States offer a venue for the first negotiating session for a framework convention, once the IPCC completes its work. I reiterate that invitation here and look forward to your cooperation in that agenda."

February 26, 1990: Secretary Baker's Speech to Governor's Conference

- o "Just a few weeks ago,...the President reiterated our policy toward climate change. We call it the "no regrets" policy, and we encourage other nations to adopt a similar approach.
- o "Just what do we mean by "no regrets"? We mean that while we are pursuing the serious scientific research that is critical to any responsible approach, we're also hedging our bets in an economically sound way.
- o "...We mean that we are prepared to take actions that are fully justified in their own right and which have the added advantage of coping with greenhouse gases. They're precisely the policies we will never have cause to regret.
- o "...If the results of international scientific research demonstrate that climatic conditions will not change in a significant way, we will have 'no regrets' for these actions because they provided other benefits. If, on the other hand, the findings of our research turn out to be more troublesome, we will have taken prudent steps toward solving the problem in a cost-effective way. We urge other nations to join us in our 'no regrets' efforts."

**INTERGOVERNMENTAL PANEL
ON CLIMATE CHANGE**

Chairman, B. Bolin (Sweden)

Vice-Chair, A. Algain (Saudi Arabia)

**WORKING GROUP I
SCIENCE**

Chairman:

J. Houghton (U.K.)

**WORKING GROUP II
IMPACTS**

Chairman:

Y. Izrael (USSR)

**WORKING GROUP III
RESPONSE
STRATEGIES**

Chairman:

F. Bernthal (U.S.)

IPCC
RESPONSE STRATEGIES
WORKING GROUP

STEERING
COMMITTEE

"Task A":
Emissions
Scenarios

"Task B":
Implementation
Mechanisms:

Legal Measures (U.K., Canada, Malta)
Financial Measures (France, Neth.)
Economic Measures (Australia, N.Z.)
Technology Measures (Japan, India)
Public Education Measures (U.S., PRC)

Energy and
Industry
Subgroup
(Japan and
China)

Agriculture
and Forestry
Subgroup
(FRG and
Zimbabwe)

Coastal Zone
Management
Subgroup
(N. Zealand &
Netherlands)

Resource Use
Management
Subgroup
(France, India,
and Canada)