THE WHITE HOUSE
WASHINGTON

4/23

TO: JOHN SUNUNU

FROM: FRED McCLURE
Assistant to the President
for Legislative Affairs

☒ FYI

☐ Comment

☐ Action

Here's the latest version of Wirth's bill S. 324. It includes a memo to me from David Sloane in my office re: "the lay of the land." Let me know if you need more.

These factors have combined to create the current atmospherics in the Committee, where a modified version of the Wirth bill will be used as the basis for mark-up the week of April 30. I have attached a copy of this bill and a fact sheet, entitled Joint Staff Draft (March 26, 1990), for your perusal. To the extent they have not already seen these materials, you might want to get them to Darman, Porter, Bromley, Boskin and Deland.

While the draft is troubling, it is critical to understand that Senators Johnston and McClure have only agreed to cosponsor this diluted version of the Wirth bill on the basis that it be the starting point for mark-up. Senator McClure, in fact, expressed grave misgivings about the draft during a recent hearing and allowed that it would have to undergo radical surgery before he could support it.

McClure, the Global Climate Coalition (industry groups), and to a less visible extent, Johnston, are now carefully reviewing the draft to develop amendments to improve the bill. Department of Energy representatives, including Polly Gault and Linda Stuntz, are working with McClure's staff in this regard. I will follow these deliberations closely and keep you advised of their progress.

McClure's staff feel they can probably garner the votes to report out a reasonable bill, but are concerned about what will happen on the floor. There, they feel our help will be critical in preventing the environmentalists from loading up the bill.

Here's a quick back-of-the-envelope sense of how Committee votes would probably stack up on the issue: For Wirth: Wirth, Bumpers, Metzenbaum and Bradley; For the Leadership: Johnston, McClure, Ford, Heflin, Domenici, Wallop, Murkowski, Nickles, Burns, Garn, McConnell. Swing votes include: Bingaman, Conrad, Rockefeller and Hatfield.

However, all bets are off on this rack up if Johnston weakens under environmental pressure.

I'll keep you posted.

ATTACHMENTS

cc: Hollingsworth
Grady
Gorman

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Memo	From David Sloane to Frederick McClure Re: Senate Energy Committee Global Warming Bill, S. 324 (2 pp.)	4/20/90	P/5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff, White House Office of
Series: Sununu, John, Files
Subseries: Issues Files
WHORM Cat.:
File Location: Global Warming (2 of 2) - 1990 [4]

Open on Expiration of PRA
(Document Follows)
By JP (NLGB) on 10/28/05

Date Closed:	12/17/2004	**OA/ID Number:**	29158-004
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
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.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

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APR 20 1990

THE WHITE HOUSE

WASHINGTON

April 20, 1990

MEMORANDUM FOR FRED McCLURE

FROM: DAVID P. SLOANE

SUBJECT: SENATE ENERGY COMMITTEE GLOBAL WARMING BILL, S. 324

I. INTRODUCTION

This memo is intended to clarify the status of the comprehensive global warming bill under consideration in the Senate Energy Committee. Governor Sununu has expressed concern and might want an update. While dissuading Committee principals from moving forward is unlikely, their product will be more responsible than any of the other potential Committee bills (Environment & Public Works, Commerce, etc.) when the Senate takes up the issue at some future date.

II. BACKGROUND & POLITICS

Senator Wirth introduced his National Energy Policy Act (S. 324) last year, but had no success in getting Chairman Johnston to put it before the Committee for consideration. However, at that time, Johnston committed to doing something with the global warming issue in the Second Session.

From a political standpoint, while neither Johnston or McClure is comfortable legislating on the global warming issue, several factors have propelled them into action. The first: jurisdiction. During debate on the Clean Air Act, Mitchell announced his plans to move a global warming bill later in the year. In fact, this was how he dissuaded Senator Bryan from offering his CAFE amendment on the air bill.

In addition, both Johnston and McClure felt the Environment & Public Works Committee traipsed all over their jurisdiction during the Clean Air Act debate, establishing major energy policies without their involvement. Neither Senator wants a recurrence of that situation -- though it is likely given the sweeping jurisdictional interest in the issue.

Second, Chairman Johnston continues to feel a need to be more aggressive on the "green" issues given the politics of his reelection effort, and the populist enviromental rhetoric of his opponent, David Duke.

NATIONAL ENERGY POLICY ACT OF 1990
(Wirth, Johnston & McClure Joint Staff Draft)
March 26, 1990

DRAFT

- Purpose

  The overall purpose of the Act is to establish a national energy policy that will reduce the generation of carbon dioxide (CO_2) and greenhouse gases as quickly as feasible.

- Goals

  1. Foster development of policies (for more efficient use standards, increased energy efficiency of existing technologies, fuel switching, use of renewables, fuel and electricity taxes, nuclear energy, and reforestation) to stabilize generation of greenhouse gases.

  2. Assess feasibility of reducing generation of carbon dioxide and other gases not controlled by the Montreal Protocol.

  3. Investigate the feasibility and economic environmental implications of achieving a 20% reduction in carbon dioxide emissions by 2005.

- Also, goal to establish an international agreement on global climate change by 1992.

- The goals are to be met by a National Energy Strategy and Action Plan which shall set forth priorities for the use of "energy resources" (which include traditional fuels as well as improvements in processing and end use efficiency) to achieve goals number two and three (reductions in carbon dioxide emissions).

- The Energy Strategy Action Plan shall include:

  1. Assignment of priorities among most cost-effective energy resources determined based on comparing system cost (all direct costs over the resources available life including environmental mitigation).

  2. A comprehensive inventory of energy resources and their costs.

  3. Targets for production, import, and consumption of "energy resources" to ensure that goals number two and three can be met.

4. A proposed 2-year action program for meeting these reduction targets which sets forth all practicable actions that can be undertaken within existing federal authority.

5. Recommendations for any new federal authority to achieve the goals of section 5 and new policies needed to encourage state action.

- Establishes a ""Director of Climate Protection" who would represent DOE in interagency and multilateral formulation of global climate change policy, and would report to Congress and the President on a review of current scientific knowledge regarding global climate change, to be performed by the National Academy of Sciences. Additionally, a public-private sector Federal Energy-Environmental Coordinating Council would assess all energy and environmental issues affecting Federal programs, and would prepare a research plan to analyze the relationship between energy use and global climate change.

- Energy efficiencies proposals include an amendment to PURPA to encourage "least-cost" utility planing. The change would require state utility commissions to consider revising ratemaking practices in order to incite utility investments in conservation and other demand reduction techniques whenever they would provide a least-cost supply option. The Federal government is directed to utilize efficiencies and renewable energy sources, and directs HUD to promulgate home energy efficiency ratings and the National Institute of Standards to develop energy efficiency for windows.

- Proposed research and development programs include Centers for Energy Intensive Industries, joint ventures in renewable energy, alternative vehicle fuels, high efficiency heat engines, hydrogen utilization and fusion technology. Natural gas R&D programs include mass transit, fleet vehicles, recovery techniques, and heating and cooling technologies.

Joint Staff Draft (March 26, 1990)

AMENDMENT NO._____Ex._____Calendar No._____

Purpose: Amendment in the nature of a substitute.

To establish a national energy strategy for the United States which reflects concern for the global environmental consequences of current trends in atmospheric concentration of greenhouse gases, and for other purposes.

IN THE SENATE OF THE UNITED STATES -- 101st Cong., 2nd Sess.

S. 324, A bill to establish a national energy policy to reduce global warming, and for other purposes.

Referred to the Committee on _____
and ordered to be printed.

☒rdered to lie on the table and to be printed

Intended to be proposed by MR. WIRTH, MR. JOHNSTON, and MR. McCLURE_____

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE. -- This Act, together with the following table of contents, may be cited as the "National Energy Policy Act of 1990".

SECTION 2. TABLE OF CONTENTS. --

TITLE IV -- NATURAL RESOURCE POLICY

SEC. 3. FINDINGS. -- The Congress finds that --

(1) scientific evidence indicates that the atmosphere of the earth is being altered by the generation from natural and man-made sources of carbon dioxide and other greenhouse gases;

(2) on the basis of current scientific understanding, trends in the concentration of such greenhouse gases in the atmosphere may result in global changes in climate, with potentially significant economic, social and environmental implications for human-kind, including agricultural production, water supplies, wetlands, weather, and human health and welfare;

(3) a scientific understanding of the causes and effects of global climate change is necessary to formulate effective policies; and

(4) the formulation of national energy and natural resources policies may be necessary in order to reduce the generation of carbon dioxide and other greenhouse gases and mitigate any adverse consequences of human-induced global climate change.

SEC. 4. PURPOSES. -- The overall purpose of this Act is to establish a national energy policy that will seek to reduce the

generation of carbon dioxide and greenhouse gases as quickly as is feasible in an effort to reduce the risks associated with global climate change. The specific purposes of the Act are to -

(1) improve understanding of the sources of greenhouse gases and their relative contributions to global climate change;

(2) evaluate the environmental, social and economic consequences of global climate change;

(3) evaluate the environmental, social and economic consequences of the policies for mitigating global climate change;

(4) identify the actions required to abate current trends in atmospheric concentrations of greenhouse gases and analyze their relative cost-effectiveness;

(5) identify the actions necessary to remedy any adverse consequences of global climate change;

(6) encourage the formulation of effective national energy and natural resources policies which will mitigate adverse consequences of human-induced global climate change; and

(7) establish programs within the Department of Energy for the achievement of these purposes.

SEC. 5. GOALS. -- (a) The goals of the program under this Act are to --

(1) foster the development of an appropriate mix of policies referred to in subsection (b) that have the

potential, if fully implemented, to stabilize the generation of carbon dioxide and other greenhouse gases in the United States;

(2) assess the feasibility of further limiting, or reducing, the generation of carbon dioxide and other greenhouse gases not controlled by the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer; and

(3) investigate the feasibility and economic, energy, and environmental implications of achieving a 20 percent reduction in the generation of carbon dioxide emissions by the year 2005 as recommended by the 1988 Toronto scientific World Conference on the Changing Atmosphere.

(b) A stabilization or reduction in the generation of carbon dioxide and other greenhouse gases may be achieved by implementing policies governing the use of energy and natural resources in the United States, such as policies that --

(1) implement standards for more efficient use of fossil fuels;

(2) increase the energy efficiency of existing technologies;

(3) result in the switch to fossil fuels that generate lower levels of carbon dioxide;

(4) promote the use of renewable energy resources, including solar, geothermal, sustainable biomass, hydropower, and wind energy;

(5) affect the pricing of fuels and electricity through

taxes and the treatment of investment for tax purposes;

(6) encourage the deployment of nuclear electric generating capacity and the development of other energy technologies, such as advanced nuclear fission and nuclear fusion, that produce energy without carbon dioxide and other greenhouse gases as a byproduct; and

(7) encourage afforestation and reforestation.

(c) The reduction of the generation of chlorofluorocarbons shall be in accordance with the provisions of the Montreal Protocol, unless subsequent Federal legislation is enacted establishing new guidelines for the reduction or elimination of the use of chlorofluorocarbons.

(d) In order to promote international cooperation in addressing greenhouse gas emissions, it is the goal of the United States to establish by 1992, an international agreement on global climate change.

SEC. 6. DEFINITIONS. -- For the purposes of this Act, the term --

(1) "Council" means the Federal Energy-Environmental Coordinating Council established pursuant to section 131;

(2) "Department" means the Department of Energy;

(3) "energy resources" includes, but is not limited to, supplies of natural gas, crude oil and petroleum products, coal, nuclear energy, renewable energy and energy saved through improvements in the

efficiency of energy processing and end-use;

(4) "global climate change" means changes in the climate of the earth that result from increases in the atmospheric concentrations of greenhouse gases;

(5) "greenhouse gases" means carbon dioxide and other gases such as chlorofluorocarbons, methane, ozone, and nitrous oxides that contribute to global climate change; and

(6) "Secretary" means the Secretary of Energy.

TITLE I. -- ENERGY POLICY INITIATIVES

SUBTITLE A. -- National Energy Strategy

SEC. 101. LEAST-COST NATIONAL ENERGY STRATEGY AND ACTION PLAN. -- (a) The first National Energy Policy Plan (the "Plan") under section 801 of the Department of Energy Organization Act (42 U.S.C. 7321) prepared and submitted by the President to Congress after the date of the enactment of this Act, and each subsequent such Plan, shall contain a least-cost national energy strategy (the "energy strategy") prepared in consultation with the Secretary.

(b) The energy strategy shall set forth Federal priorities for the encouragement of the use of energy resources designed to achieve to the maximum extent practicable, the energy production, utilization, and conservation objectives of the Plan and the goals under paragraphs (2) and (3) of section 5 at the least-cost to the Nation as a whole.

(c) The energy strategy shall include --

(1) an assignment of priorities among the energy resources that the Secretary determines to be the most cost-effective, taking into consideration the impact of the production and use of these energy resources on environmental and global climate change;

(2) a comprehensive inventory of energy resources available and their projected costs, taking into account all costs of production, transportation, and utilization of such energy resources, including --

(A) coal, clean coal technologies, and underground coal gasification;

(B) energy efficiency, including existing technologies for increased efficiency in production and end use of energy, and from other technologies that are anticipated to be available through further research and development; and

(C) other alternative energy resources such as renewable energy resources, solar energy, nuclear fission, fusion, geothermal, fuel cells, and hydroelectric power;

(3) targets for the domestic production, import, and consumption of the cost-competitive energy resources that will be needed to ensure that the Nation can achieve the energy resource production, utilization, and conservation objectives of the Plan and the goals under paragraphs (2) and (3) of section 5;

(4) a proposed two-year action program for meeting the energy resource acquisition targets under paragraph (3), which sets forth all practicable actions that can be undertaken within existing Federal authority; and

(5) recommendations for any new Federal authority needed to achieve the goals of section 5 and the objectives of the energy strategy under subsection (a) and for any new Federal policies that are needed to encourage necessary State actions.

(d) Following submission to Congress of the energy strategy under subsection (a), the President, to the maximum extent practicable, shall implement the provisions of the action program under subsection (c)(4).

(e)(1) The relative cost effectiveness of energy resources under this section shall be determined based upon a comparison of the estimated system costs of similarly reliable and available alternative energy resources.

(2) System costs of an energy resource under paragraph (1) are all direct costs for the resource over its available life, including the cost of distribution, transportation, waste management, environmental mitigation, and, in the case of imported energy resources, maintaining access to foreign sources of supply.

(3) When comparing an energy efficiency resource to an alternative fossil energy resource, a higher priority shall be assigned to the energy efficiency resource whenever its estimated

system cost is less than 110 percent of the estimated system cost of the alternative fossil energy resource.

SEC. 102. CONFORMING AMENDMENTS. -- (a) Section 801 of Public Law 95-91 is amended --

(1) in subsection (b)(1) by inserting "at least-cost" after "necessary to satisfy projected energy needs of the United States"; and

(2) in subsection (c)(1) by inserting "cost estimates," after "whatever data and analysis are necessary to support the".

(b) Title III of the Energy Security Act (42 U.S.C. 7361, et seq.) is hereby repealed.

SUBTITLE B. -- Director of Climate Protection

SEC. 111. APPOINTMENT OF DIRECTOR -- (a) Within six months after the enactment of this Act, the Secretary shall appoint within the Department, a Director of Climate Protection (the "Director"). The Director shall:

(1) serve as the Department's representative for interagency and multilateral policy discussions of global climate change;

(2) monitor domestic and international policies for the effects of such policies on the generation of carbon dioxide and other greenhouse gases; and

(3) have the authority to participate in the planning activities in all Departmental programs.

(b) Beginning 18 months after the date of the enactment of

this Act, and annually thereafter, the Director shall participate in the formulation of the energy strategy under section 101, research priorities under section 301, and the priorities established by the management plan under section 302.

SUBTITLE C. -- National Academy of Sciences Review

SEC. 121. REVIEW. -- (a) Within 90 days after his appointment under section 111, the Director, in consultation with the Office of Science and Technology Policy (the "Office"), shall enter into an agreement with the National Research Council to use the services of the National Academy of Sciences and the National Academy of Engineering (the "Academies") to conduct an on-going review of current knowledge regarding --

(1) trends in the atmospheric concentrations of greenhouse gases, including current capabilities to model such trends with sufficient reliability to support national and regional policy formulation;

(2) the causes of global climate change and the relative contribution of various sources of greenhouse gases including, but not limited to, fossil fuel production and use, forest management practices, agricultural practices, and other sources;

(3) climatic, physical, economic, social and environmental consequences of current trends in atmospheric concentration of greenhouse gases; and

(4) actions that might be taken to mitigate the possible adverse physical, economic, and social

consequences of global climate change and the relative cost-effectiveness of these actions.

(b) In conducting such a review, the Academies are encouraged to consult with international governmental and non-governmental entities to determine where there is a consensus in current knowledge with respect to paragraphs (a)(1) through (4).

(c) The Secretary, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, and the Director of the National Science Foundation shall, upon request, furnish to the Office, or the National Research Council, any information which such Office or Council determines to be necessary for purposes of conducting the review required by subsection (a).

SEC. 122. REPORT TO THE CONGRESS. -- (a) Within one year after the date of the enactment of this section, and periodically thereafter, the Academies shall submit a report containing the findings and recommendations resulting from the review conducted under section 111 to the Office and the Congress. The findings and recommendations contained in such report shall not be subject to any prior clearance or review, nor shall any prior clearance or conditions be imposed on the National Research Council, as part of the agreement made by the Office.

(b) Within six months after the transmission of such report to the Congress, the President shall transmit to the Congress his assessment of the findings and recommendations in the report pursuant to subsection (a) and any recommendations therein.

SUBTITLE D. -- Federal Energy-Environmental Coordinating Council

SEC. 131. MEMBERSHIP OF COUNCIL. -- There is hereby established a Federal Energy-Environmental Coordinating Council. Membership on the Council shall consist, in part, of the Secretary (who shall be chairman), and the Administrator of the Environmental Protection Agency (who shall be vice-chairman). The remaining membership of the Council shall consist of --

(1) one representative each from the Department of Agriculture, the Department of Commerce, the Department of the Interior, the Department of Transportation, the Department of State, the Council on Environmental Quality, the National Aeronautics and Space Administration, the National Science Foundation, and the National Oceanic and Atmospheric Administration;

(2) one representative each from the director of the Argonne National Laboratory, the director of the Brookhaven National Laboratory, the director of the Oak Ridge National Laboratory, the director of the Idaho National Engineering Laboratory, the director of the Lawrence Berkeley Laboratory, the director of the Pacific Northwest National Laboratory, and the director of the Solar Energy Research Institute; and

(3) four additional members to be appointed by the President.

SEC. 132. DUTIES OF COUNCIL -- (a) The Council shall:

(1) consider energy and environmental issues and activities affecting Federal programs and activities;

(2) identify associated research needs and priorities, including areas of unwarranted duplication;

(3) identify ways to further international cooperation on energy and environmental matters of global significance; and

(4) make timely recommendations to the President and the Congress on energy and environmental matters, including actions necessary to assess the scope of, and mitigate, global climate change.

(b) The President shall assign to the Council responsibility for the development and coordination of Federal research activities involving energy issues pertaining to global climate change.

(c) The Council shall perform such other related advisory duties as shall be assigned by the President or by the Chairman of the Council.

(d) For the purpose of this section, each Federal agency represented on the Council shall furnish necessary assistance to the Council. Such assistance may include --

(1) detailing employees to the Council to perform such functions, consistent with the purposes of this section, as the Chairman of the Council may assign to them; and

(2) undertaking, upon request of the Chairman, such special studies for the Council as come within the scope of

authority of the Council.

(e) The Council shall convene as necessary, but no less than twice during each fiscal year.

(f) By January 15 of each calender year, the Council shall submit to the President and the Congress a report which shall --

(1) detail the progress of the research program under section 133; and

(2) contain such research and legislative recommendations as are developed by the Council.

SEC. 133. COMPREHENSIVE RESEARCH PLAN. -- (a) The Council shall prepare a comprehensive research plan to identify the relationship between energy resource production, transportation and utilization and the causes and effects of global climate change. The comprehensive research plan shall also seek to identify those actions necessary to limit or ameliorate any adverse effects that the energy sector may have on environmental quality and global climate change.

(b) The comprehensive research plan shall include programs to --

(1) identify and monitor the natural and human-induced causes and effects of global climate change resulting from energy resource production, transportation, and utilization;

(2) determine the atmospheric effects of the generation of carbon dioxide and other greenhouse gases from global trends in the combustion and use of fossil fuels;

(3) determine the atmospheric effects of the generation

of carbon dioxide and other greenhouse gas emissions from forest management practices;

(4) assess the economic, climatic and societal effects of trends in atmospheric concentrations of carbon dioxide and other greenhouse gases; and

(5) foster cooperation toward an international assessment of causes and effects of global climate change resulting from energy resource production, transportation, and utilization, including cooperative scientific and research ventures with foreign governments and international entities.

(c) The Administrator of the National Oceanic and Atmospheric Administration shall serve as the director of the research program set forth in the comprehensive research plan under subsection (a).

TITLE II. -- ENERGY EFFICIENCY INITIATIVES

SUBTITLE A. -- Energy Efficiency

SEC. 201. GOALS. -- The Secretary, in consultation with the interagency committee organized under section 656 of the Department of Energy Organization Act (42 U.S.C. 7266), shall --

(1) give high priority to improvements in energy efficiency in planning, research and development programs, private assistance programs, and to improvements in buildings and equipment of the Department; and

(2) submit to Congress within one year after date of the enactment of this subtitle, and every three years

thereafter, a report evaluating the combination of energy efficiency policy options that would be necessary to produce a decrease of one, two, three, or four per centum per year in U.S. energy use per unit of GNP through the year 2005. These policy options and programs shall be ranked according to their cost effectiveness.

SEC. 202. CENTERS FOR ENERGY-INTENSIVE INDUSTRIES. -- (a) The Secretary, acting in accordance with authority contained in the Federal Nonnuclear Energy Research and Development Policy Act of 1974 (42 U.S.C. 5901-5920) and other laws applicable to the Secretary, shall --

(1) pursue a research and development program intended to improve energy use efficiency in energy-intensive industries and industrial processes; and

(2) undertake joint ventures as provided for in section 303.

(b)(1) The Secretary shall --

(A) conduct a competitive solicitation for proposals from specialized private firms and investors for such joint ventures; and

(B) provide financial assistance to at least five joint ventures.

(2) The purpose of such joint ventures shall be to design, test and demonstrate changes to industrial processes that will result in improved energy efficiency. The joint ventures may also demonstrate other improvements of benefit

to such industries so long as demonstration of energy efficiency improvements is the principal objective of the joint venture.

(3) In evaluating proposals for financial assistance and joint ventures under this section, the Secretary shall consider --

(A) whether the research and development efforts under this section (i) improve the quality and efficiency of industrial processes and (ii) reduce the generation of carbon dioxide and other greenhouse gases into the atmosphere; and

(B) the regional distribution of energy-intensive industries and whether the joint-venture projects are located in the region in which the energy-intensive industries are located.

(4) Industries for which the centers are established shall contribute matching funds starting in fiscal year 1992.

(c) The research and development strategy under this section shall be guided by --

(1) a detailed characterization of the needs of domestic manufacturing industries;

(2) a close working relationship with all sectors of the domestic manufacturing industry; and

(3) coordination among the centers to pool and conserve resources.

(d) There is authorized to be appropriated to the Secretary $5 million for fiscal year 1991, $15 million for fiscal year 1992, and $25 million for fiscal year 1993.

SEC. 203. FEDERAL ENERGY MANAGEMENT AMENDMENTS. -- Part 3 of Title V of the National Energy Conservation Policy Act (NECPA) (42 U.S.C. 8251 et seq.), as amended, is further amended as follows:

(a) In Section 541:

(1) insert the following new finding and renumber accordingly:

"(4) there are also significant opportunities in the Federal Government to increase the use of renewable and alternative clean energy sources;"; and

(2) in the renumbered finding "(6)", insert the following after the words "energy efficiency":

"and the use of renewable and alternative clean energy sources";

(b) in Section 542 insert ", and the use of renewable and alternative clean energy sources," after the words "use of energy";

(c) in Section 543:

(1) Strike subsection (a) and insert the following new text in lieu thereof:

"(a) Energy Management Requirement for Federal Buildings. - (1) Not later than January 1, 2000, each Federal agency shall, to the maximum extent

practicable, install in the United States all energy conservation measures, and all renewable and alternative clean energy measures, with payback periods of less than ten years as calculated using the methods and procedures developed pursuant to section 544. Each Federal agency shall have substantially completed at least 25 percent of these projects by January 1, 1995. If any agency has been unable to meet this requirement, such agency shall spend no funds in States where this requirement has not been met, for the construction or acquisition of a building except to meet the requirements of this section. If any agency has not met the requirements of this section for the year 2000, then such agency shall spend no funds in States where this requirement has not been met, for the construction or acquisition of a building except to meet the requirements of this section. The Secretary may waive the requirements of this Section if the Secretary finds that an agency is taking all practicable steps to meet the requirement and that the sanctions of this Section will pose an unacceptable burden upon the agency.

(2) An agency may exclude from the requirements of paragraph (1) any building, and the associated energy consumption and gross square footage, if the head of such agency finds that compliance with the requirements of paragraph (1) would be impractical. A finding of

impracticability shall be based on the type and amount of energy consumed, the technical feasibility of making the desired changes, and the unique character of many facilities operated by the Departments of Defense and Energy. Each agency shall identify and list in each report made under section 548 the buildings designated by it for such exclusion. The Secretary of Energy shall review such findings for consistency with the impracticability standards set forth herein, and may reverse a finding of impracticability, in which case, the agency shall comply with the requirements of paragraph (1). This section shall not apply to an agency's facilities which generate and/or transmit electric energy, nor to the uranium enrichment facilities operated by the Department of Energy.";

(2) In subsection (b):

(A) after the words "subsection (a)," insert the following:

"The Secretary of Energy shall consult with the Secretary of Defense and the Administrators of the Environmental Protection Agency and the General Services Administration in developing guidelines for the implementation of this Part, and"

(B) strike the phrase "Federal Energy Management Improvement Act of 1988" in paragraph (1) and insert in lieu thereof "Federal Energy Management Amendments of 1990, and submit to the Secretary of Energy";

(C) after the words "high priority projects;" insert the following: "and such plan shall include steps to take maximum advantage of contracts authorized by 42 U.S.C. 8287 et seq., financial incentives and other services provided by utilities for efficiency investment and other forms of financing to reduce the direct costs to the government."

(D) at the end of paragraph (2), strike the semicolon and insert the following:

", and update such surveys periodically, but not less than every three years;"

(E) replace paragraph (3) with the following new paragraph:

"(3) using such surveys, determine the cost and payback period of energy conservation and renewable and alternative clean energy measures likely to achieve the goals of this section;"; and

(F) insert a new paragraph (4) as follows, and renumber paragraph (4) as "(5)".

"(4) install those energy conservation and alternative clean energy measures which will attain the requirements of this section in a cost effective manner as defined in Section 544, and";

(d) in Section 544:

(1) Strike "National Bureau of Standards," in subsection (a) and insert in lieu thereof "National

Institute of Standards and Technology, the Administrator of the Environmental Protection Agency,";

(2) strike "; and" at the end of paragraph (a)(1) and insert in lieu thereof the following:

". These methods shall also incorporate the value of environmental externalities as determined by the Administrator of the Environmental Protection Agency, who shall determine such value within 18 months of enactment of this legislation."; and

(3) strike all after the word "agency", in paragraph (b)(2) and insert in lieu thereof:

"no agency shall, after January 1, 1994, enter into or renew a lease for space exceeding thirty-five thousand square feet in new or renovated buildings where the space exceeds 70 percent of the building's leasable space unless that building has installed all energy conservation, efficiency and renewable energy improvements with paybacks of less than ten years based on the methods established under this section or the landlord has begun to make such investments and will complete installation by January 1, 2000. Any agency unable to comply with this section shall, in a report to the Secretary, demonstrate that it has used its best efforts to persuade the lessor to install these improvements and that no reasonable alternatives for leased space are available.

(e) in Section 545, strike the word "measures." and insert in lieu thereof the following:

"and renewable and alternative clean energy measures as needed to meet the goals established in section 543.";

(f) in Section 546, strike the text of subsection "(b)" and insert in lieu thereof the following:

"Implementation - To facilitate the financing of energy conservation, and renewable and alternative clean energy measures, each Federal agency shall promote the use of contracts authorized by title VIII of this Act. Each agency shall procure such contracts, notwithstanding any other procurement requirements, by utilizing the following procedures:

"(1) By January 1, 1991, each Federal agency shall encourage firms engaged in providing energy services to submit annually a statement of qualifications, including financial and performance information. Each agency shall, by June 1, 1991, and annually thereafter, designate and list, from these submissions, those firms that are presumptively qualified to provide energy services. Such qualifications shall be based upon criteria published by each agency. The Secretary of Energy, in consultation with the Secretary of Defense and the Administrators of the Environmental Protection Agency and the General Services Administration, may issue a form for use by the agencies to obtain the necessary information and provide for other means

to facilitate the qualification process.

"(2) The agency shall select three firms from the qualifying list, or from formal proposals supplied by other firms, to conduct discussions with same concerning each proposed agency project undertaken pursuant to 42 U.S.C. 8287. The selection shall be based upon criteria established and published by each agency. The agency may request a technical and price proposal from the three firms.

"(3) The agency shall select from the three firms the best qualified firm to provide energy services at a contractual arrangement that the agency determines is fair and reasonable to the government, taking into account the estimated value and cost of the services to be rendered, and the scope and nature of the project. The agency is authorized to enter into a contract with this firm. In the event that the agency cannot execute a satisfactory contract with this firm, the agency shall then proceed to negotiate a contract with one of the remaining firms. If the agency is unable to execute a contract with the second firm, the agency may negotiate with the remaining firm, or select another firm from the qualified list on file. The agency is not obligated to enter into a contract if it determines it is undesirable to do so.

"(4) Each Federal agency shall endeavor to do at least three contracts in 1991, and six contracts in 1992 employing this procedure, and then, as required in the plan to be

submitted pursuant to Section 543(b), shall use these contracts to the maximum extent practicable. In the plans submitted pursuant to Section 543(b), the Agencies shall report on their experience with these contracts in 1991 and 1992.

(g) in Section 548:

(1) strike the word "Each" in subsection (a) and insert in lieu thereof the following:

"In addition to the plan required to be submitted to the Secretary pursuant to Section 543 (b)(1), each"; and

(2) insert the phrase "by April 2 of each year," after the word "annually" in subsection (b);

(3) insert the words "by each agency", after the words "under this part" in subsection (b)(1); and

(h) in Section 549:

(1) insert after the word "renewable" the phrase "and alternative clean" in subsections (4) and (8); and

(2) strike the word "geothermal energy" and insert "geothermal energy, fuel cells" in lieu thereof.

SEC. 204. REPEAL OF PROHIBITIONS ON SUPPLY AND INSTALLATION OF RESIDENTIAL ENERGY CONSERVATION MEASURES BY UTILITIES. -- Section 216 of the National Energy Conservation Policy Act (42 U.S.C. 8217) is repealed and subsequent sections are renumbered accordingly.

SEC. 205. HOME ENERGY EFFICIENCY RATINGS. -- Title II of

the National Energy Conservation Policy Act is amended by adding a new Part 6 as follows:

"Part 6 -- Residential Energy Efficiency Ratings

"SEC. 271. (a) Within 12 months after the date of the enactment of this section, the Secretary, in consultation with the Secretary of Housing and Urban Development and State governments, shall, by rule, promulgate guidelines for regulations to be implemented by State governments that would enable the assignment of an energy efficiency rating to residential buildings.

"(b) The rule under subsection (a) shall --

"(1) provide for a numerical rating of the efficiency with which any residential building may be supplied with heating and cooling energy on an annual basis, and evaluate the practicality of including major energy consuming appliances in such rating;

"(2) provide that all residential buildings can receive a rating at time of sale;

"(3) ensure that the rating is prominently communicated to potential buyers and renters; and

"(4) ensure that the rating system is designed to facilitate its use by the secondary mortgage markets to promote energy efficiency.

"(c) Within twelve months of the date of the enactment of this section, the Secretary shall establish a program to provide technical and managerial support for State and local

governments adopting energy efficiency rating systems or building codes. The program shall utilize the Federal government's experience in developing Federal building energy performance standards and shall provide compliance methods, educational materials for builders and code officials, and other technical support.

"(d) For purposes of the rule under subsection (a) supply of energy to any residential building from renewable sources shall not result in a reduction in the energy efficiency rating of such building.".

"(e) There are hereby authorized such to be appropriated funds as are necessary to carry out the purposes of this section.".

SEC. 206. ENERGY EFFICIENCY LABELING FOR WINDOWS AND WINDOW SYSTEMS. -- (a) After a period affording opportunity for public comment, not to exceed 60 days after the date of the enactment of this section, the Secretary shall direct the National Institute of Standards and Technology to develop, within one year after such date of enactment, test procedures under section 323 of the Energy Policy and Conservation Act (42 U.S.C. 6293) for windows and window systems.

(b) The Secretary shall prescribe test procedures for windows and window systems in accordance with the requirements of such section 323 of said Act within 18 months after the date of the enactment of this act.

(c) The Federal Trade Commission (hereafter in this section,

the "Commission") shall prescribe labeling rules under section 324 of said Act (42 U.S.C. 6294) for windows and window systems except to the extent that with respect to any type of window or window system (or class thereof), the Commission determines that labeling in accordance with this section is not technologically or economically feasible or is not likely to assist consumers in making purchasing decisions.

(d) For purposes of sections 323 and 324 of said Act, windows and window systems shall be considered covered products under section 322 of such Act (42 U.S.C. 6292).

SEC. 207. ENERGY EFFICIENCY INFORMATION. -- (a) The Administrator of the Energy Information Administration (hereafter in this section, the "Administrator") shall ensure that the National Energy Information System under 15 U.S.C. 790(a) contains the energy information necessary to permit the calculation, analysis, and publication of trends in energy efficiency in such classes, sectors, and regions as may be necessary to achieve the purposes of this title.

(b) In carrying out the requirements of subsection (a), the Administrator shall include in the System information with respect to programs of electric and natural gas utilities that seek to improve the efficiency with which utility customers use electricity and natural gas or affect the timing of such usage. The information in the System shall be sufficient to --

(1) identify the nature, extent, costs, and performance of such programs;

(2) estimate current and likely future effects of the programs on annual usage, peak demand, and other significant indices of consumption;

(3) compare the costs of the programs with the savings resulting from program operation on an annual basis; and

(4) permit analysis of the effects of such programs on different classes of utility customers.

(c) Within one year after the date of the enactment of this section, the Administrator shall report to Congress on the information being collected or otherwise acquired by the Administrator with respect to the efficiency of energy consumption. The report shall estimate future needs for collection of additional information related to energy efficiency and environmental impacts. The report shall also consider the feasibility of --

(1) increasing the frequency of collection of information and end use of energy;

(2) including additional energy-using classes and sectors in surveys conducted; and

(3) collecting additional information to assist in the analysis of barriers to improvement in energy efficiency.

(d) The Administrator shall periodically publish measures of energy efficiency in classes, sectors, and regions that consume significant amounts of energy.

SEC. 208. COMPACT FLUORESCENT LAMPS IN FEDERAL FACILITIES. -- Not later than 90 days after the date of the enactment of this

title, the Secretary of Energy shall submit to the Congress a report on the feasibility and effectiveness of requiring some or all Federal facilities to use compact fluorescent lamps instead of incandescent lamps in order to reduce the use of electrical energy and thereby reduce the levels of sulfur dioxide emissions.

SEC. 209. REVIEW. -- The Secretary shall periodically review labels established under section 206 and make recommendations as appropriate to Congress.

SUBTITLE B. -- Amendments to Public Utility Regulatory Policies Act of 1978

SEC. 211. ENCOURAGEMENT OF LEAST-COST INVESTMENTS. -- The Public Utility Regulatory Policies Act of 1978 (92 Stat. 3117), as amended, is further amended by inserting the following new sections after section 116 and renumbering the existing sections accordingly:

"SEC. 117. Least-cost Investment for Regulated Utilities.

"(a) Adoption of Standards. -- (1) Not later than two years after the date of the enactment of this act, each State regulatory authority (with respect to each electric utility for which it has ratemaking authority) shall provide public notice and conduct a hearing respecting the standard established by subsection (b). Such authority, on the basis of such hearing, shall adopt and implement the standard established by subsection (b) if, and to the extent, such authority determines that such adoption and implementation is appropriate and consistent with otherwise applicable

State law or regulatory policies.

(2) For purposes of any determination made by such authority on the basis of such hearing and any review of such determination in any court in accordance with section 123, the purposes of this title supplement otherwise applicable State law.

"(b) Establishment. -- The following Federal standard is hereby established:

"(1) The rates allowed to be charged by an electric utility shall be such that the implementation of least-cost supply measures by such utility permits the utility to realize higher earnings than would be realized from its implementation of other supply measures. For purposes of this standard, the phrase 'least-cost supply measures' shall mean actions (including, but not limited to, conservation and other means of demand reduction) taken by the utility to provide adequate and reliable service to consumers with the incurrence of lowest total costs to society, such costs to include costs incurred by the utility and its customers, and environmental costs.

"(2) In implementing least-cost supply measures, each electric utility shall, in addition to measures it may take on its own, consider competitive purchases of

conservation and other reductions in demand from its customers and other parties. Such purchases may be made as part of a general competitive solicitation of least-cost supply measures, including the construction of, or purchase of power from new generation facilities.

"(c) Procedural Requirements. -- Each State regulatory authority (with respect to each electric utility for which it has ratemaking authority) within the two year period specified in subsection (a), shall:

"(1) adopt and implement, pursuant to subsection (a), the standard established by subsection (b); or

"(2) if the standard is not adopted and implemented, such authority shall state in writing that it has determined not to adopt and implement such standard, together with the reasons for such determination. Such statement of reasons shall be available to the public.

"(d) Definitions. -- For purposes of this section, the the term 'electric utility' means any person who is engaged in the local distribution and sale of electricity to any ultimate consumer and over whom a State regulatory authority has ratemaking authority.

"SEC. 118. LEAST-COST INVESTMENT FOR NONREGULATED UTILITIES.

"(a) Adoption of Standards. -- (1) Not later than two years after the date of the enactment of this section, each

nonregulated electric utility shall provide public notice and conduct a hearing respecting the standard established by subsection (b). Such utility, on the basis of such hearing, shall adopt and implement the standard established by subsection (b) if, and to the extent, such utility determines that such adoption and implementation is appropriate under, and consistent with, otherwise applicable State law or regulatory policies.

"(2) For purposes of any determination made by such utility on the basis of such hearing and any review of such determination in any court in accordance with section 123, the purposes of this title supplement otherwise applicable State law.

"(b) Establishment. -- The following Federal standard is hereby established:

"(1) Each nonregulated electric utility shall implement least-cost supply measures. For purposes of this standard, the phrase "least-cost supply measures" shall mean actions (including, but not limited to, conservation and other means of demand reduction) taken by such utility to provide adequate and reliable service to consumers with the incurrence of lowest total costs to society, such costs to include costs incurred by the utility and its customers, and environmental costs.

"(2) In implementing least-cost supply measures each

nonregulated electric utility shall, in addition to measures it may take on its own, consider competitive purchases of conservation and other reductions in demand from its customers and other parties. Such purchases may be made as part of a general competitive solicitation of least-cost supply measures, including the construction of, or purchase of, power from new generation facilities.

"(c) Procedural Requirements. -- Each nonregulated electric utility shall, within the two year period specified in subsection (a):

"(1) adopt and implement, pursuant to subsection (a), the standard established by subsection (b); or

"(2) if the standard is not adopted and implemented, such utility shall state in writing that it has determined not to adopt and implement such standard, together with the reasons for such determination. Such statement of reasons shall be available to the public.

"(d) Definitions. -- For purposes of this section, the term 'nonregulated electric utility' means any person who is engaged in the local distribution and sale of electricity to any ultimate consumer and over whom a State regulatory authority does not have ratemaking authority.".

TITLE III -- ENERGY RESEARCH AND DEVELOPMENT INITIATIVES

SUBTITLE A. -- General

SEC. 301. ENERGY RESEARCH AND DEVELOPMENT PRIORITIES. --

The Secretary shall establish priorities, using the following criteria, for research and development programs of the Department of Energy:

(1) the potential to reduce generation of carbon dioxide and other greenhouse gases sooner than alternative projects;

(2) the projected cost effectiveness of the energy resource to be produced or saved, including an evaluation of the likelihood of the research contributing to the achievement of the purposes of this Act;

(3) the comparative environmental and public health impacts of the energy to be produced or saved by the specific research;

(4) the national security impact of the energy produced or saved, including its projected contribution to the reduction of oil imports and to the diversity of the domestic energy resource mix;

(5) the obstacles inherent in private industry's development of new energy technologies and steps necessary for establishing or maintaining technological leadership in the area of renewable energy technologies, including, but not limited to, solar, fuel cells, fusion, and hydrogen;

(6) the contribution of given research activities in areas of fundamental scientific knowledge; and

(7) the anticipated impact of tne results of research activities on special or targeted populations, including

low-income or aged persons.

SEC. 302. MANAGEMENT PLAN. -- (a) The Secretary shall prepare a management plan for the conduct of research, development, and commercialization of energy technologies that is consistent with the purposes of this Act and guided by the priorities set forth in section 301. The management plan under this section shall provide the framework from which funding for research, development, and commercialization proposed by the Secretary to the Office of Management and Budget will be derived. The management plan shall contain --

(1) a comprehensive analysis of the energy resource requirements of the United States by major consuming sector, including energy consumption in electric utilities, industry, commercial buildings, residential buildings, and transportation, at ten- and twenty-year intervals after the date of the analysis;

(2) for each sector identified under paragraph (1), an estimate of the contribution of carbon dioxide and other greenhouse gases to global climate change;

(3) a description of the principal supply and energy efficiency alternatives that could meet the requirements under paragraph (1) and an assessment of the impact of these alternatives on the rate of global climate change derived from each sector;

(4) a research, development, and commercialization program plan for:

(A) the energy resource alternatives available to each sector identified under paragraph (1) that are consistent with and guided by the priorities set forth in section 301; and

(B) joint ventures pursuant to section 303; and

(5) a mechanism for combining the program plans under paragraph (4) into an overall research, development, and commercialization strategy and management plan for the Department that is consistent with and guided by the priorities set forth in section 301.

(b) In addition, the management plan under subsection (a) shall contain proposals for --

(1) investigation of promising but unproven energy resources and technologies that have been identified as potentially significant future contributors to the Least-cost National Energy Plan under title I;

(2) development of a capability to shift as expeditiously as practicable to an energy resource supply and use pattern in the United States that has minimum impact on the environment and global climate change; and

(3) creation of opportunities for export of energy technology from the United States that can make a substantial contribution to reducing the impact of energy resource supply and use patterns of foreign nations on the global climate.

(c) Within one year after the date of the enactment of this

section, the Secretary shall submit the first management plan under this section to Congress. Thereafter, the Secretary shall resubmit a revised management plan biennially at the time of submittal of the President's annual budget submission to the Congress.

(d) From time to time, but at least biennially, the Secretary shall review and evaluate the provisions of the management plan and make revisions to the plan. Such revisions shall be made available to Congress and the public.

SEC. 303. JOINT VENTURES. -- The Secretary is authorized to conduct joint ventures pursuant to the Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989 (P.L. 101-218) to carry out the purposes of this Act.

SUBTITLE B. -- Engine and Vehicle Fuel Research

SEC. 311. VEHICLE ENGINE-FUEL RESEARCH. -- (a) The Secretary shall establish and carry out a program of research, development and demonstration on advanced vehicle engine systems (including engine systems which rely on alternative fuels and reformulated gasoline) that offer the potential to reduce the generation of greenhouse gases and improve the efficiency of energy in transportation uses.

(b) The Secretary shall prepare a program plan pursuant to section 302(a)(4)(B) to be administered and carried out by the Secretary in the conduct of activities under this section and related law.

SEC. 312. HIGH EFFICIENCY HEAT ENGINES. -- (a)(1) The

Secretary shall establish and carry out a program of research, development, and demonstration on high efficiency heat engines including, but not limited to, advanced gas turbine cycles for high efficiency electric power generation, such as --

(A) advanced combined cycle turbines;

(B) steam-injected gas turbines (STIG); and

(C) intercooled steam-injected gas turbines (ISTIG);

(2) The Secretary in consultation with the Energy Research Advisory Board shall prepare a program plan pursuant to section 302(a)(4)(B) to be administered and carried out by the Secretary in the conduct of activities under this section.

(b) The Secretary, pursuant to section 303, shall enter into joint ventures with the appropriate parties to construct and demonstrate the high efficiency heat engines.

(c) There is authorized to be appropriated not more than $25,000,000 for each of the fiscal years 1991, 1992, and 1993, for purposes of this section.

SUBTITLE C. -- Hydrogen

SEC. 321. GOALS. -- (a) The Secretary shall establish research and development goals to assure the development of a domestic hydrogen fuel capability within the shortest time practicable. Such goals shall include goals for the production, transportation, transmission, distribution, storage and use of hydrogen. Particular attention shall be given to developing an understanding and resolution of all potential safety and environmental problems associated with the production and use of

hydrogen as an energy resource.

(b)(1) The Secretary shall transmit the hydrogen research and development goals established under subsection (a) to the Congress at the time of transmittal of the President's annual budget submission to the Congress.

(2) Whenever the Secretary determines that any of the goals established under paragraph (1) are no longer appropriate, the Secretary shall notify the Congress of the reason for the determination and provide amended goals that are consistent with the national energy strategy.

SEC. 322. PROGRAM MANAGEMENT PLAN. -- (a)(1) The Secretary shall prepare a program plan pursuant to section 302(a)(4)(B), to be administered and carried out by the Secretary in the conduct of activities under this section. Such plan shall be structured to permit the realization of a domestic hydrogen production capability within the shortest time practicable to achieve the goals established under section 321.

(2) The program plan shall include, but not necessarily be limited to:

(A) research and development priorities and goals to be achieved by the program;

(B) program elements, management structure, and activities, including program responsibilities of individual agencies and individual institutional elements;

(C) program strategies including technical milestones to be achieved toward specific goals during each

fiscal year for all major activities and projects;

(D) the estimated costs of individual program items, including current as well as proposed funding levels for each of the five years of the plan for each of the participating agencies;

(E) a description of the methodology of coordination and technology transfer; and

(F) the proposed participation by industry and academia in the planning and implementation of the program.

SEC. 323. ESTABLISHMENT OF A PROGRAM. -- (a) The Secretary shall establish a research and development program, consistent with the program plan under section 322, to ensure the development of a domestic hydrogen fuel production capability within the shortest time practicable.

(b)(1) The Secretary shall initiate research or accelerate existing research in areas which may contribute to the development of hydrogen production and use.

(2) Areas researched shall include production, liquefaction, transmission, distribution, storage, and use of hydrogen. Particular attention shall be given to developing an understanding and resolution of all potential problems of introducing hydrogen production and use into the marketplace.

(c) The Secretary shall give priority to those techniques for the production of hydrogen that use renewable energy resources as their primary energy source.

(d) The Secretary shall, for the purpose of performing his

responsibilities pursuant to this section, solicit proposals for, and evaluate any reasonable new or improved hydrogen technology, that the Secretary determines could lead or contribute to the development of hydrogen production technology.

(e) The Secretary shall conduct evaluations, arrange for tests and demonstrations, and disseminate to developers information, data, and materials necessary to support efforts undertaken pursuant to this section.

SEC. 324. DEMONSTRATIONS AND PLAN. -- (a)(1) The Secretary, pursuant to section 303, shall conduct demonstrations of hydrogen technology, preferably in self-contained locations, so that technical and non-technical parameters can be evaluated to best determine commercial applicability of the technology.

(2) Concurrently with activities conducted pursuant to section 323, the Secretary shall, pursuant to section 303, conduct small-scale demonstrations of hydrogen technology at self-contained sites.

(b) The Secretary shall, in consultation with the Secretary of Transportation, the Administrator of the National Aeronautics and Space Administration, and the Hydrogen Technical Advisory Panel established under section 326, prepare a comprehensive large-scale hydrogen demonstration plan with respect to demonstrations carried out pursuant to subsection (a)(1). Such plan shall include --

(1) a description of the necessary research and development activities that must be completed before the

initiation of a large-scale hydrogen production demonstration program;

(2) an assessment of the appropriateness of a large-scale demonstration immediately upon completion of the necessary research and development activities; and

(3) an implementation schedule with associated budget and program management resource requirements.

SEC. 325. COORDINATION AND CONSULTATION. -- (a) The Secretary shall have overall management responsibility for carrying out the program under this subtitle. In carrying out the program, the Secretary, consistent with such overall management responsibility --

(1) shall use the expertise of the National Aeronautics and Space Administration and the Department of Transportation; and

(2) may use the expertise of any other Federal agency in accordance with subsection (b) in carrying out any activities under this subtitle, to the extent that the Secretary determines that any such agency has capabilities which would allow such agency to contribute to the purpose of this subtitle.

(b) The Secretary may, in accordance with subsection (a), obtain the assistance of any department, agency or instrumentality of the Executive branch of the Federal government upon written request, on a reimbursable basis or otherwise and with the consent of such department, agency, or instrumentality.

Each such request shall identify the assistance the Secretary deems necessary to carry out any duty under this subtitle.

(c) The Secretary shall consult with the Administrator of the National Aeronautics and Space Administration, the Administrator of the Environmental Protection Agency, the Secretary of Transportation, and the Hydrogen Technical Advisory Panel established under section 326 in carrying out his authorities pursuant to this subtitle.

SEC. 326. TECHNICAL PANEL. -- (a) There is hereby established a technical panel of the Energy Research Advisory Board, to be known as the Hydrogen Technical Advisory Panel, to advise the Secretary on the program under this subtitle.

(b)(1) The technical panel shall be appointed by the Secretary and shall be comprised of such representatives from domestic industry, universities, professional societies, Government laboratories, financial, environmental, and other organizations as the Secretary, in consultation with the Chairman of the Energy Research Advisory Board, deems appropriate based on his assessment of the technical and qualifications of such representatives. Appointments to the technical panel shall be made within ninety days after the date of the enactment of this Act. The technical panel shall have a chairman, who shall be elected by the members from among their number.

(2) Members of the technical panel need not be members of the full Energy Research Advisory Board.

(c) The activities of the technical panel shall be in

mpliance with any laws and regulations guiding the activities
technical and fact-finding groups reporting to the Energy
esearch Advisory Board.

(d) The heads of the departments, agencies, and
nstrumentalities of the Executive branch of the Federal
overnment shall cooperate with the technical panel in carrying
ut the requirements of this section and shall furnish to the
echnical panel such information as the technical panel deems
ecessary to carry out this section.

(e) The technical panel shall review and make any necessary recommendations to the following items, among others --

(1) the implementation and conduct of the program under this subtitle; and

(2) the economic, technological, and environmental consequences of the deployment of hydrogen production and use systems.

(f) The technical panel shall prepare and submit annually to the Energy Research Advisory Board a written report of its findings and recommendations with regard to the program under this subtitle. The report shall include --

(1) a summary of the technical panel's activities for the preceding year;

(2) an assessment and evaluation of the status of the program; and

(3) comments on and recommendations for improvements in the comprehensive five-year program management plan required

under section 322.

(g) After consideration of the technical panel report and within thirty days after its receipt, the Energy Research Advisory Board shall submit the report, together with any comments which the Board deems appropriate, to the Secretary.

(h) The Secretary shall provide such staff, funds, and other support as may be necessary to enable the technical panel to carry out the functions described in this section.

SEC. 327. DEFINITIONS. -- As used in this subtitle, the term "capability" means proven technical ability.

SEC. 328. AUTHORIZATION OF APPROPRIATIONS. -- There is hereby authorized to be appropriated to carry out for the purpose of this subtitle (in addition to any amounts made available for such purpose pursuant to other acts) --

(1) $10,000,000 for the fiscal year beginning October 1, 1991;

(2) $15,000,000 for the fiscal year beginning October 1, 1992; and

(3) $20,000,000 for the fiscal year beginning October 1, 1993.

SUBTITLE D. -- Fusion

SEC. 331. GOALS -- (a) The Secretary shall establish research, development, and demonstration goals to assure the timely development of magnetic and inertial confinement fusion for the production of electricity consistent with the purposes of this Act. Such goals shall provide for the achievement by the

year 2010 of --

(1) a demonstration of the achievement of ignition conditions in both magnetic and inertial confinement fusion test facilities;

(2) a demonstration of the technological feasibility of magnetic and inertial confinement fusion for the production of electricity; and

(3) in the event such feasibility is determined, the preparation of the design for a prototype commercial fusion reactor, including associated cost estimates and specifications in sufficient detail to permit bids for construction.

(b)(1) The Secretary shall submit to the Congress, at the time of the President's annual budget submission to Congress, a report on fusion research, development, and demonstration goals established under subsection (a); and

(2) Whenever the Secretary determines that any of the goals established under paragraph (1) are no longer appropriate, the Secretary shall notify the Congress of the reason for that determination and provide amended goals that are consistent with the national energy strategy.

SEC. 332. PROGRAM MANAGEMENT PLAN. -- (a) The Secretary shall establish a comprehensive program plan under section 302(a)(4)(B) to achieve the goals established pursuant to section 331. Such a program plan shall --

(1) describe the actions necessary to achieve the

goals established pursuant to subsection (a);

(2) describe any technical and non-technical barriers to achievement of the goals;

(3) provide an estimate of the funds that would be required to achieve such goals;

(4) describe the role of the United States under appropriate scenarios for international collaboration in such a program of fusion research, development, and demonstration; and

(5) review and analyze the major obstacles to such international collaboration.

(b) The management plan shall also include the recommendations of the Secretary regarding additional legal and budgetary authority required to achieve the goals established pursuant to subsection (a).

SUBTITLE E. -- Coal

SEC. 341. GOALS. -- (a) The Secretary shall establish research, development, and demonstration goals to assure the timely development of technologies for the production, transportation, and use of coal consistent with the purposes of section 5 of this Act. Such goals shall be employed by the Secretary when establishing program objectives for the management plans formulated pursuant to subsection 342.

(b)(1) The Secretary shall submit a report on coal research, development, and demonstration goals established under subsection (a) to the Congress at the time of the President's

budget submission to the Congress.

(2) Whenever the Secretary determines that any of the goals established under paragraph (1) are no longer appropriate, the Secretary shall notify the Congress of the reason for that determination and provide amended goals that are consistent with the national energy strategy.

SEC. 342. PROGRAM PLAN. -- The Secretary shall establish a comprehensive program plan under section 302(a)(4)(B) to achieve the goals established pursuant to section 341.

SUBTITLE F. -- Natural Gas

SEC. 351. MASS TRANSIT PROGRAM. -- (a)(1) The Secretary, in consultation with the Administrator of the Urban Mass Transit Administration, shall, consistent with the Alternative Motor Fuels Act of 1988, PL 100-494, enter into cooperative agreements with, and provide financial assistance under section 303 to, any municipal, county, or regional transit authority in an urban area with a population over 100,000 (according to latest available census information) to demonstrate the feasibility of using natural gas or liquefied petroleum gas as a fuel for mass transit.

(2) The program of the Secretary to implement the agreements under paragraph (1) may include interested or affected private firms willing to provide assistance in cash or in kind for any such demonstration.

(b)(1) The Secretary shall not enter into any agreement under subsection (a) with any municipal, county or regional

transit authority unless such government body agrees to provide at least twenty-five per centum of the costs of such demonstration.

(2)(A) An authority may petition the Secretary for priority in allocating financial assistance under this section.

(B) The Secretary, at his discretion, may grant such priority under this section to any authority that demonstrates that the use of natural gas or liquefied petroleum gas as a transportation fuel would have a significant effect on the ability of an air quality region to comply with applicable regulations governing ambient air quality.

(c) Within 6 months after the date of the enactment of the Act, the Secretary shall report to Congress on his plans to implement this subtitle.

(d) There is authorized to be appropriated not more than $30,000,000 for each of fiscal years 1991, 1992, and 1993 for purposes of this section.

SEC. 352. NATURAL GAS USE IN FLEET VEHICLES. -- (a) The Secretary, consistent with the Alternative Motor Fuels Act of 1988, P.L. 100-494, and in consultation with the Administrator of the U.S. Environmental Protection Agency and the President of the Gas Research Institute, shall establish and carry out a program, and provide financial assistance to encourage the development and commercialization of natural gas and liquefied petroleum gas use in passenger fleets, light duty trucks and heavy duty trucks

by providing for the purchase and construction of dedicated natural gas and liquefied petroleum gas fueled vehicles, and vehicles dually fueled by natural gas, liquefied petroleum gas, and gasoline or diesel, and associated refueling equipment.

(b) Public and private fleets may be eligible for financial assistance under this section. A public or private fleet operator may petition the Secretary for priority in allocating financial assistance under this section.

(c) The Secretary, at his discretion, may grant such priority to those fleets where the use of natural gas or liquefied petroleum gas as a transportation fuel would have a significant effect on the ability of an air quality region to comply with applicable regulations governing ambient air quality.

(d) To facilitate the use of natural gas and liquefied petroleum gas fueled vehicles, the existing Federal vehicle anti-tampering regulations shall be amended by adding the following:

"The conversion of a vehicle from either gasoline or diesel alone to natural gas or liquefied petroleum gas alone, or to natural gas or liquefied petroleum gas and either gasoline or diesel, shall not be considered a violation of any anti-tampering provisions of the Federal law and implementing regulations, provided that the conversion complies with emissions standards which shall be issued by the EPA administrator not later than September 30, 1990."

(e) There is authorized to appropriated not more than

$30,000,000 for each of fiscal years 1991, 1992, and 1993, for purposes of this section.

SEC. 353. TRAINING PROGRAM. -- (a) The Secretary shall establish and carry out a training and certification program for technicians who are responsible for vehicle installations of equipment that converts gasoline or diesel-fueled vehicles to the capability to run on natural gas or liquefied petroleum gas alone, or on natural gas or liquefied petroleum gas and either diesel or gasoline, and for the maintenance of such converted vehicles. Such training and certification programs shall provide these technicians with instruction on the correct installation procedures and techniques, adherence to specifications, vehicle operating procedures, and other appropriate mechanical concerns applicable to these vehicle conversions.

(b) The Secretary, at his discretion, shall enter into cooperative agreements with, and provide financial assistance, under this section, to appropriate parties to provide training programs that will ensure the proper operation and performance of conversion equipment.

(c) There is authorized to be appropriated, consistent with the Alternative Motor Fuels Act of 1988 (P.L. 100-494), and in consultation with the Administrator of the U.S. Environmental Protection Agency, not more than $5,000,000 for each of the fiscal years 1991, 1992, and 1993 for purposes of this section.

SEC. 354. VEHICLE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAM. -- (a) The Secretary, in consultation with the Energy

Research Advisory Board, shall establish and carry out a program of research, development, and demonstration on techniques related to improving natural gas and liquefied petroleum gas vehicle technology including, but not limited to, the following areas --

(1) gaseous fuel injection;

(2) carburetion;

(3) manifolding;

(4) combustion;

(5) power optimization;

(6) emissions control, including catalysts;

(7) novel gas compression concepts;

(8) advanced storage systems; and

(9) advanced gaseous fueling technologies.

(b) The Secretary, consistent with the Alternative Motor Fuels Act of 1988 (P.L. 100-494), shall enter into cooperative agreements with, and provide financial assistance under this section, to public entities or interested or affected private firms willing to provide twenty-five per centum of the costs of such programs to perform the research and development necessary to improve natural gas and liquefied petroleum gas vehicle technology.

(c) There is authorized to be appropriated not more than $10,000,000 for each of the fiscal years 1991, 1992, and 1993 for purposes of this section.

SEC. 355. NATURAL GAS RECOVERY, RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM. -- (a) The Secretary shall expand and

continue a program of research, development, and demonstration on techniques to increase the availability of natural gas from --

(1) intensive recovery of natural gas in place in discovered reservoirs or formations; and

(2) economic recovery of unconventional natural gas, including gas from tight sands, Eastern shales, gas from less permeable formations, coal-bed methane, and geopressured reservoirs.

(b) The Secretary shall seek to enter into joint research and development ventures under section 303 with persons engaged in the production, transportation, distribution, or major use of natural gas to implement the program under subsection (a).

(c) There is authorized to be appropriated not more than $25,000,000 for each of the fiscal years 1991, 1992, and 1993 for purposes of this section.

SEC. 356. NATURAL GAS HEATING AND COOLING TECHNOLOGIES. -- **(a) The Secretary, in consultation with the President of the Gas Research Institute, shall expand the program for research, development, and demonstration for natural gas heating and cooling technologies for residential and commercial buildings. The program shall increase research on thermally-activated heat pumps including:**

(1) absorption heat pumps; and

(2) engine-driven heat pumps.

(b) There is authorized to be appropriated to the Secretary, not more than $10,000,000 for each of the fiscal years 1991,

1992, and 1993 for purposes of this section in addition to current authorizations.

SUBTITLE G. -- Methane Assessment

SEC. 361. OBJECTIVE. -- (a) The objective of this subtitle is to identify and analyze options to reduce the risks of global climate change by --

(1) reducing worldwide generation of methane;

(2) identifying and analyzing the relationships between methane and other greenhouse gases to determine the synergies that may contribute to global climate change;

(3) promoting additional analyses of the factors causing methane concentrations to increase and of the sources of methane generation and the opportunities for reducing such generation; and

(4) identifying options for the reduction of methane generation that are economically as well as environmentally advantageous.

(b) In order to achieve the objective of this subtitle, it is a national goal to --

(1) reduce the generation of methane associated with human activities in the United States;

(2) stimulate international agencies to fund projects in developing countries that will reduce the generation of methane;

(3) stimulate other governments to implement measures to reduce the generation of methane; and

(4) in support of international efforts to reduce the generation of methane, provide data regarding sources of methane emissions and options for reducing such emissions.

SEC. 362. DOMESTIC METHANE SOURCE INVENTORY AND CONTROL OPTIONS. -- (a) Not later than one year after the date of the enactment of this Act, the Secretary, in consultation with the Secretary of Agriculture, the Secretary of the Interior, and the Administrator of the Environmental Protection Agency, shall submit to the Congress reports on:

(1) Methane generation associated with natural gas extraction, transportation, distribution, storage and use. Such reports shall include an inventory of methane generation associated with such activities within the United States. Such reports shall include, but are not limited to, information on accidental and intentional methane releases from natural gas and oil wells, pipelines, processing facilities, and gas burners.

(2) Methane generation associated with coal extraction, transportation, distribution, storage, and use. Such report shall include an inventory of methane generation associated with such activities within the United States. Such reports shall include, but are not limited to, information on accidental and intentional releases from mining shafts, degasification wells, gas recovery wells and equipment, and from the processing and use of coal.

(3) Methane generation associated with the burning of

biomass. Such report shall include an inventory of methane generation associated with the intentional burning of agricultural wastes, wood, grasslands and forests.

(4) Other methane generation associated with human activities. Such report shall identify and inventory other domestic sources of methane generation that are deemed by the Secretary to be significant.

(b) Not later than one year after the date of the enactment of this Act, the Secretary shall submit to the Congress a report that presents a plan outlining measures that could be implemented to stop the growth in atmospheric concentrations of methane from sources within the United States. This plan shall identify and evaluate the technical options for reducing the generation of methane from each of the sources listed in paragraph (a) as well as other sources deemed by the Secretary to be significant, and shall include an evaluation of costs. The plan shall identify the reductions in the generation of methane that must be achieved to prevent increasing atmospheric concentrations of methane. The plan shall also identify the U.S. and international lending agency programs, and an itemization of the costs of each category of reductions, that could be used to induce lesser developed countries to undertake measures that will reduce the generation of methane and the resource needs of such programs.

SEC. 363. INTERNATIONAL STUDIES. -- (a) Not later than one year after the date of the enactment of this Act, the Secretary, in consultation with the Secretary of State, shall submit to

Congress a report on methane emissions from countries other than the United States. Such report shall include inventories of methane generation associated with the activities listed in section 362.

(b) Not later than one year after the enactment of this Act, the Secretary shall submit to Congress a report that analyzes the potential for preventing an increase in atmospheric concentrations of methane from sources in other countries. Such report shall identify and evaluate the technical options for reducing the generation of methane from each of the sources listed in paragraph (a) of section 362 as well as other sources that are deemed by the Secretary to be significant, and shall include an evaluation of costs. The report shall identify the reductions in the generation of methane that must be achieved to prevent increasing atmospheric concentrations of methane. The report shall also identify technology transfer programs that could promote methane reductions in the generation of methane in lesser developed countries.

SEC. 364. NATURAL SOURCES. -- Not later than September 30, 1992, the Secretary, in consultation with the Secretary of the Interior, shall submit to Congress reports on --

(1) methane emissions form biogenic sources such as (A) tropical, temperate, and subarctic forests (B) tundra and (C) freshwater and saltwater wetlands; and

(2) changes in the generation of methane from biogenic sources that may occur as a result of predicted increases in

temperatures and atmospheric concentrations of carbon dioxide.

SUBTITLE H. -- Federal Energy Technology Transfer Council

SEC. 371. GOALS AND MEMBERSHIP OF THE COUNCIL. -- (a) There is hereby established a Federal Energy Technology Transfer Council (hereafter referred to as the "Council"), which shall seek to enhance economic development in lesser developed countries by expanding the transfer of energy efficient and renewable energy technologies to such countries.

(b) Membership on the Council shall consist, in part, of the Secretary (who shall be chairman) and the Secretary of Commerce (who shall be vice-chairman). The remaining membership of the Council shall consist of sixteen members including:

(1) one member to be appointed by the Administrator of the Environmental Protection Agency, one member to be appointed by the Secretary of State, one member to be appointed by President of the Overseas Private Investment Corporation, one member to be appointed by the Administrator of the Agency for International Development, one member to be appointed by the President of the Export-Import Bank of the United States, and one member to be appointed by the Director of the Office for Science and Technology Policy;

(2) three members, to be appointed by the Secretary, from the Department of Energy National Laboratories;

(3) three members, to be appointed by the Secretary, from persons having experience in international energy

efficiency, renewable energy programs, international trade and development, finance, technology transfer, academia or other relevant expertise the Secretary deems appropriate;

(4) one member each, to be appointed by the Secretary, from the Solar Energy Research Institute and the U.S. Export Council for Renewable Energy; and

(5) one member, to be appointed by the Secretary, from the Committee on Renewable Energy Commerce and Trade (hereafter referred to as CORECT) and one member from the Office of Energy at the Agency for International Development (hereafter referred to as the "Office").

SEC. 372. DUTIES OF THE COUNCIL. -- (a) The Council shall, in consultation with CORECT, promote the development and application of energy efficient and renewable energy technologies in developing nations which:

(1) promote more efficient use of fossil fuels;

(2) reduce dependence on the importation of fossil fuels by encouraging the use of sustainable biomass, wind power, small-scale hydropower, solar thermal, geothermal and other environmentally sensitive energy resource technologies;

(3) foster rural and urban energy development and energy self-sufficiency through the use of clean, efficient, reliable, and economical renewable energy technologies;

(4) provide aggressive in-country technical training for local users and international development personnel;

(5) establish feasibility and loan guarantee programs to facilitate access to capital and credit; and

(6) support, through a mix of financial and tax incentives, private sector efforts to commercialize and export renewable energy resource and energy efficiency technologies.

(b) The Council, in consultation with (CORECT), shall be responsible for the development of a comprehensive data base and information dissemination system. The system shall provide information on the specific energy technology needs of developing nations, the technical and economic competitiveness of various renewable energy resource technologies, and the status of ongoing technology assistance programs. The Council shall make such information available to industry, Federal and multilateral lending agencies, non-governmental organizations, host-country and donor-agency officials, and such others as the Secretary deems necessary.

SEC. 373. COMPREHENSIVE ENERGY TECHNOLOGY EVALUATION. -- (a) Not later than September 30, 1991, and biennially thereafter, the Secretary, in consultation with the Council, shall prepare and submit to Congress, a comprehensive report evaluating the full range of energy and environmental technologies necessary to meet the energy needs of developing countries while reducing the generation of carbon dioxide and other greenhouse gases. This report shall also provide information on specific developing country needs, an inventory of U.S. technologies and services to

meet those needs, and an update on the status of ongoing bilateral and multilateral technology assistance and renewable energy resource programs.

(b) The report should also include an evaluation of current programs and recommendations for future programs that --

(1) develop and promote sustainable use of indigenous renewable energy resources in developing countries in order to supplant fossil fuel emissions that may contribute to global climate change;

(2) given the credit and capital restrictions in lesser-developed countries, focus on technologies that are both appropriate and economically viable;

(3) meet existing developing nation needs for energy rather than creating new needs, thereby ensuring immediate income-generating use of the power generated;

(4) work with local individuals to assure that programs and projects meet specific national and local needs;

(5) use indigenous materials and associated hardware, wherever possible, in order to reduce costs and ensure project replicability;

(6) provide examples of cost-effective systems and applications for in-country non-governmental organizations and project technical personnel;

(7) expand technical and administrative training programs, as well as distribution of multilingual technical training manuals and related materials; and

(8) examine the potential for using economic incentives to promote technology transfer (e.g. shared savings contracts, loan guarantees, tax incentives, etc.) to lesser-developed countries.

SEC. 374. AUTHORIZATION. -- There is authorized to be appropriated $10 million for fiscal year 1991, and such sums as may be necessary to carry out the purposes of this subtitle thereafter.

TITLE IV -- NATURAL RESOURCE POLICY

SEC. 401. ECOLOGICAL AND ENVIRONMENTAL RESOURCE STUDY. -- (a) The Secretary of the Interior, in consultation with the Secretary of Agriculture, shall conduct a study of the ecological and environmental resources that would be affected by a global climate change. The study should include effects on wildlife habitat preservation, coastal protection, inland rivers and lakes, irrigation and reclamation, ground water protection, national wildlife refuges and parks, national forests, and other Federal lands.

(b) The study should --

(1) include specific regional climatic and resource base information useful in anticipatory and mitigatory planning;

(2) identify actions that, if taken, could help mitigate the effects of global climate change; and

(3) evaluate the cost-effectiveness, including environmental externalities of possible action.

SEC. 402. NATIONAL FORESTATION INITIATIVE. -- The Secretary of Agriculture, in cooperation with the Secretary of the Interior, shall report to the President and the Congress on the feasibility of a National Reforestation Initiative. Such report shall include:

(1) in coordination with the Resources Planning Act of 1974, an inventory of Federal, State, and private forested lands;

(2) an evaluation of the status of timber harvesting on those lands, including the extent to which those lands are being reforested;

(3) an assessment of the extent to which Federal, State, and private lands can be reforested, including lands not necessarily suitable for timber harvesting such as urban areas;

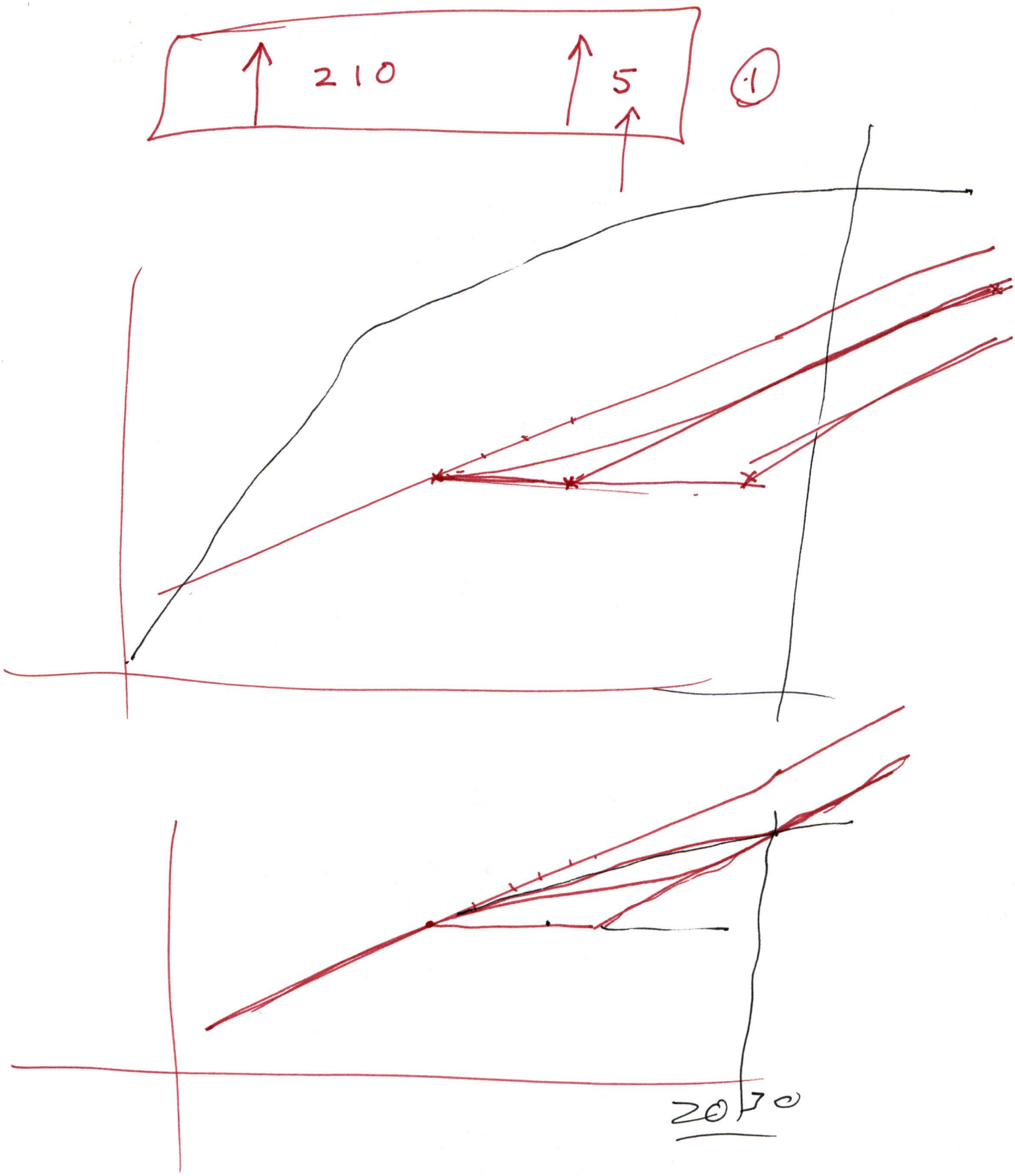
(4) an evaluation of the potential of a national reforestation initiative for reducing, mitigating, or preventing climate change, and the measures needed to achieve that potential; and

(5) an assessment of the potential economic and environmental benefits and costs of such an initiative, the measures available to mitigate such costs, and an evaluation of the effectiveness of such measures.

SEC. 403. URBAN FORESTRY AND ENERGY SAVINGS. -- The Secretary, in consultation with the Secretary of Agriculture, and other relevant Federal agencies, shall conduct a study of the

potential for reducing carbon dioxide emissions by undertaking targeted urban tree plantings designed to reduce the air-conditioning needs of buildings. The study shall provide estimates of the cost-effectiveness of such a program and shall outline a range of Federal, State, and local public policies and incentives that would encourage public and private efforts to undertake such plantings.

Within 18 months after the date of enactment, the Secretary shall complete the study and transmit it to the Congress.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NES PROCESS

Form a steering working group to preview all drafts prepared by DOE of chapters/options of the NES. This group would consist of senior representatives of the following offices:

Chief of Staff
OMB
CEA
Domestic Policy
DOE
Other appropriate departments/offices on an issue by issue basis

The principals of these offices would need to meet only to offer broad guidelines for DOE drafting when deemed appropriate or to resolve significant differences which cannot be settled satisfactorily by their representatives.

When agreement is reached on chapters/options by this steering working group, they will be brought to the EPC working group for review and comment. Following that review and comment and resulting appropriate changes, the chapters/options are presented to the EPC for decision.

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH
P.O. Box 3000 • Boulder, Colorado 80307-3000
Telephone: (303) 497-1000 • Telex: 989764

~~12 April~~ 1990
18 April 1990 —
Please note changes made by Warren Washington.

Dr. John H. Sununu
Chief of Staff
White House
Washington, DC 20500

Dear John:

I enjoyed meeting with you, Allan Bromley, and Dan Albritton on 30 March. I hope we are making progress in answering your questions about climate models. Your comments are well taken on the need for adequate vertical, as well as horizontal, resolution in climate models.

If I recall correctly, you wanted to know what happens, in terms of slowing down greenhouse warming, when we increase the depth of the upper ocean (where most of the additional heat goes). The atmospheric radiative forcing part of the model allows for solar and infrared radiation with clouds (Kiehl et al., 1987). Solar radiation is generally broken down into two regions—one is between 0–0.9 μm and is usually denoted ultraviolet and visible; the other is 0.9–4.0 μm and is denoted near-infrared. In the present calculation, we make this division into 0.0–0.9 μm and 0.9–4.0 μm intervals. The model includes fractional clouds, absorption by gases in the ultraviolet, absorption by ozone in the visible spectral regions, carbon dioxide, water vapor, oxygen, cloud-level liquid water, and albedos (that is, reflectance of clouds and the surface).

After averaging out horizontal effects, we set forth the basic physics of the climate model (see enclosed reprint by Dickinson, 1981), where steady-state global temperature change ΔT, due to a change in external heating ΔQ in the climate system, gives

$$\Delta T = \frac{\Delta Q}{\lambda}, \tag{1}$$

where λ is the feedback describing the change of outgoing thermal and reflected solar radiation at the top of the atmosphere. If λ is large, then the temperature change is small and vice versa. Various National Academy studies estimate that (approximately) $\lambda \simeq 2$ W m^{-2} K^{-1}.

In time-dependent form, (1) becomes

~~$C\frac{\partial T}{\partial t} + \lambda T = \Delta Q,$~~ $C\frac{\partial T'}{\partial t} + \lambda T' = \Delta Q$ (2) *

(primes added)

where $T' = \Delta T$, and where C is the heat capacity of atmosphere-ocean climate system. Because the climate system has several sub-systems, such as the atmosphere and the oceans with different heat capacities, it is better to separate them into two equations for each medium, that is,

$$C_a \frac{\partial T_a'}{\partial t} + \lambda_{am}(T_a' - T_m') + \lambda T_a = \Delta Q, \tag{3}$$

(primes added)

$$C_m \frac{\partial T_m'}{\partial t} + \lambda(T_m' - T_a') = 0, \tag{4}$$

where T_a' and T_m' are atmospheric temperature change and ocean mixed-layer temperature; C_a and C_m are heat capacities of the atmosphere and ocean mixed layer; λ_{am} is the feedback parameter between the atmosphere and ocean mixed layer (estimated $\simeq 50$ W m^{-2} K^{-1}). The latter term allows transfer of heat for the atmosphere and ocean. The following table provides quantitative measures of the parameters:

Medium	Mass ($\times 10^3$ Kg m^{-2})	Heat Capacity (W m^{-2} year K^{-1})
Atmosphere	14	$C_a = 0.45$
Ocean mixed layer (81 m)	81	$C_m = 10$

The solution to (3) and (4) can be simplified by combining the two first-order ordinary differential equations into one second-order ordinary differential equation that can be solved by a simple Runge-Kutta numerical method incorporated into the computer program.

In determining climate change in this simple model, we first estimated λ from a radiative column model by using, say, a vertical profile of tropical atmospheric temperature. The climate sensitivity factor is obtained from variations of the net radiative flux at the tropopause due to changes in temperature and moisture. Thus,

$$\lambda = \frac{dF^N}{dT} = \frac{\partial F}{\partial T} + \frac{\partial F}{\partial q}\frac{dq}{dT} + \frac{\partial S}{\partial q}\frac{dq}{dT}. \tag{5}$$

The quantities $\partial F/\partial T$, $\partial F/\partial q$, and $\partial S/\partial q$ are obtained from the column radiation model. dq/dT is estimated from the assumption of fixed relative humidity. Calculations from the column model yield a value of $\lambda \simeq 2$ W m^{-2} K^{-1}. Once λ has been determined, it can be used in (4) to obtain a change in the ocean mixed-layer temperature for a given forcing ΔQ. For example, a doubling of carbon dioxide yields $\Delta Q \simeq 4$ W m^{-2}. Thus, from (1) the equilibrium temperature change would be expected to be $\Delta T \simeq 2$°K.

The time-dependent evolution of ΔT can be obtained from the computer model of the mixed-layer temperature change described above. The column radiation model can also be used to calculate ΔQ for other carbon-dioxide concentrations. A note of caution, however—Figures 2.12 and 2.13 (enclosed) show that the upper mixed layer of the ocean is approximately 70 m or so. Our knowledge of the ocean's thermal structure indicates that, except in the high latitudes, only the upper mixed layer of the ocean is involved in greenhouse warming. The latest 3-D climate models support this. In fact, in the greenhouse warming scenario, the ocean becomes more statically stable and contains less coupling between the top and bottom, except for some regional features in the high latitudes.

Several sample computations with the 1-D model with different ocean depths are enclosed.

Next week I will be attending meetings in Washington, DC, including the White House Conference on Science and Economics Research Related to Global Change. I will bring along a floppy disk containing a 1-D model with interactive oceans, and, at your convenience, I could install the model on your computer.

Sincerely,

Warren M. Washington

Warren M. Washington, Director
Climate & Global Dynamics Division

Telephone: (303) 497-1321
Fax: (303) 497-1137
E-Mail: warren washington@ncar.ucar.edu

Enclosures:

1. Figures 2.12 and 2.13
2. Documentation of the column radiation and cloud model
3. Reprint by Robert Dickinson on simple climate model

cc: D. Allan Bromley
Nancy Maynard
Daniel Albritton

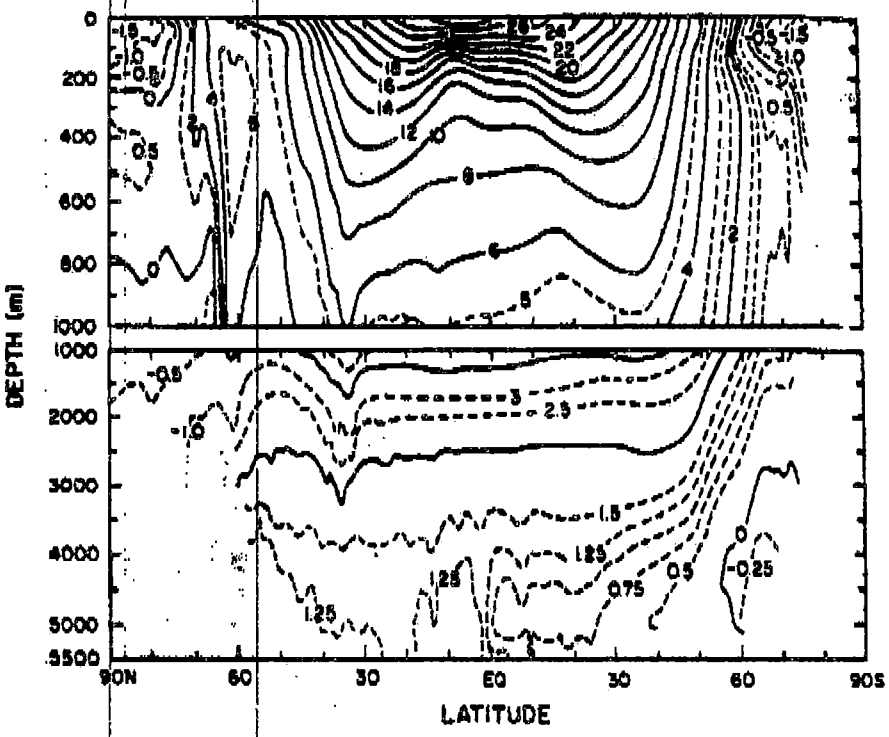


Fig. 2.12 Annually averaged ocean potential temperature (in °C) as a function of latitude and depth. [Redrawn from Levitus (1982).]

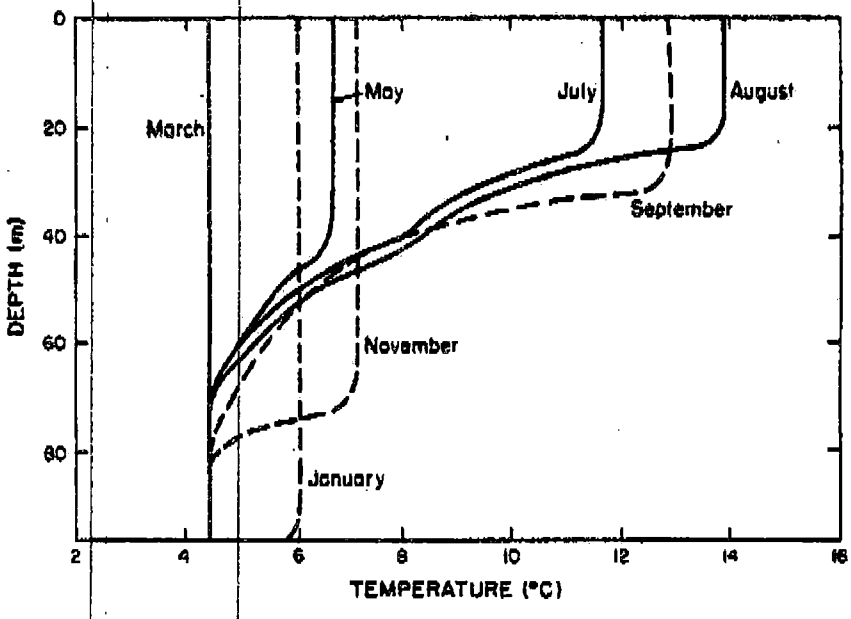


Fig. 2.13 Standard ocean temperature profiles in the Northern Hemisphere mid-latitudes in January, March, May, July, August, September, and November. [After Knauss (1978).]

18 April 1990

TO: Governor Sununu

FROM: Warren Washington
National Center for Atmospheric Research

SUBJECT: One-Dimensional Climate Model

Instructions for installing software and running demonstration version of model.

1. Create directory on hard disk, e.g.,

```
c:
cd \
md climate
cd climate
```

2. Copy files to directory on hard disk, e.g,

```
copy a:*.* c:\climate
```

The following files should now be in the climate directory:

climate.exe	menu based control program
radiate.exe	radiation model program
coupled.exe	coupled model program
plotit.exe	plot program for output from coupled model
helvb.fon	font file used by plot program
equil.dat	data file used by radiation model (equilibrium climate profile)
2co2.dat	data file used by radiation model (doubled CO2 climate profile)
qchange.dat	data file used by radiation model (increased water vapor climate profile)
tchange.dat	data file used by radiation model (increased temperature climate profile)

3. To run demonstration program:

a. From the climate directory, type climate <cr>
b. A menu will appear with choices to select from. Enter the number of the selection. Incorrect input results in the computer beeping and redisplaying the menu.

- Choosing the radiation model selection brings you to a second menu from which you choose various climate profiles to run. Each of the profile choices runs the radiation model with a different data file and displays the results in browsing utility. Press X to exit the browsing utility. You are returned to main menu

- Choosing the coupled model selection brings you to a screen requiring user input for two parameters: the time period over which climate changes will be viewed and the thickness of the ocean layer. Enter each of these numbers followed by a carriage return. The numbers must be integers, e.g., 40, 65, or 99 but not 43.2, 69.6, etc. The time period parameter in this demonstration version cannot be greater than 99. (The program crashes and the machine must be powered down and back up to resume!) After the two parameters are typed, the coupled model is run, followed by the plot program to display the results. To return to the menu after the plot is complete, press carriage return.

- Computing the climate sensitivity factor runs the radiation model three times on each of three climate profiles. Then, the coupled model is run with user input as above, followed by the plot program.
- Computing the climate forcing factor runs the radiation model twice on each of two climate profiles. Then, the coupled model is run with user input as above, followed by the plot program.

4. Troubleshooting

This demonstration program requires a math coprocessor, an EGA or VGA graphics adaptor, and a color monitor. If when running the radiation model, the browse utility is displayed with no file (empty screen), then a math coprocessor was not found. On a 16 MHz 80386 based machine, the radiation takes less than 10 seconds to run. The coupled model and plot program take a total of approximately 30 seconds. The computation selections each take approximately 1 minute to run.

determine the energy states of the atoms, was observed after the end of the 256-millisecond test period. The energy states of the ions, however, collapsed when hit by the pulses during the test period, before the return scatters were actually observed.

Despite the apparent link between the viewer and the behavior of the ions, it was the act of measurement—not the act of observing the measurement—that immobilized the ions. Even so, the experiment may strengthen the conviction of those who believe the old adage: "A watched pot never boils." —*Corey S. Powell*

Murky Water

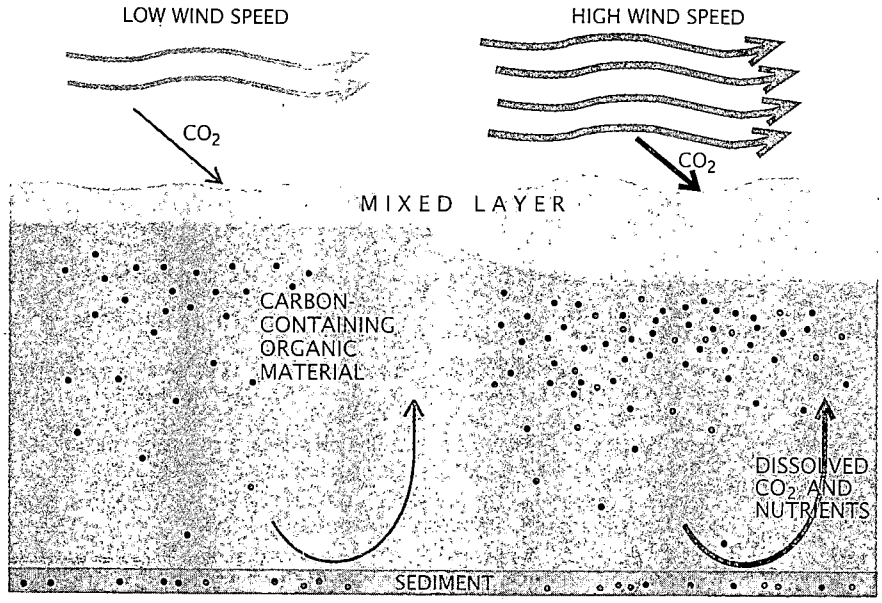
Just what role do oceans play in absorbing greenhouse gases?

Power plants, cars and burning forests emit carbon dioxide; oceans absorb it. The long-accepted wisdom on global warming is that the boundless depths covering nearly three quarters of the world's surface buffer the greenhouse effect. Climatic shifts and sea-level changes will occur—but slowly.

This picture is probably wrong. New data have led investigators to conclude that the oceans consume far less CO_2 than previously thought and thus that land-bound sinks must be consuming more. Furthermore, the ocean's capacity to absorb CO_2 and sequester it from the atmosphere now appears to depend on near-surface wind patterns, which may change as the world heats up.

Every year human activities pump about seven billion tons of carbon (in the form of carbon dioxide) into the atmosphere. Terrestrial and oceanic sinks pull four billion tons back out, leaving an annual increase of three billion. Until recently modelers believed the oceans took up two or three billion tons and that forests, grasslands and soils accounted for the rest.

Then Pieter Tans of the National Oceanic and Atmospheric Administration, Inez Fung of the National Aeronautics and Space Administration and Taro Takahashi of the Lamont-Doherty Geological Survey set out to determine from first principles just how much carbon could pass from atmosphere to ocean. Using a model of atmospheric circulation and data on the relative concentrations of CO_2 in the atmosphere and oceans, the group calculated how much gas the oceans can absorb. Absorption is greatest where CO_2-laden air meets water that con-



WIND-DRIVEN MIXING of ocean layers is a crucial factor in oceanic absorption of carbon dioxide, West German researchers contend. Increased mixing leads to greater plankton growth, and wind-borne particles may cause more microscopic shells and organic matter to sink and become incorporated into sediments.

tains relatively little carbon dioxide; where CO_2 in water is high, the transfer may even go in reverse.

The results were surprising: the ocean apparently absorbs at most a billion tons of carbon, not two or three. Terrestrial sinks must be taking up significantly more carbon than was once believed, but exactly which sinks are performing such yeoman service is as yet a mystery.

Revised data on how much carbon the oceans absorb are mirrored by confusion about what happens to the carbon once it enters the ocean. In its broadest outlines the story is simple: plankton in the top layers of the ocean take up dissolved CO_2 and incorporate it into their shells or organic matter. This material falls into the deep ocean (much of it in the form of fecal pellets from fish that eat plankton or one another) where some of it is eaten, some is locked into sediments and the bulk is decomposed and dissolved. As the deep water returns to the surface at upwelling zones, it carries the dissolved nutrients and CO_2 with it. The difference between the amount of carbon falling down and the amount welling up determines how much the ocean can absorb from the atmosphere.

The details, however, are much more complicated. Plankton productivity, the downward flux of carbon-containing material, decomposition rates and sediment formation vary widely from ocean to ocean, month to month and year to year. The underlying causes of variation are not fully understood, says Eric T. Sundquist of the U.S. Geological Survey. While fossil-fuel emissions do drive some shifts, others may have little to do with human actions, he says.

One explanation for some of the variations may be the wind. Birgit Haake and Venugopalan Ittekot of the Institute for Biogeochemistry and Ocean Chemistry at the University of Hamburg contend that ocean winds can critically influence both the amount of carbonate and organic material produced by plankton and the amount that eventually ends up locked into sediments. Strong winds, the researchers say, increase the depth of the ocean's uppermost mixed layer, where plankton live, leading to increased plankton growth.

Furthermore, the stronger the wind, the greater the amount of terragenous material, such as dust or river sediment, that is mixed into the ocean. This material may provide extra nutrients, and it can bind carbonaceous matter into clumps that are more likely to reach the ocean bottom without being eaten or dissolved.

The net result: more wind equals more carbon taken out of the atmosphere (and vice versa). A set of plankton traps anchored in the Arabian Sea by a German-Indian collaboration yields supporting data. Wind speed, mixed-layer depth and falling carbonaceous debris fluctuate in step over the course of a year. In addition, it appears that more carbon-containing matter actually reaches the bottom when winds are stronger.

Haake is quick to point out that the results are preliminary and the hypothesis unproved. The theory agrees with what is known of major climatic changes—winds were half again as strong and the atmosphere dustier during the ice ages—but more evidence is needed to test it. For example, she says, analysis of sediments worldwide might show a link between dust and plankton.

Or it might not. Sundquist, for one, is unimpressed. Terragenous materials may not significantly affect the rates at which carbon-containing materials sink, he says, and current theories hold that most degradation takes place on the ocean floor, not as particles fall through the water.

Even if strong winds bring more carbon to the ocean floor, the effect on atmospheric-carbon concentrations could be negligible in the short run. Oceanic cycling of carbon dioxide takes place over 100 or even 1,000 years, says Tyler Volk of New York University. Emissions of CO_2 from the combustion of fossil fuels and deforestation could double atmospheric concentrations in decades. Oceans could bring those levels back to normal only over thousands of years, and meanwhile the identity of the land-bound sink (or sinks) soaking up much of the atmosphere's excess carbon remains unknown. —*Paul Wallich*

Go with the Grain

Tiny crystal composites produce new metals and ceramics

It takes a fine flour to make a good cake batter. Similarly, the recipe for a good metal or ceramic calls for a powder of tiny crystals. Over the past four years materials scientists in West Germany, Japan and the U.S. have perfected a process for producing crystals, virtually uniform in size, that contain only a few thousand molecules. An immense number of these crystals can be collected, heated and compressed to form a material that has grains only a few billionths of a meter, or nanometers, long. These "nanophase" materials include metals that are remarkably strong, ceramics that are unusually ductile and composites that have extraordinary structural and electrical properties. Such materials could be useful for engines, aerospace applications and electronic devices.

THE WHITE HOUSE

WASHINGTON

April 26, 1990

MEMORANDUM FOR THE CHIEF OF STAFF

FROM: ED ROGERS

SUBJECT: GLOBAL CHANGE

This is the analysis of the Gregg Easterbrook story I sent to you early this week.

Natural release of CO2 is 200 billion tons, however, natural absorption is 204 billion tons.

As the chart shows, fossil fuels and deforestation account for 7 billion tons.

The analysis of the chart is on page 41.

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20500

Michael R. Deland
Chairman

(202) 395-5080

April 25, 1990

MEMORANDUM TO: GOVERNOR JOHN SUNUNU

FROM: MICHAEL DELAND

THROUGH: ED ROGERS

SUBJECT: New Republic Article
"Everything 'One' Know[s] About the Environment is Wrong"

The figures cited in Gregg Easterbrook's article regarding the CO_2 added to the atmosphere from "natural processes" and "human activity" were gleaned from an April 1989 Scientific American article (attached -- see chart on page 38). As you no doubt know, both the authors, Richard A. Houghton and George M. Woodwelll, are of the "world is warming" school.

I find the recent Easterbrook article to be an interesting change in tone from his prior writings. I'm having lunch with him on Monday, April 30th, and will keep you posted.

Attachment

SCIENTIFIC AMERICAN

April 1989 Volume 260 Number 4

SCIENTIFIC AMERICAN April 1989 Volume 260 Number 4

Global Climatic Change

Evidence suggests that production of carbon dioxide and methane from human activities has already begun to change the climate and that radical steps must be taken to halt any further change

by Richard A. Houghton and George M. Woodwell

The world is warming. Climatic zones are shifting. Glaciers are melting. Sea level is rising. These are not hypothetical events from a science-fiction movie; these changes and others are already taking place, and we expect them to accelerate over the next years as the amounts of carbon dioxide, methane and other trace gases accumulating in the atmosphere through human activities increase.

The warming, rapid now, may become even more rapid as a result of the warming itself, and it will continue into the indefinite future unless we take deliberate steps to slow or stop it. Those steps are large and apparently difficult: a 50 percent reduction in the global consumption of fossil fuels, a halting of deforestation, a massive program of reforestation.

There is little choice. A rapid and continuous warming will not only be destructive to agriculture but also lead to the widespread death of forest trees, uncertainty in water supplies and the flooding of coastal areas. When the ice now covering the Arctic Ocean melts, further unpredictable changes in the global climate will ensue. There may be controversy over whether the data are adequate and whether the warming is caused by changes in the atmosphere. Yet there is an unusually powerful consensus among climatologists that the dominant influence on global climate over the next centuries will be a warming driven by the accumulation of heat-trapping gases. The consequences are threatening enough so that many scientists, citizens and even political leaders are urging immediate action to halt the warming.

RICHARD A. HOUGHTON and GEORGE M. WOODWELL have collaborated for more than 20 years on topics of environmental concern. Houghton is an ecologist and a senior scientist at the Woods Hole Research Center in Woods Hole, Mass. For the past 10 years he has been concerned with the global carbon cycle and has specialized in the response of ecosystems, particularly forests, to climatic change. Woodwell is also an ecologist and is the director of the Woods Hole Research Center. He and Houghton hope to be able, along with their Woods Hole colleagues, to advance improved models for the management of renewable resources.

The fact that heat-trapping gases have been accumulating in the atmosphere is well established. Since the middle of the 19th century the amount of atmospheric carbon dioxide has increased by about 25 percent. The increase has come about because human activities, especially the burning of coal and oil and the destruction of forests, have released greater quantities of carbon dioxide into the atmosphere than have been removed by diffusion into the oceans or by photosynthesis on land [*see illustration on page 38*].

The increase in carbon dioxide appears trifling when one considers that the total amount in the atmosphere is a little more than .03 percent by volume. But in spite of its low concentration, carbon dioxide and several other gases present in even smaller amounts have an important role in determining the temperature of the earth. In contrast to both nitrogen and oxygen, which together make up more than 99 percent of the atmosphere, these trace gases absorb infrared radiation, or radiant heat. Since in this regard they act much like the glass over a greenhouse, they are commonly referred to as greenhouse gases.

Because the total amount of greenhouse gases is small, their concentrations are easily changed. An increase in the concentration of any one of them increases the atmosphere's capacity to retain heat and raises the temperature at which the atmosphere comes into equilibrium with the energy it receives from the sun. In recent years investigators have recognized that the atmospheric burden of greenhouse gases other than carbon dioxide, such as methane (CH_4), nitrous oxide (N_2O) and the chlorofluorocarbons (CFC's), is also growing at an increasing rate. By the mid-1980's, in fact, these gases had reached levels at which their combined effect approached that of carbon dioxide.

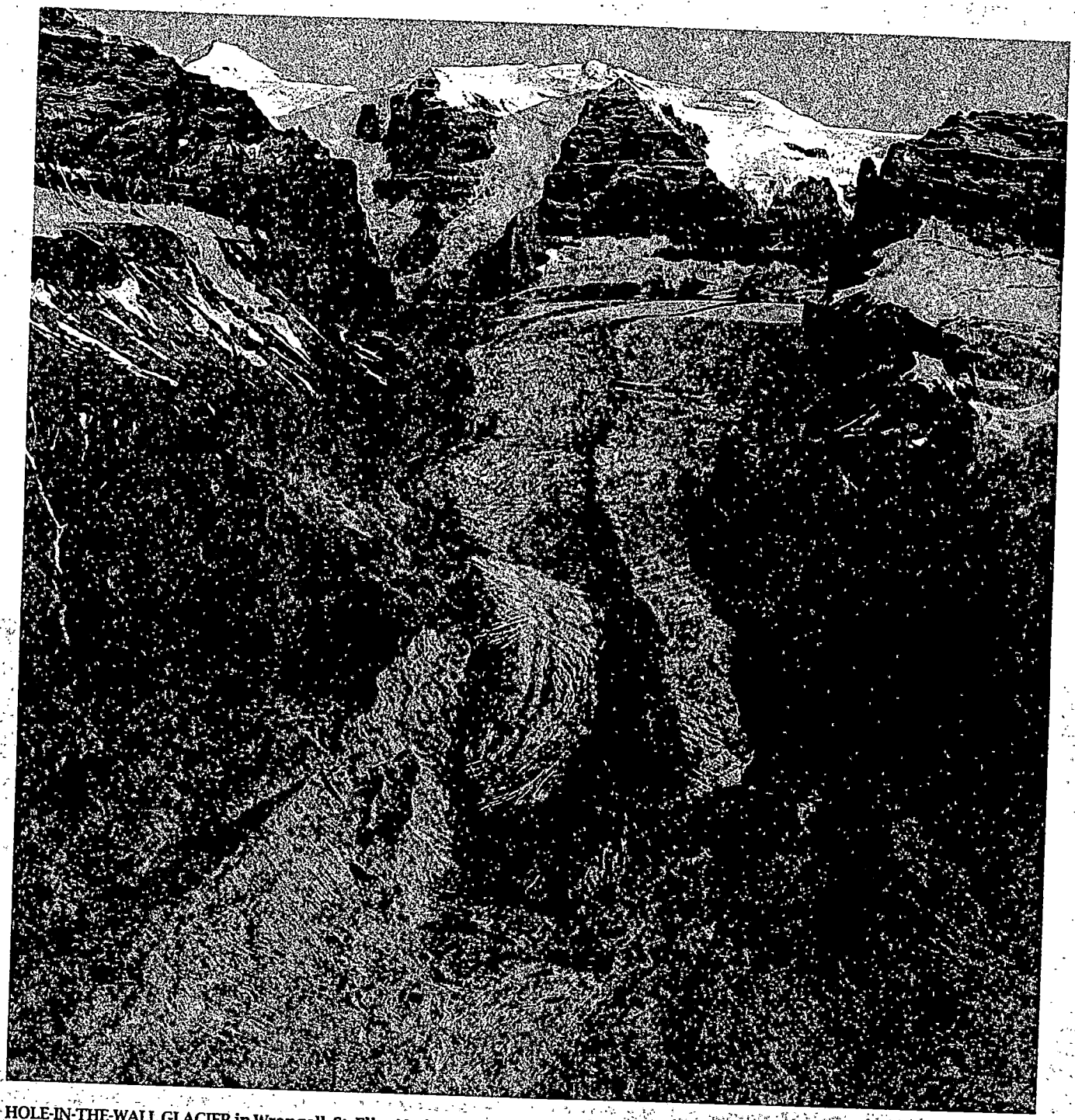
In this article we emphasize the role of carbon dioxide and methane because they are the principal contributors to the current warming, because their concentrations are strongly influenced by biological processes and because slowing or stopping the global warming will require control of carbon dioxide emissions in particular.

Global warming due to the accumulation of heat-trapping gases, particularly carbon dioxide, was predicted at the turn of the century by Svante Arrhenius in Sweden and Thomas C. Chamberlin in the U.S. Systematic research on the atmospheric accumula-

tion of carbon dioxide began only in 1958. Since then Charles D. Keeling of the Scripps Institution of Oceanography has provided a continuous record of the carbon dioxide level at various stations, the best-known of which is at Mauna Loa in the Hawaiian Islands [*see illustration on page 39*].

Information on the earth's temperature has been more difficult to accumulate. Strong evidence for global warming became available by late 1988. The most direct evidence lies in temperature records from around the world. James E. Hansen of the National Aeronautics and Space Administration's Goddard Institute of Space Studies and his colleagues have analyzed temperature records going back to 1860. Their analyses suggest that the average global temperature has increased by from .5 to .7 degree Celsius since that year. The greatest increase has taken place in the past decade; this recent warming is both statistically significant and consistent with their experience based on theory and on models of the global climatic system.

Thomas M. L. Wigley and his colleagues, working independently at the University of East Anglia in England, have also shown the increase in average global temperature. The rise has



HOLE-IN-THE-WALL GLACIER in Wrangell–St. Elias National Park, Alaska, is shown in an aerial view. The exposed ground at the foot of the glacier exhibits striations and moraines, the piles of debris left by a moving glacier; the ground has not had time to grow vegetation. All these are signs of recent glacial retreat. Similar behavior of a number of glaciers around the world (*see illustration on page 41*), the increasing depth to permafrost and other data suggest that warming has continued since the last glacial period. Its cause, however, extending back long before the current buildup of greenhouse gases, remains a puzzle.

not been observed in all regions: a recent analysis of climate records by Kirby Hanson and his colleagues at the National Oceanic and Atmospheric Administration shows no trend in temperature for the contiguous U.S. Such regional variation is not unexpected; the contiguous U.S. covers only 1.5 percent of the globe's surface.

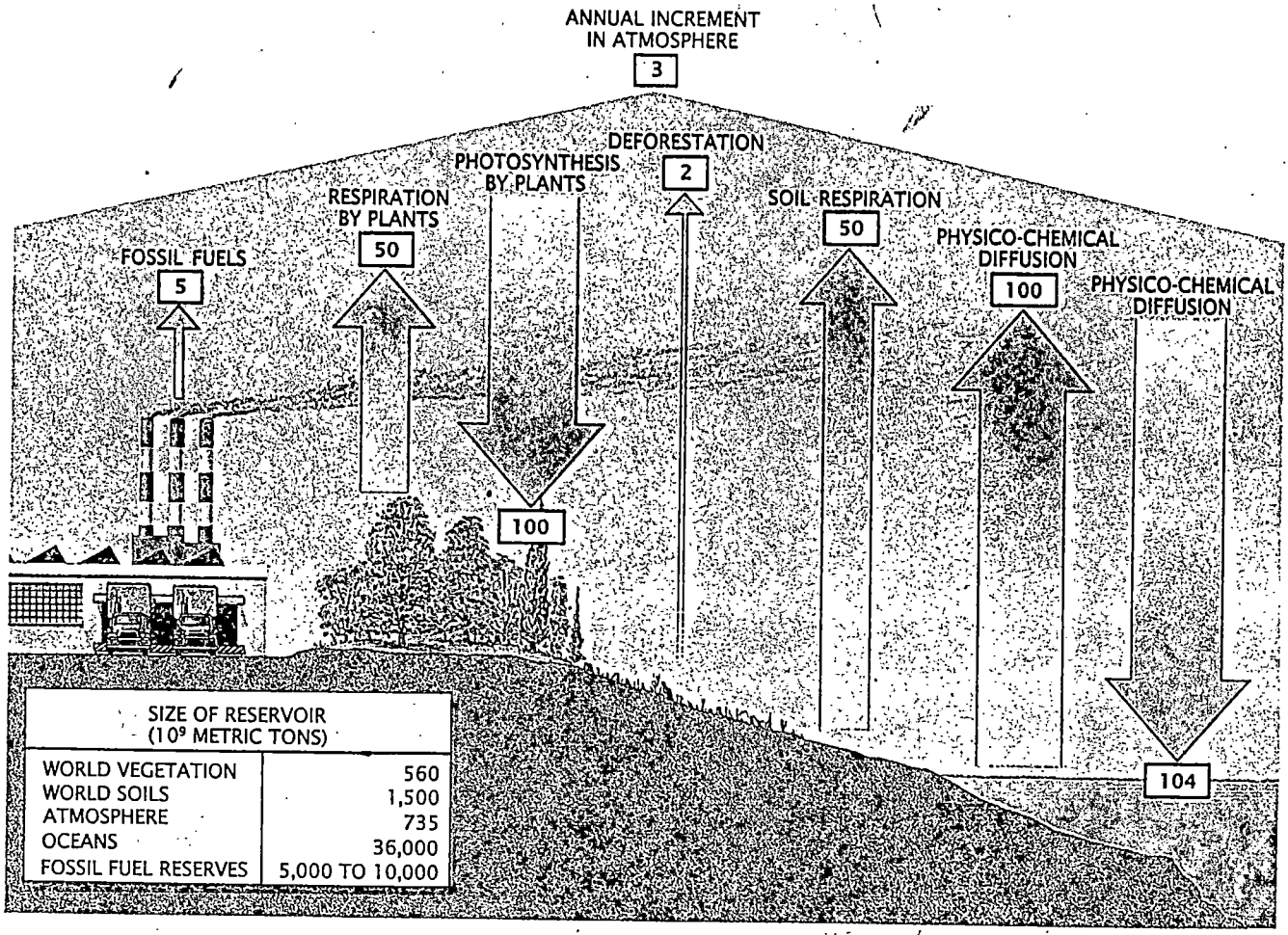
The observed rise in global temperature has not been steady and is clearly not simply a response to the accumulation of greenhouse gases. There was, for example, a decline in the mean global temperature between 1940 and 1965 in spite of the continued increase of heat-trapping gases in the atmosphere. Nevertheless, Phil D. Jones, one of Wigley's collaborators, has just recently reported that the global temperature has risen about .5 degree C since the beginning of the century and that the six warmest years on record were 1988, 1987, 1983, 1981, 1980 and 1986 in that order.

If a .5-degree temperature change seems insubstantial, one should remember that in 1816, the "year without a summer," the mean global temperature drop was also less than one degree. It was nonetheless sufficient to cause frosts in June in New England and widespread crop failures [see "The Year without a Summer," by Henry Stommel and Elizabeth Stommel; SCIENTIFIC AMERICAN, June, 1979]. The heat and drought that have afflicted North America and other regions of the earth in recent years are consistent with the predictions of a global warming trend.

There are other indications of an accelerated warming. According to Arthur H. Lachenbruch and B. Vaughn Marshall of the U.S. Geological Survey, the depth to permafrost in the Alaskan and Canadian Arctic has increased in recent decades. The average temperature of Canadian lakes has increased; the annual maximum extent of sea ice surrounding the Antarctic continent and in the Arctic seas appears to be declining; inland glaciers throughout Europe and elsewhere have receded.

These observations are consistent with predictions made by climatologists on the basis of theory aided by general circulation models. Several such global models exist and, although analyses based on them do not agree in detail, the general predictions are consistent with theory and experience. Climatologists expect that the greatest warming will occur at higher latitudes in winter. In these latitudes the warming, according to the models, will probably be at least twice the global average. In addition it is expected that the upper atmosphere will cool as the lower atmosphere warms and that there will be less precipitation and less moisture in the soil at lower latitudes. All these trends have been reported in recent years.

Data such as those are always open to further analyses, interpretation and augmentation. They invariably appear to suffer from inadequacies of



SIZE OF RESERVOIR (10^9 METRIC TONS)	
WORLD VEGETATION	560
WORLD SOILS	1,500
ATMOSPHERE	735
OCEANS	36,000
FOSSIL FUEL RESERVES	5,000 TO 10,000

ANNUAL CARBON FLUXES are shown in units of one billion (10^9) metric tons. Photosynthesis on land removes about 100 billion tons of carbon from the atmosphere annually in the form of carbon dioxide. Plant and soil respiration each return about 50 billion tons. Fossil-fuel burning and deforestation release into the atmosphere respectively about five and two billion tons. Physicochemical processes at the sea surface release about 100 billion tons into the atmosphere and absorb about 104. The net atmospheric gain is about three billion tons annually. The table lists the world's major carbon reservoirs.

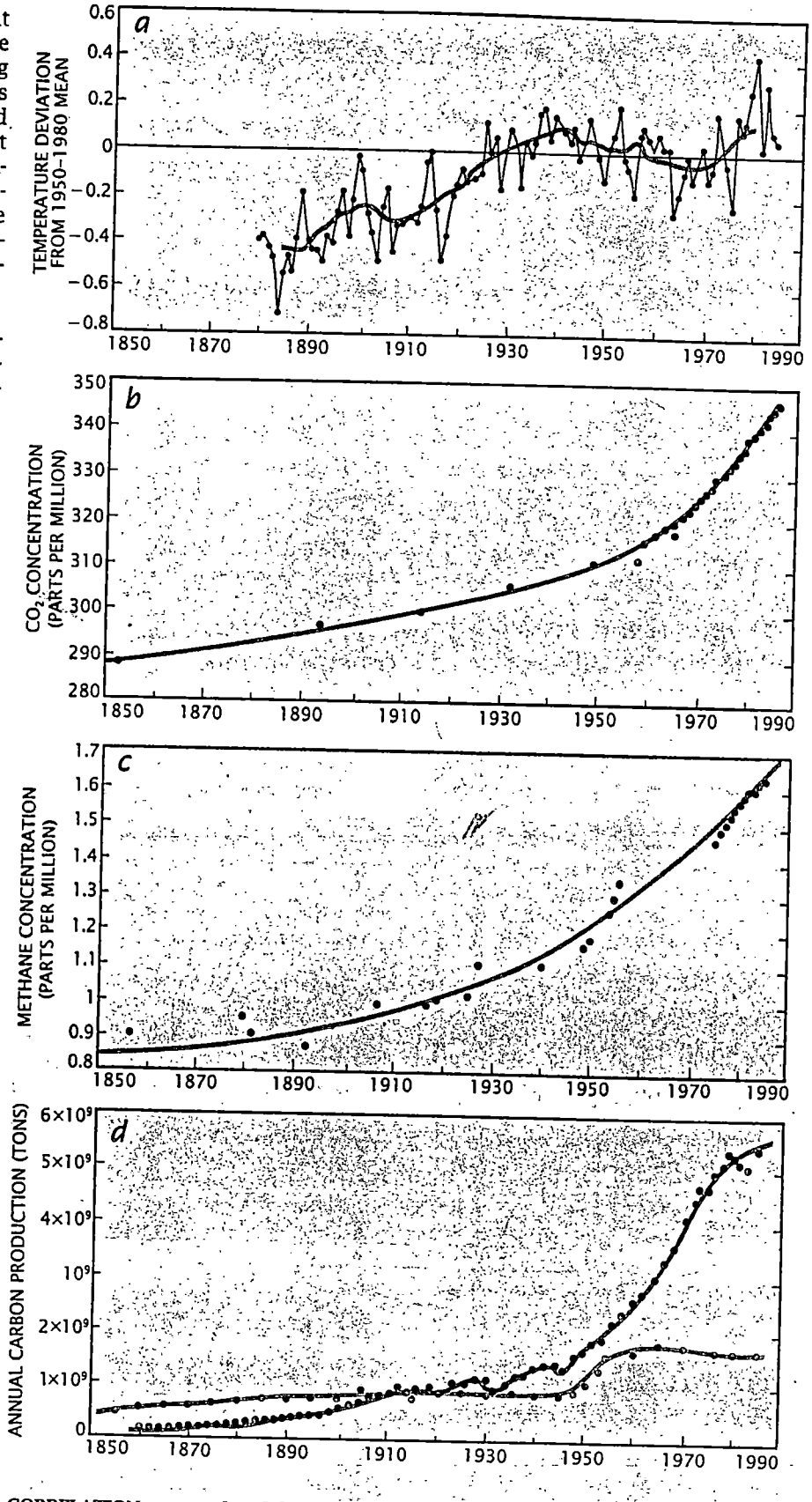
measurement and uncertainties about whether the period over which the measurements were taken was long enough to be significant. Investigators are currently improving the data and the analyses, but the fact remains that the observations described above, taken together with the rising concentration of greenhouse gases, constitute strong evidence that the process anticipated nearly a century ago by Arrhenius is under way.

One can learn much about potential future changes in climate by examining past climatic change. A mere 15,000 years ago glaciers covered much of North America and northern Europe. Were changes in the composition of the atmosphere involved in the great climate swings that brought glacial and interglacial periods? The answer is not completely clear, but one of the most important advances in recent years has been the ability to determine atmospheric composition in previous eras from tiny samples of air trapped in glacial ice. In particular, determination of the atmospheric composition during periods of glacial expansion and retreat has been made possible by data obtained from an ice core drilled by a joint French-Soviet team at the Antarctic Vostok station.

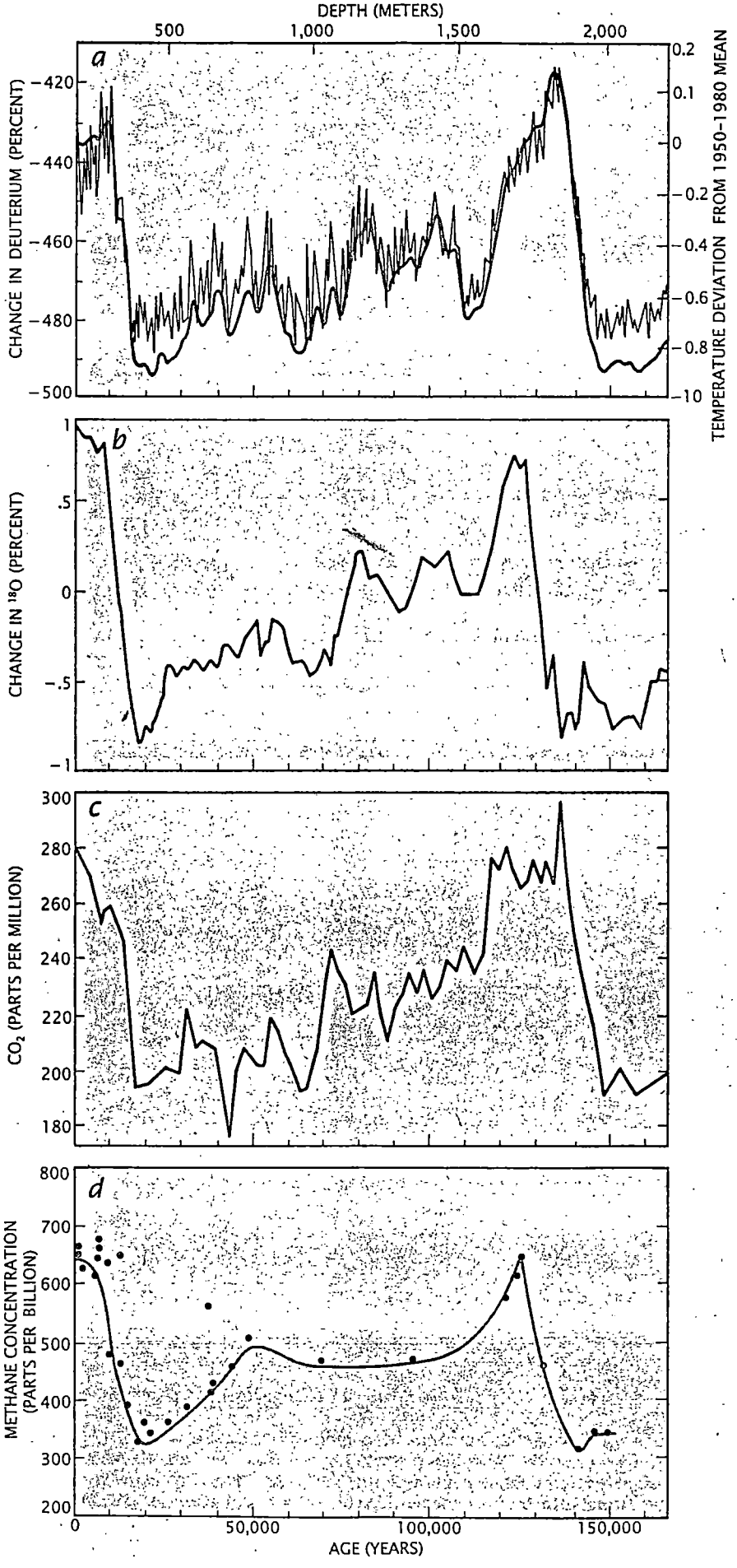
The Vostok core, as it is called, was 2,000 meters in length, long enough to sample ice dating through the past 160,000 years [*see illustration on next page*]. The data show fluctuations in temperature of up to 10 degrees; such fluctuations are derived from changes in the isotopic ratios in the core. It is well established, for example, that the ratio of the two common isotopes of oxygen, ^{18}O and ^{16}O, in cores of marine sediments reflects past temperature changes.

The Vostok data also show how the abundances of atmospheric gases have fluctuated with temperature over the past 160,000 years: the higher the temperature, the greater the concentration of carbon dioxide and vice versa. To be sure, the correlation of carbon dioxide with temperature does not establish whether changes in atmospheric composition caused the warming and cooling trends or were caused by them. Although the carbon dioxide content follows temperature very closely during periods of deglaciation, it apparently lags behind temperature during periods of cooling.

Although there is tight statistical coupling between carbon dioxide and temperature throughout the record, the temperature changes are from five



CORRELATION among the global temperature change, level of heat-trapping gases and carbon dioxide emissions is shown in the first three graphs for the past 140 years. In graph *a* both the annual mean temperature (*spiky curve*) and the five-year running mean (*smooth curve*) are plotted. Graphs *b* and *c* show the atmospheric carbon dioxide and methane content respectively. Pre-1958 data come from analyses of air trapped in bubbles of glacial ice from various sites around the world. The annual production of carbon from fossil-fuel burning (*black*) and from change in land use (*color*) is shown in *d*; the last data were obtained from historical sources.



to 14 times greater than would be expected on the basis of the radiative properties of carbon dioxide alone. This relation suggests that quite aside from changes in greenhouse gases, certain positive feedbacks are amplifying the response. Such feedbacks might involve ice on land and sea, clouds or water vapor, which also absorb radiant heat.

Other data from the same Vostok core sample show that methane also closely follows temperature and carbon dioxide. The methane concentration nearly doubled, for example, between the peak of the penultimate glacial period and the following interglacial period. Within the present interglacial period it has more than doubled in just the past 300 years and is rising rapidly. Although the concentration of atmospheric methane is more than two orders of magnitude lower than that of carbon dioxide, it cannot be ignored: the radiative properties of methane make it 20 times more effective molecule for molecule than carbon dioxide in absorbing radiant heat. On the basis of Hansen's radiative-convective model, which includes chemical feedbacks, methane appears to have been about 25 percent as important as carbon dioxide in the warming that took place during the most recent glacial retreat 8,000 to 10,000 years ago.

How can a global rise in temperature be expected to cause greater releases of carbon dioxide and methane into the atmosphere? In the process of photosynthe-

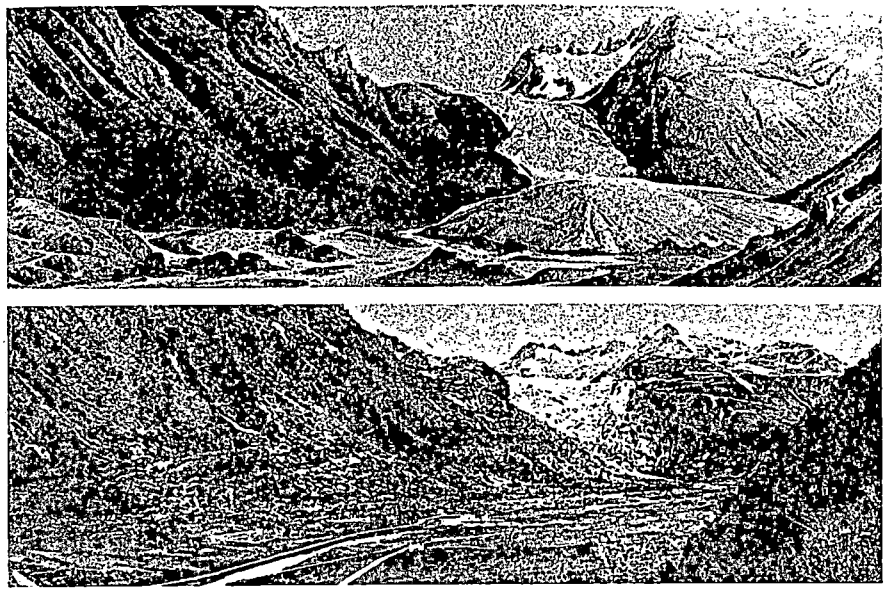
VOSTOK ICE-CORE DATA reveal a correlation between certain gas concentrations and temperature over the past 160,000 years. The ice core, 2,200 meters long, contains bubbles of air with carbon dioxide and methane that were trapped at different depths (*top scale*) and hence at different times (*bottom scale*). Several independent methods have established that the deuterium concentration in ice is a good measure of past temperature; both temperature and deuterium level are plotted in *a*. More traditional is the use of the oxygen isotope ^{18}O to track temperature; curve *b* is almost identical with *a*. The remarkable agreement with the shape of the Vostok-station carbon dioxide curve *c* argues that carbon dioxide can also serve as a global thermometer. Data on Antarctic methane compiled in 1985 and 1986 from several stations (*d*) strengthens the conclusion that levels of greenhouse gases are positively correlated with temperature and may actually influence it.

sis terrestrial plants remove about 100 billion tons of carbon from the atmosphere per year, or about 14 percent of the total atmospheric carbon content. An approximately equal amount of carbon is returned to the atmosphere through the processes of plant respiration and decay of organic matter. Because the fluxes are a substantial fraction of the carbon dioxide already in the atmosphere at any time, a change of a few percent in either the photosynthetic or the respiratory flux would soon significantly alter the atmospheric carbon dioxide content. Will global warming produce such an imbalance?

The answer is unclear and probably will remain so until after the climate has changed considerably more than it has already. Nevertheless, the general picture is probably as follows. The rate of photosynthesis is affected by many factors, particularly the availability of light, water and nutrients. It is not, however, very sensitive to temperature change. The rates of plant respiration and decay, on the other hand, do strongly depend on the temperature. A one-degree temperature change in either direction often alters rates of plant respiration by from 10 to 30 percent.

These observations suggest that a global warming will speed the decay of organic matter without appreciably changing the rate of photosynthesis. That will increase the release of carbon dioxide into the atmosphere. A warming will also result in more methane, because methane is produced by respiration in regions where oxygen is not freely available, such as swamps, bogs and moist soils. In recent years there has been a rise in the concentration of atmospheric methane of more than 1 percent per year. The increase is both rapid and significant because, as noted above, methane is 20 times as effective as carbon dioxide in trapping heat. The wet soils where methane is produced as a result of anaerobic decay probably represent the world's major source of methane. The global warming that has already occurred has undoubtedly stimulated anaerobic decay and the production of methane as well as carbon dioxide.

It is possible to estimate the size of the resulting increase in carbon production at least crudely. A significant fraction (from 20 to 30 percent) of global respiration on land takes place in the forest and tundra of the middle and high latitudes, where the warming is expected to be greatest. If we assume that the mean global warming to date has been .5 degree C, and that in the middle and high latitudes the rise has been one degree, then plant respiration in these latitudes and the decay of organic matter in soils has increased significantly. If the increase in respiration is between 5 and 20 percent over 20 to 30 percent of the total area respiring, then total global respiration will increase between 1 and 6 percent above normal. Once again assuming that the annual flux of carbon into the atmosphere is 100 billion tons and that the rate of photosynthesis remains unchanged, the warming that has already taken place has meant an injection of between one and six billion tons of carbon per year. Over the past century from 20 to 30 billion tons of carbon may have been released in this manner.



RHÔNE GLACIER in Switzerland is shown in a lithograph after an 1848 watercolor by Henri Hogard (*top*). Four sets of moraines are clearly visible. The outermost set has been dated to 1602, the second to 1818, the third to 1826 and the fourth to 1848; the pattern indicates that the glacier had been retreating up the valley for at least 250 years. A photograph from 1970 (*bottom*) shows that the glacier has retreated still farther up the valley. The retreat is additional evidence for recent global warming.

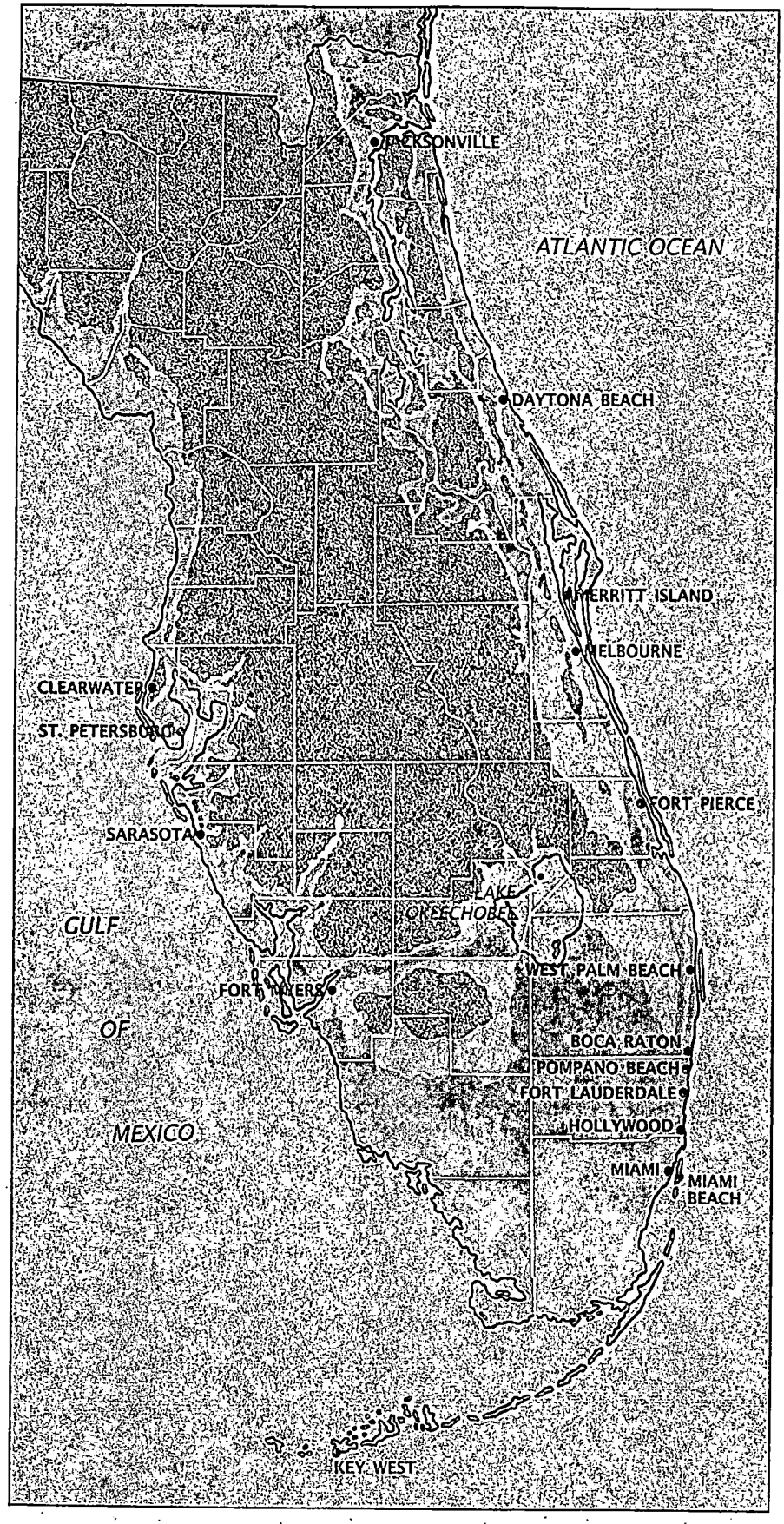
That estimate is probably high, because the average warming may have been less than assumed and because photosynthetic response will tend to reduce the release of carbon dioxide. Yet the estimate is probably not high by as much as a factor of two, and it serves to emphasize the importance of biotic feedback mechanisms.

How does the value just computed compare with amounts of carbon released by other known processes? The release from the burning of fossil fuels is approximately 5.6 billion tons per year; deforestation adds an amount estimated at between .4 and 2.5 billion tons per year. The total carbon injected into the atmosphere from these two sources added to a temperature-enhanced respiration is not known, but it appears to be more than six billion tons annually and may approach 10 billion.

The release of carbon due to changes in the respiratory rate could fluctuate appreciably; a gradual warming, such as that experienced over most of this century, would change the respiratory rate slowly enough so that year-to-year changes would be inconspicuous. On the other hand, a sudden warming or cooling over a period of several years might result in an observable change in the carbon dioxide content of the atmosphere. In the past 15 years the annual rate of accumulation of atmospheric carbon dioxide has been about 1.5 parts per million, equivalent to a global accumulation of about three billion tons of carbon.

According to data recorded on Mauna Loa and at the South Pole by Keeling, however, over the past 18 months the accumulation rate has risen to about 2.4 parts per million, equivalent to about five billion tons of carbon. Keeling expects that the surge will prove transitory, as a lesser surge in 1973 and 1974 did. Nevertheless, the implication we assign to the observations at the moment is that the surge is a result of the high temperatures that have marked the 1980's, delayed by the time necessary to warm the soil. Whether this interpretation is correct remains to be seen.

Any climatic change can also be ex-



"GLOBAL WARMING FLOODS FLORIDA" could be a tabloid headline if the polar ice caps began to melt. Florida is shown here as it might look if sea level rose 4.6 meters above (*bluish green*) or 7.6 meters above (*light green*) the present level (*blue*). In either case Miami and Lake Okeechobee are submerged. A rise of four to five meters might be expected if the West Antarctic Ice Sheet broke up under global warming.

pected to affect the ability of the terrestrial biota, in particular forests and soils, to retain carbon. At warming rates that are lower than the rates at which forests develop, forests may actually expand, and with them the capacity to store carbon. But if the warming rate exceeds the rates at which forests migrate into more climatically favorable regions, widespread mortality of trees and other plants is likely to follow. The net result of such destruction of forests is difficult to predict, but it will probably mean a further release of carbon dioxide through the decay of plants, animals and organic matter in soils.

The amount of carbon dioxide that could be injected into the atmosphere would depend heavily on the rate of climatic change in the forested zones of the middle and high latitudes. Although it is impossible to make any accurate calculation, an upper limit is given by the amount of carbon in these forested latitudes: approximately 750 billion metric tons, or about the same amount of carbon as there is in the atmosphere currently.

Is it possible that a global warming could stimulate the growth of forests? In this case the spread of forests to high latitudes and tundra regions would result in a greater uptake of carbon dioxide from the atmosphere and a greater accumulation of carbon dioxide in the soil. Such a transition is unlikely. Forests require centuries to develop, especially where soils are thin and nutrients are in short supply. They also require climatic stability and sources of seeds. The climatic transitions currently under way, unless they are checked, are rapid by any measure and can be expected to continue into the indefinite future. They do not offer the conditions under which forests are able to develop on new land and remain for long periods.

Might the warming at least stimulate existing forests to store additional carbon in plants and soil? Perhaps. The boreal forest and other coniferous forests may indeed be sufficiently resilient to respond to warming with increased photosynthesis and growth. Whether the carbon taken up by photosynthesis will be stored or simply released through increased respiration remains an open question.

There is also the possibility that the tundra, the treeless plain found in arctic and subarctic regions, will respond to a warming in surprising ways, including an increase in the production of carbon and its storage in

peat. The nature of the response will largely hinge on the availability of water. A wetter tundra might store additional carbon in soils; a drier tundra might release it through the decay of organic matter in long-frozen soil or soil that is normally frozen for most of the year. W. Dwight Billings of Duke University believes global warming will speed the decay of peat in tundra soils and precipitate that ultimate breakdown of the tundra known as thermal karst erosion, which allows flowing water to erode the tundra in great acre-size chunks. Not only is the tundra devastated but also substantial amounts of carbon dioxide and methane that were stored in the peat as carbon are released into the atmosphere.

The evidence indicates that under rapid planetary warming respiration rates will increase more than photosynthesis rates. The changes will lead to the release of additional carbon dioxide and methane into the atmosphere. The magnitude of the release will hinge strongly on the rate of warming: the faster the warming, the larger the release. Such behavior is consistent with (but not proved by) the data from the Vostok core.

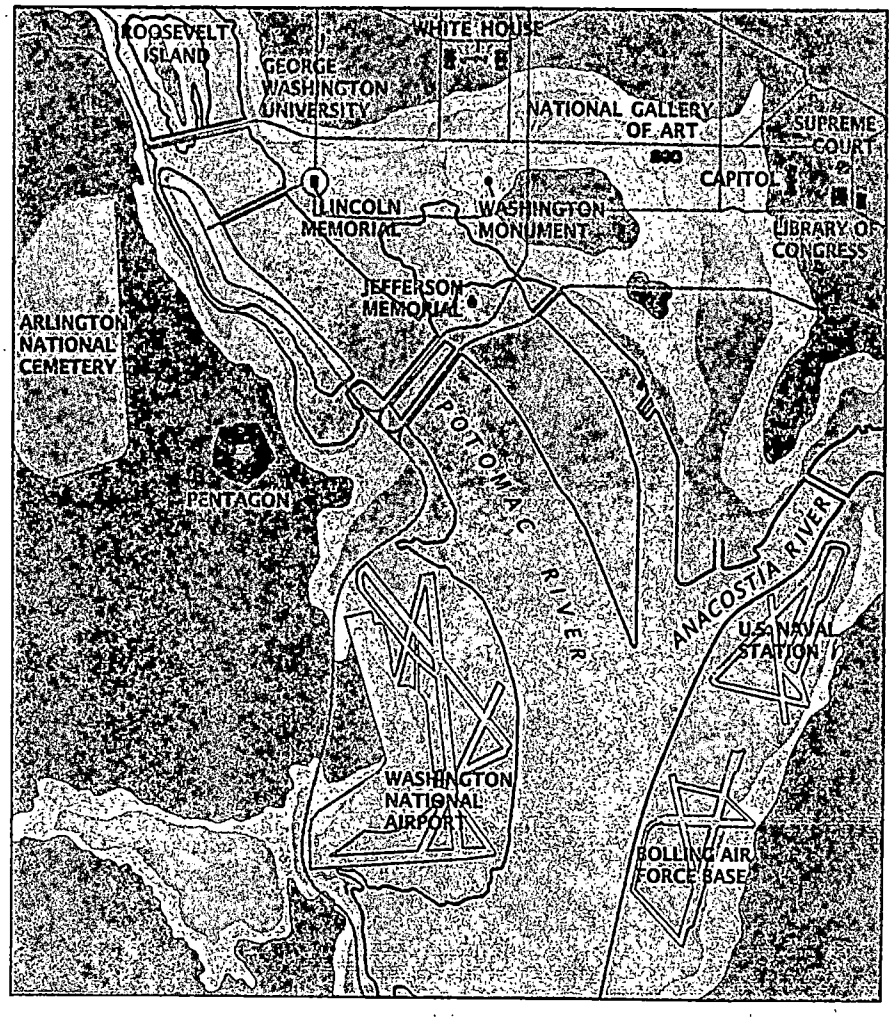
What will be the consequences of a continued global warming? In 1985 a group of meteorologists meeting under the auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) demonstrated that without the respiratory feedback mechanisms addressed above, the combined effect of the greenhouse gases would warm the earth by an average of from 1.5 to 4.5 degrees C before the middle of the next century. The conclusion was recently confirmed in a review written by more than 50 scientists who met in Villach, Austria, in 1987 and was published by the WMO and the UNEP.

Seldom has there been such a strong consensus among scientists on a major environmental issue. The warming, unless consciously checked by human effort, will be rapid and will be felt differentially over the earth. Winter temperatures in the middle and high latitudes can be expected to rise by more than twice the world average. If the mean global temperature were to rise by from two to three degrees C by the year 2030, the winter temperature increase in Minneapolis might approach from four to six degrees C, or about one degree per decade. Summer temperatures would also rise, but less severely. A one-degree change in temperature is equivalent to a change in latitude of from 100 to 150 kilometers. The prairie-forest border, which is now south and west of Minneapolis, might be expected to migrate north at a rate of between 100 and 150 kilometers per decade, or between 400 and 600 kilometers by the year 2030.

Such changes are likely to be difficult for most of the world's peoples. First, the changes will be continuous. Unless the warming stops, efforts to adapt to climatic changes are likely to be responses to conditions that no longer exist. Second, the changes in climate will be irreversible for any time of interest to us or our children. There is no way to cool the earth or to lower sea level; we cannot return quickly to an atmosphere with lower concentrations of greenhouse gases. The best we can do is to reduce current emissions. If that step is taken immediately, a further warming of more than one degree can be expected as the full effects of the heat-trapping gases already present are felt.

Finally, the effects are open-ended. Although most modeling to date simulates a doubling of the atmospheric carbon dioxide content, there is simply no reason to assume that the concentrations will stop at twice the current levels. Estimated reserves of recoverable fossil fuels in themselves are enough to increase the atmospheric concentration of carbon dioxide by a factor of from five to 10.

Can anything be done to slow the climatic change that is now under way? The immediate need is to stabilize the greenhouse-gas content of the atmosphere. Regardless of its source, over the past decade carbon has been accumulating in the atmosphere at a rate of about three billion tons annually. (The remainder is being absorbed by the oceans or stored in forests and soils.) If current fluxes were reduced by three billion tons annually, the atmospheric carbon dioxide level would be stabilized for a few years. The stabilization would not



WASHINGTON, D.C., is depicted here under the same conditions as in the preceding illustration. Washington National Airport and the Lincoln Memorial are inundated. The 7.6-meter contour reaches almost to the Capitol steps and to the White House.

be permanent, however. The rate of accumulation in the oceans is determined by how fast they can absorb carbon dioxide from the atmosphere; this in turn depends on the difference in carbon dioxide concentration between the atmosphere and the ocean. As the flux of excess carbon is reduced, the difference is also reduced and the ocean becomes less capable of absorbing excess carbon; carbon dioxide emissions would have to be reduced still further to prevent additional atmospheric accumulation.

The largest source of carbon dioxide emissions is the combustion of fossil fuels, which releases about 5.6 billion tons of carbon into the atmosphere annually. Industrial nations contribute about 75 percent of these emissions; steps toward stabilizing the composition must begin in the industrialized world. A recent study carried out under the auspices of the World Resources Institute and led by José Goldemberg, president of the University of São Paulo in Brazil, suggests that the consumption of energy from fossil fuels in the developed nations could be halved by a program of conservation and improved efficiency alone.

Although developing nations produce less carbon dioxide, their contributions are growing; if economic development follows conventional patterns, their potential contributions are very large. The second step toward the stabilization of greenhouse gases will require innovations in economic development that lessen dependence on fossil fuels.

The other known major source of carbon dioxide is deforestation, predominantly in the Tropics. By 1980 about 11,000 square kilometers of forest were being cleared annually, with the result that in 1980 between .4 and 2.5 billion tons of carbon (as carbon dioxide) were released into the atmosphere. The rate of deforestation has increased over the past decade. If the present release of carbon is near the upper end of the above range, halting deforestation would reduce carbon emissions by the three billion tons per year needed immediately to stabilize atmospheric composition.

Reforestation will also help to stabilize the composition of the atmosphere. The reforestation of from one to two million square kilometers (about the area of Alaska) will result in the annual storage of one billion tons of carbon. Although this area is large and productive land in the Tropics is at a premium, there may be as much as 8.5 million square kilometers of once forested land available for reforestation. Of this land, about 3.5 million square kilometers could be returned to forest if permanent agriculture were to replace shifting cultivation. Another five million square kilometers of deforested land are currently unused, and there reforestation could in principle be implemented immediately. Forests established to store carbon would, of course, have to be maintained: neither harvested nor destroyed by toxic effects or change in climate.

Each of the measures to stabilize the atmospheric carbon dioxide level would have salutary effects locally, regionally and nationally, quite apart from its effects on climatic change. An improvement in energy-use efficiency, a step that might have been taken long ago with benefits to all, would bring economic and material advantages to both individuals and nations. An improvement in efficiency would lessen reliance on fossil fuels; this in turn would reduce sulfur and nitrogen oxide emissions, acid deposition and the release of other toxins. Halting deforestation would help to maintain the genetic diversity of the planet, reduce erosion, stabilize local and regional climates, cleanse water and air and preserve opportunities for future generations.

No one remedy by itself is likely to stabilize the levels of carbon dioxide and methane in the atmosphere. If the accumulation of carbon dioxide in the atmosphere persists, the carbon burden will have shifted from three billion tons annually to five billion tons and will be that much more difficult to address. The measures that are required can begin at home, although it is clear the world must join in the effort if it is to be effective. There are precedents for international action on similar issues. The Limited Test Ban Treaty of 1962 was an agreement among certain nations to avoid atmospheric tests of nuclear weapons. It has been effective. Nations that did not sign it (France and the People's Republic of China) have yielded to international pressure and now conduct weapons tests underground. The Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol, the latter negotiated in 1987, have moved the world far toward the elimination of chlorofluorocarbons.

There is no reason to assume that similar progress cannot be made with carbon-based fuels and deforestation. With that end in view a series of steps has already been undertaken: 50 specialists in international diplomacy and law met recently under the auspices of the Woods Hole Research Center to outline approaches that might work. The greatest problem is gaining the active and effective support of the developing nations, which are poised for a massive increase in fossil-fuel consumption. Development need not, however, follow historical paths. To cite one example, the low-latitude countries stand to gain immeasurably as techniques for exploiting solar energy are perfected. Solar-powered electrolysis of water can produce hydrogen, which in turn can run automobiles and other machinery. There are few places in North America where domestic hot water cannot now be produced by solar energy at little or no cost throughout most of the year. Nor is it to the advantage of nations to allow their forests to be destroyed.

Conferences are under way in the developing nations to explore alternatives to the present course. The first was held in New Delhi in February; the second is planned for São Paulo in September under the leadership of Goldemberg. The conferences will explore the possible responses of developing nations to a world in which conventional energy sources are limited. There are extraordinary opportunities for industrial innovations, particularly in energy efficiency and solar power. But developing countries cannot be expected to shoulder the entire burden; the developed nations, which are responsible for most of the problem, must do their share.

These issues will persist throughout the next century and dominate major technical, scientific and political considerations into the indefinite future.

FURTHER READING

GLOBAL DEFORESTATION: CONTRIBUTION TO ATMOSPHERIC CARBON DIOXIDE. G. M. Woodwell, J. E. Hobbie, R. A. Houghton, J. M. Melillo, B. Moore, B. J. Peterson and G. R. Shaver in *Science*, Vol. 222, No. 4628, pages 1081-1086; December 9, 1983.

THE FLUX OF CARBON FROM TERRESTRIAL ECOSYSTEMS TO THE ATMOSPHERE IN 1980 DUE TO CHANGES IN LAND USE: GEOGRAPHIC DISTRIBUTION OF THE GLOBAL FLUX. R. A. Houghton, R. D. Boone, J. R. Fruci, J. E. Hobbie, J. M. Melillo, C. A. Palm, B. J. Peterson, G. R. Shaver, G. M. Woodwell, B. Moore, D. L. Skole and N. Myers in *Tellus*, Vol. 39B, Nos. 1-2, pages 122-139; February-April, 1987.

GLOBAL TRENDS OF MEASURED SURFACE AIR TEMPERATURE. James Hansen and Sergej Lebedeff in *Journal of Geophysical Research*, Vol. 92, No. D11, pages 13345-13372; November 20, 1987.

ENERGY SERIES

The Atlantic Council
of the United States

Policy Paper

Energy Imperatives for the 1990s

Report of the Atlantic Council's Energy Working Group

C. J. Silas, *Chairman*
John E. Gray, *Vice Chairman*
W. Kenneth Davis, *Vice Chairman and Rapporteur*

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02. Memo	From Michael Boskin to Secretariat of the WH Conference on Science and Economics Research Related to Global Change (4 pp.)	4/4/90	P/5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff, White House Office of
Series: Sununu, John, Files
Subseries: Issues Files
WHORM Cat.:
File Location: Global Warming (2 of 2) - 1990 [4]

Open on Expiration of PRA
(Document Follows)
By ___ (NLGB) on 10/28/05

Date Closed:	12/17/2004	**OA/ID Number:**	29158-004
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

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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]

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(b)(1) National security classified information [(b)(1) of the FOIA]
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(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

THE CHAIRMAN OF THE
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON

April 4, 1990

MEMORANDUM FOR SECRETARIAT OF THE WHITE HOUSE CONFERENCE ON SCIENCE AND ECONOMICS RESEARCH RELATED TO GLOBAL CHANGE

FROM: MICHAEL J. BOSKIN MJB

SUBJECT: Global Stewardship Statement

As you know, I support the Global Stewardship theme for the upcoming White House Conference. However, the present draft of the Global Stewardship Statement is not only absolutely unacceptable, but inherently dangerous. I have personally and through my staff raised this set of issues on previous drafts and have been told that my concerns would be addressed. THEY HAVE NOT BEEN. I do not want a version of this to go forward that does not incorporate all of my revisions. This should be considered as an order, not a request.

The main problems are as follows:

1. The repeated assertion that investment in environmental assets and/or the natural resource base are the keys to future economic growth is incorrect and must be removed. Current economic research shows that the statement is false in the greenhouse context, the single most important global change issue. In its present form, the statement effectively dismisses all of the current economics work in this area.

2. A main thrust of our position on climate change has been that we need to take account of adverse impacts on future growth in setting our policy goals. Issuance of the draft statement in its present form under over the President's signature would undercut this approach.

3. Our overall policy position has been that environmental quality and economic growth can be reconciled, but that their compatibility is not automatic and depends on selection of appropriate goals and policy instruments.

4. The penultimate sentence baldly states that the balance we need to draw is between the present and the future. This suggests that the future always benefits from investments in environmental assets. The President's stated position is that the future has a large stake in economic growth, and that ill-conceived environmental efforts can damage the interests of future generations. Economic concerns should not be reduced to a reflection of the greed of the present generation.

5. Finally, there is no significant role for economics or economics research in this version of the global stewardship vision. This directly undercuts the main purpose of the conference. Mere repetition of the mantra that we need more economics research is insufficient without any indication of where the economic uncertainties are and why they might matter. Economics matters because there are tradeoffs. After the easy decisions have been made, the tradeoffs will get steeper, and we will have to choose how far to go along each global change policy dimension.

These concerns are reflected in the attached markup of the draft statement and the detailed comments outlined below. My revisions reflect an attempt to reach a middle ground. They should be incorporated exactly, and returned for my approval by noon, April 5. They are both consistent with the President's stated policy and reflective of the balance that is necessary for this conference.

Detailed Comments

- Without the paragraph six sentence addition there is no role for economics in resolving global change uncertainties. Also, "justifiable" rather than "necessary" is appropriate to describe our actions: necessity implies an absolute standard, while justifiable reflects the need to assess tradeoffs.

- The discussion of our natural resource base comes too close to sounding like a "Club of Rome" discussion of limits to growth. The topic of the conference is environmental resources, not coal, oil, or nickel reserves.

- Many environmental resources are renewable, so that the "depletion" concept in paragraph four is inappropriate. Our standard income accounting cannot be easily corrected without placing a valuation on environmental externalities. (OECD has concluded that it is not now possible to include environmental values directly in economic measures, and that attempts to do so would seriously pollute important economic data. We could develop satellite accounts for these resources.)

- Paragraph five and the last sentence in paragraph three presumes that investment in environmental assets promotes economic growth - in other words that it represents a "win/win." This is totally inconsistent with stated U.S. policy that tradeoffs exist which must be evaluated and with the President's own statements regarding the need to "reconcile the economy and the environment." You don't need to reconcile objectives that are inherently harmonious.

- Unlike the phrase "mortgaging our future" which makes sense, the phrase "mortgaging our natural resource base" doesn't. The former phrase reflects the notion that we are allowing an outside party to hold our future in escrow in exchange for some present benefit, thereby putting it at risk in the event our repayment plans to restore our equity fail. Consuming our environmental assets--if indeed that is what we're doing--is more analogous to a reverse mortgage in which the owner's equity is steadily reduced. The President's message should not include a phrase that sounds good but lacks meaning.

Attachment

cc: D. Allan Bromley
Michael Deland
John Sununu
Andrew Card
James Cicconi

FOR GLOBAL STEWARDSHIP

Global stewardship is our shared responsibility and our shared *opportunity*. We must manage the Earth's natural resources in ways that assure the sustainability of humanity on this planet and in ways that maximize our potential for growth and opportunity for all. Global stewardship is a continuing process of political, economic and social decision-making that meets the needs of the present generation while expanding the ~~ability~~ opportunities of future generations ~~to meet their needs~~.

Global stewardship will become ~~the~~ a dominant scientific, economic and environmental issue of the 21st century. The experience of the past 45 years has shown that growth can be achieved only through the synergy of democratic political institutions and market economic systems. But just as democratic institutions are expanding, our ability to grow could be limited by ~~damage~~ changes to our already stressed environment. Solutions must be found which will ~~allow increased economic activity~~ protect the quality of our environment without mortgaging our natural resource base. Our natural resources must be treated like the valuable resources ~~assets~~ they are—as key determinants of our future capacity for growth.

For perhaps the first time in human history, we now understand that our progress depends on *accounting* for ~~the depletion of natural~~ our environmental resources and using them wisely ~~along with their consumption~~. A new understanding of complex environmental systems is emerging. This understanding means that we are now called upon to create new directions for our creative energies and technologies. *Global stewardship is the key.*

To exercise effective global stewardship, we must advance our knowledge of natural and human systems. We must create solutions that join economic growth with sound management of our environment. Meeting this challenge will require an integration of scientific, economic, and environmental concerns—an integration which moves global stewardship and human sustainability to center stage. Reinvestment in and wise management of our environmental assets ~~are the key to~~ can enhance our future growth. prospects. delete sentence

while maintaining the quality of the natural environment.

There is also uncertainty regarding the social and economic consequences of change itself and of policy measures which might be taken to address it.

As "global stewards" we need new tools to effectively evaluate how to respond to global environmental changes. Science and economics research can provide some of the tools needed to understand and properly manage our changing planet. Global change is concerned with such diverse but interrelated issues as ozone depletion, greenhouse gases, climate change, food security, water supply, sea level changes, wetlands, deforestation, biodiversity, population changes, and energy demands. A common ingredient in each of these issues is the level of uncertainty about the scale at which these changes are occurring and humanity's relative contribution to the change. As global stewards we must address these uncertainties by increasing our scientific and economic knowledge and ~~[illegible]~~ take ~~necessary~~ justifiable action to manage global change...even in the face of remaining uncertainty.

Therefore, the challenges of global stewardship require agreement in these three areas:

- Scientific and economic uncertainties—research challenges;
- Strategies and challenges to integrating economic and scientific research; and
- Building better international partnerships for economic and scientific research.

Our existence depends on our ability to draw sustenance from the natural world while supporting the systems that regenerate that world. Building an integrated program of economic and scientific research is the step we must take today on the path of global stewardship. Global stewardship is not a fixed state but a process of change in which ~~the present and the future~~ environmental and economic values are brought into balance to meet human needs and to expand human prospects. Let us join together and accept the challenge of Global Stewardship.

George Bush

natural environment while allowing for the economic growth necessary to sustain a growing world population and improve its living standards

f: global warm

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

FEB 2 3 1990

THE CHIEF of STAFF
was seen
1990 FEB 23 PM 6:20

MEMORANDUM FOR THE PRESIDENT

THE ADMINISTRATOR

SUBJECT: Environmental Elements for Your Discussions with German Federal Chancellor Kohl

SUMMARY: As you know, the Chancellor has a strong personal commitment to work on environmental issues, both domestic and global. Although overshadowed by economic and security issues in the German unification process, environmental protection is also a major element in "inner-German" cooperation. Thus, he may raise any of the issues noted below with you during his stay at Camp David, in terms of both U.S.-German relations and the G-7 Summit process.

GLOBAL CLIMATE CHANGE: Although the FRG is much more energy-efficient than the U.S., both German government and industry are committed to further reductions of carbon dioxide emissions to counteract global warming. Last fall, in response to your interest in this subject, the Chancellor committed to provide specific information on how the FRG would go about this task. I have just received information from one of his senior advisors, Baldur Wagner, indicating that over the last 15 years they have managed to keep energy consumption constant while real GNP rose about 30 percent. This effort involved a 19 percent drop in primary energy consumption in industry and a 25 percent reduction in specific heating energy for buildings. Driving these reductions were:

1) higher energy prices, including fuel oil taxes;
2) mandated building insulation and efficiency standards;
3) conservation investments;
4) increased energy efficiency in consumer products, including cars;
5) public-sector energy conservation as a model;
6) education and training programs concerning reduction of energy consumption and promotion of energy-efficiency research and development.

I was told they will take measures to increase by at least 30 percent the fuel efficiency of new automobiles, will phase out brown coal development (which now is heavily subsidized), arrange to purchase significant nuclear-generated power from France (also reducing the trade imbalance with France), and require numerous energy efficiency investments by industry. Internationally, the FRG

proposes to support a framework convention on climate change, and simultaneously to negotiate two protocols, one to reduce carbon dioxide emissions, and a second to address deforestation and promote reforestation.

ENVIRONMENTAL ASSISTANCE TO EASTERN EUROPE: The FRG is very much aware of the severe environmental degradation in Eastern Europe and is directly affected by transboundary pollution. About 60 percent of the FRG's air pollution comes from its eastern neighbors, and most ground and surface water flowing from east to west is moderately to heavily polluted. The Germans are already active in environmental assistance to Eastern Europe, both to help protect the environment of the FRG and because of the significant commerical opportunities. I indicated to Kohl in November that we would welcome German participation in the new Budapest Environmental Center.

DEVELOPMENT ASSISTANCE AND DEBT-FOR-NATURE PROJECTS: The Chancellor is strongly committed to ensuring that all German development assistance, whether given bilaterally or multilaterally, is consistent with protecting the environment. While in Bonn for my meeting with the Chancellor, I also met with his Minister for Economic Cooperation (Warnke) and his Environment Minister (Toepfer). We agreed on the desirability of a meeting of the environment and development Ministers from the G-7 countries. This may come up as a point to be included in the recommendations of the Houston Summit.

The Chancellor is strongly committed to the principle of "debt-for-nature swaps", and the FRG is currently converting some of its Polish debt into environmental projects in Poland. Again, specific G-7 support for one or more debt-for-nature schemes could be agreed upon in Houston. The Chancellor was specifically interested in a debt-swap involving a Francophone country in Africa, to include the French.

ACID RAIN RESEARCH AND CONTROL: The acid rain problem, and therefore the economic consequences of acid precipitation are at least an order of magnitude greater in the FRG than in the U.S. Much of their forest damage is visible to the public at large, while in the U.S. most damage is less visible and is mostly in relatively remote locations. In the early 1980s, they undertook a very ambitious program to reduce sulfur dioxide emissions in Germany.

However, much of the acid rain problem arises from pollution from the GDR, Czechoslovakia, and Poland, thus requiring the FRG to take a regional leadership role in encouraging reduction of industrial and power plant emissions.

William K. Reilly

COMMON GROUND

For Governor Sununu
Confidential Please

February 13, 1990

Governor John Sununu
Chief of Staff
The White House
First Floor, West Wing
1600 Pennsylvania Avenue
Washington, D.C. 20500

THE CHIEF of STAFF has seen

Dear John:

I admire your guts in helping the President stay away from the climate change issue until you are satisfied that you have sifted through all the facts, defined the problem based on the best current science and are able to choose a course of action based on reality.

Here are some of the more appealing media events during 1990 which may provide the forum for the President to present something substantive in this busy and important year. There are others to choose from which are mentioned in the Climate Change Network update enclosed for your information.

11/89	2/90	4/90	5/90	5/90	9/90	10/90	11/90	12/31/92
Ministers Meeting	IPCC Plenary	Earth Day	Inter-Parliamntry Conf.	Action for Common Future	IPCC Draft	UN General Assembly	2nd World Conf	UN World Conf. on the Environment
Nthrlnds	D.C.	Int'l	D.C.	Bergen		New York	Geneva	Brazil

As you know, over the past several months, we here at the Center have been totally immersed in the climate change issue through numerous small group discussions, two multi-interest sessions in Washington and a week monitoring the IPCC's Response Strategy Working Group session in Geneva last October.

We've gotten a real taste of the emotion and context behind the problem and have witnessed the evolution of a possible U.S. industry leadership position on climate change that makes both good environmental and economic sense.

Behind it all is a reality I've been wrestling with ever since 1961 when I was asked to serve six years on the National Petroleum Council representing 4,000 small heating oil dealers in New England; 90% of all the world's proven petroleum reserves are in the hands of six unstable families in the mid-east, a situation economists would call disproportionate allocation of resources, and one fraught with danger as you well know.

CENTER for POLICY NEGOTIATION Inc.
20 Park Plaza, Boston, Massachusetts 02116 617-482-8660

Increasingly, it has become apparent that global warming is a doorway to the more complex issue of sustainable development. Here is another example of of a disproportionate allocation of resources--principally fossil fuels. The problem here may be that the global politics of population and poverty and the disproportionate availability of technology as well as resources is putting immediate pressure on the leadership of the L.D.C.s.

If this is so, there may be a way for the President to deal with the climate change issue in the broader context of sustainable development. By raising a contentious issue one level higher in complexity, it is often possible to build collaborative action, where at the lower level, continued conflict may be inevitable.

I am optimistic today about the opportunity presented by the global warming debate because the right people are at the right place at the right time. I think you and I could choose two dozen people who have spent time and energy (and invested personal capital) trying to do something about their piece of the problem who would benefit by a chance to talk together off-the-record in a tightly planned session to see how their pieces fit together.

If such a meeting were preceded by two or three pertinent background papers and people had a day to talk things over, there is no telling what might happen.

Attached you will find my nominees for such a session which include the authors of two superb background documents.

I need to be at the White House at 2:00 pm this Thursday, February 15, to meet with Nancy Maynard at OSTP. If there is is a crack in your schedule before or after that time or later in the day, I'd bring along a strawman meeting plan and agenda for you to shoot holes in.

Warmest regards,

Thomas J. Scott
President

Enclosures:

Climate Change Network Up-Date
Ad Hoc Discussion Group List
1990 Institutional Milestones--Global Climate Change
CPN Board of Directors

For Governor Sununu
Confidential Please
2/13/90

Global Climate Change Network Up-Date

As you know, the Center's initial project emphasis has been on providing an informal forum for some members of U.S. industry and a cross section of environmental interests, agency officials and members of the research community to consider the full context of the global climate change issue and to develop some initial ideas on ways to address it. This is a critical step given that the industrial sector is both the key to U.S. economic vitality and the primary contributor to the CO2 problem.

The Center's climate change initiative will continue to focus on providing support to these interests as they work toward a national strategy on climate change and possible Framework Convention by the 1992 UN World Conference on the Environment.

The following workplan for meetings convened by the Center is designed to parallel the 1990 milestones described in the cover letter.

	Meetings	February	March	April	May	June	July
	Multi-Interest			X		X	
	Sponsors		X				
	Environmental Interests		X				
Issue Work Groups	Energy Effic.				X		X
	Reforestation					X	
	Waste Reduc.				(X)		

This ambitious non-government funded project is now in place and being put into motion. It is designed to track the emerging climate change infrastructure and milestones to 1992.

The Emerging Infrastructure and Milestones

At the International Level

Some commentators have suggested that the 20th anniversary of the Stockholm Conference on the Environment to be celebrated by UNEP in Brazil in 1992, may be an appropriate time to achieve a common goal--to celebrate the completion of a Framework Convention on Climate Change.

If the activities of the IPCC can be sustained, they offer the appropriate institutional mechanism to assist in realizing this objective. Acceptance of its draft report in November 1990 concurrent with the 2nd World Conference on the Environment in

Conference on Climate Change is scheduled for April 29th - May 2nd; it is a bipartisan Congressional initiative involving world legislators.

An opportunity to enhance government/non-government collaboration is offered by the "Action for Common Future" on May 8-15, 1990 in Bergen, Norway, a major government/non-government media event.

At the National Level

In Congress there are six pieces of climate change legislation in the hopper pending further public pressure for action. These have been set aside during the current session to permit reauthorization of the Clean Air Act.

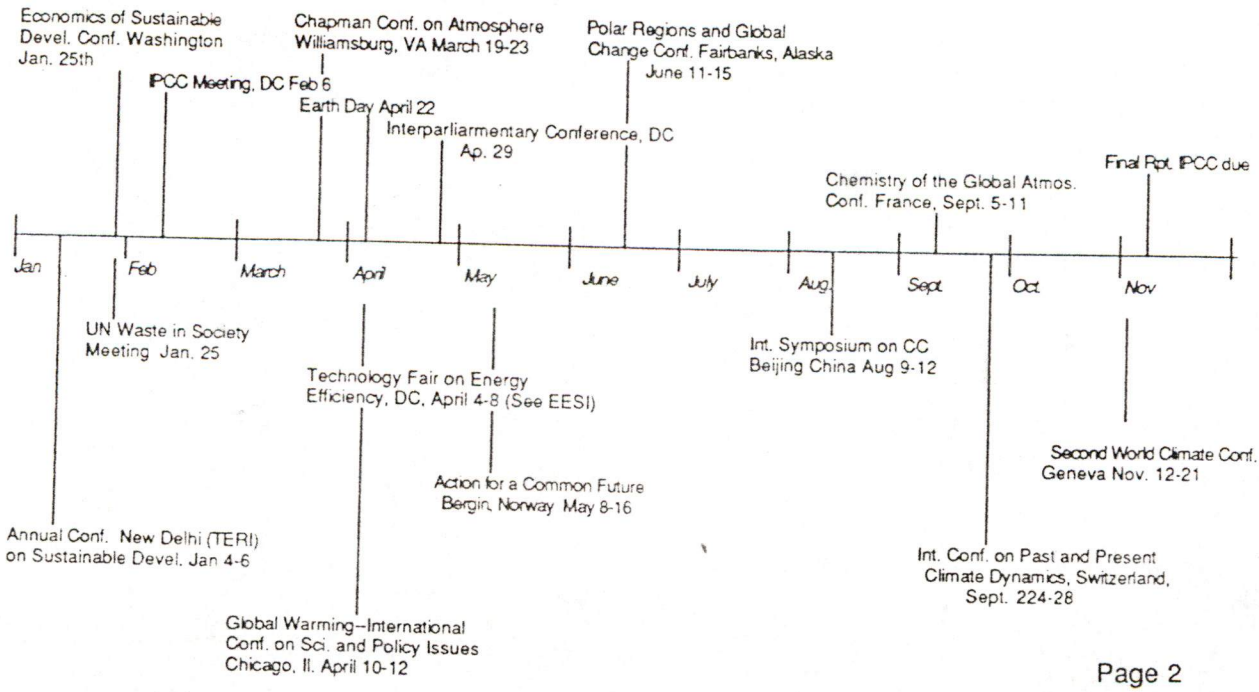
In the Administration, pressure is building for the President to come forward with a leadership initiative--putting additional susbstance behind his allusion to the power of the "White House effect " in dealing with the "greenhouse effect."

At the Grass Roots Level

It is increasingly apparent that successfully addressing the complex global objective of sustainable development will depend on forging a community-level partnership between the entrepreneur and the environmentalist. Called eco-preneurialism, it's in your house and my house, your town and mine where a new kind of environmental innovation will emanate if the global problem is to be solved.

At the community level, voluntary initiatives are being stimulated by the Renew America projects and by Jeremy Rifkin's Global Greenhouse network. The National Governors Association is looking at a role for the state in this issue.

1990 Institutional Milestones--Global Climate Change



About the Center

For the past three years, the Center has been working to establish a framework for dealing with critical environmental issues. The Center has worked off-the-record and anonymously, utilizing the concepts of policy negotiation to provide issue and information management support to government, industry and public interest advocate organizations to help people get to reality in environmental decision making.

Our small board of directors is made up of key people concerned with critical economic and environmental issues and our networks include a cross section of the people who frame the environmental decisions in the agencies, industry, the advocacy organizations and their usual sources of scientific and technical information.

Besides our climate network, we have active networks in air quality, e.g. acid rain, water quality, e.g. Chesapeake Bay, and energy planning in New England.

Objectives

To accomplish the goal of supporting and enhancing climate change deliberations at the international, national and grass-roots levels, the Center has structured a work plan to deal with scientific uncertainty and political reality. Its objectives are to:

- Enhance systematic but informal and off-the-record interaction, among a cross-section of individuals responsible for framing environmental decisions, around a strawman short-term U.S. policy position on climate change.

- Identify major issues related to long-term responses to global change and promote an informed and informal discussion of these issues.

One possible outcome is the structuring of a multi-track response strategy to stabilize greenhouse gases that is beneficial to society irrespective of the impact of global warming (i.e. that looks at energy efficiency, waste reduction and reforestation initiatives specifically, while science reduces the uncertainty around climate change).

Next Steps

After two intensive sessions, the multi-industry group has considered a context in which to view the climate change issue and now wants to look at energy efficiency and reforestation, as possible near term response initiatives, in greater detail. In addition, participants want to look at other ways U.S. industry can help devise voluntary policies and technologies to mitigate the consequences of global change which are beneficial for other reasons while continuing to track congressional activities, the IPCC and the emerging science.

The attached network list reflects the present make-up of the climate change network.

behind U.N. efforts and serve as a rallying point for U.S. action. Finally, at the grass-roots level public interest and business initiatives, along with community waste-reduction, energy efficiency and reforestation drives, offer a means to support the president if he should decide to take a leadership role.

The Need

What is needed is to provide a focal point for this three-year initiative. Here are a group of twenty-five which could provide the catalyst.

For Governor Sununu
Confidential Please

Global Warming: Problem or Opportunity?

An Ad Hoc Discussion Group

Edward Woolard duPont	Environment/The Economy	Gus Speth World Resources Institute	World Resources
John Akers IBM	Education	Tina Hobson Renew America	Energy Efficiency/Grassroots
John Young Hewlett Packard	International Competitiveness	Jeremy Rifkin Foundation on Economic Trends	Global Greenhouse Network
Steven Wolf United Airlines	Waste Reduction	John Adams Natural Resources Defense Cncl	Public Interest Advocacy
Lod Cook ARCO	Energy	Dennis Hays Earth Day	Catalyst
Bob Mallott FMC Corporation	Corporate Philanthropy		

Frank Press National Academy of Sciences	The Scientific Community
Howard Johnson MIT Chairman Emeritus	Scientist Emeritus
James Joseph Council on Foundations	Foundation Sponsorship
Louis Cabot Brookings Institution	Neutral Ground

Invited Observers:	Technical Coordinator:	Resource People:	
Gov. John Sununu Chief of Staff	George Hatsopoulos Thermal Electron	Dennis Pirages* University of Maryland	Amory Lovens Rocky Mountain Institute
Alan Bromley OSTP	Peter Drucker Claremont University	Gordon McDonald* MITRE	Arno Rosemarin Jrnl of the Human Envt
Noel Brown UNEP, North America			

2/14/90

* Author of background document

For Governor Sununu
Confidential Please

Global Warming: Problem or Opportunity?

An Ad Hoc Discussion Group

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duPont	Environment/The Economy	World Resources Institute	World Resources
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IBM	Education	Renew America	Energy Efficiency/Grassroots
John Young		**Jeremy Rifkin**	
Hewlett Packard	International Competitiveness	Foundation on Economic Trends	Global Greenhouse Network
Steven Wolf		**John Adams**	
United Airlines	Waste Reduction	Natural Resources Defense Cncl	Public Interest Advocacy
Lod Cook		**Dennis Hays**	
ARCO	Energy	Earth Day	Catalyst
Bob Mallott			
FMC Corporation	Corporate Philanthropy		

Frank Press	
National Academy of Sciences	The Scientific Community
Howard Johnson	
MIT Chairman Emeritus	Scientist Emeritus
James Joseph	
Council on Foundations	Foundation Sponsorship
Louis Cabot	
Brookings Institution	Neutral Ground

Invited Observers:
Gov. John Sununu
Chief of Staff
Alan Bromley
OSTP
Noel Brown
UNEP, North America

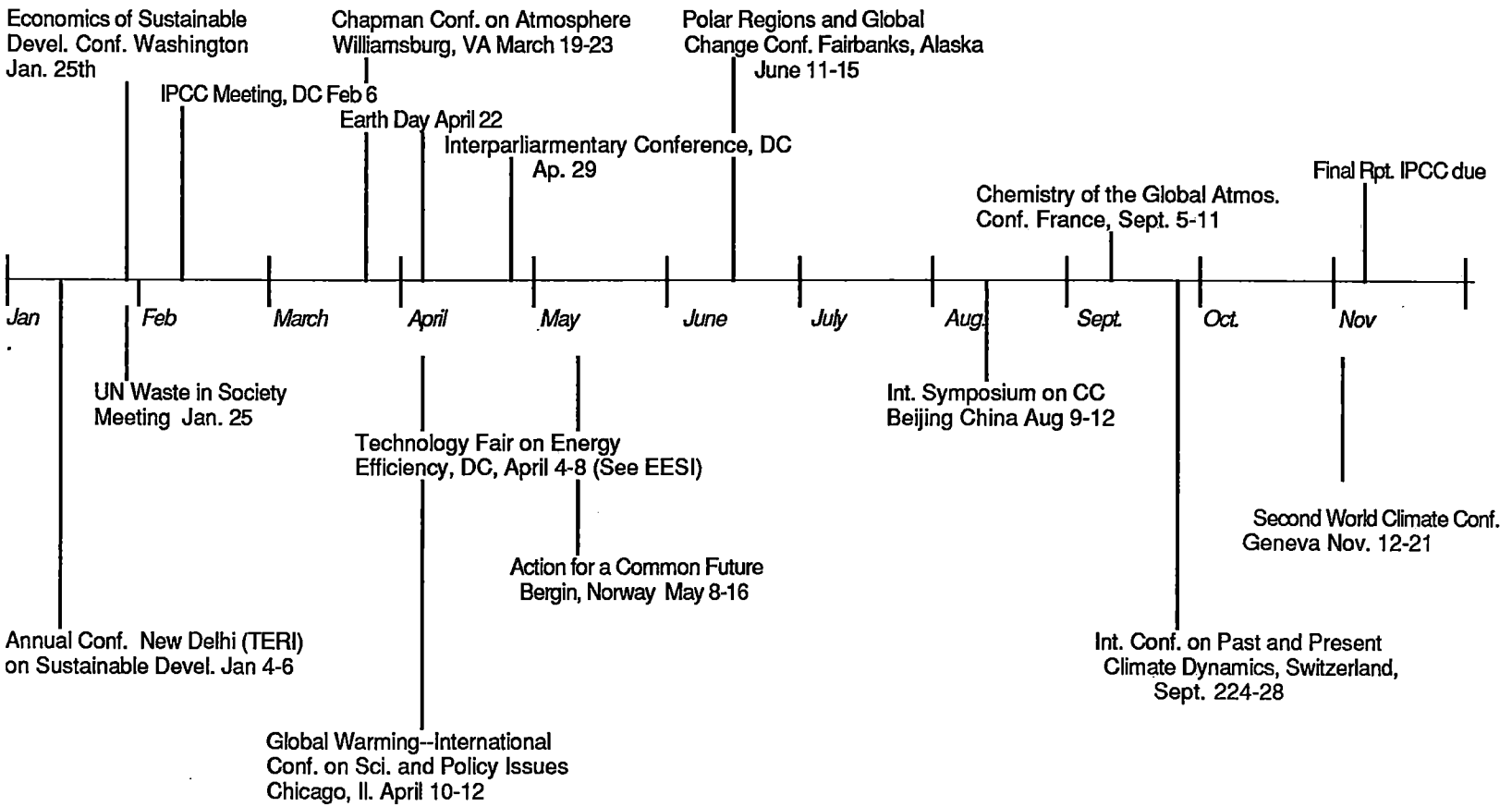
Technical Coordinator:
George Hatsopoulos
Thermal Electron
Peter Drucker
Claremont University

Resource People:
Dennis Pirages*
University of Maryland
Gordon McDonald*
MITRE
Amory Lovens
Rocky Mountain Institute
Arno Rosemarin
Jrnl of the Human Envt

* Author of background document

2/14/90

1990 Institutional Milestones--Global Climate Change



BOARD OF DIRECTORS--CENTER FOR POLICY NEGOTIATION
1989-1990

Alan Cope — Vice President for Marketing Services of Consolidation Coal Co., Pittsburgh, PA., Mr. Cope has been in the energy industry in the US and Europe for 31 years. Formerly an executive with British Petroleum, he later joined Conoco and, most recently, its subsidiary, Consolidation Coal Co. His expertise spans the areas of supply, marketing, planning, and government relations. He is a graduate of Oxford University.

Gregary DeBaryshe — President, Holometrix Inc., Cambridge MA, Mr. DeBaryshe is a scientist and former chairman of the New England Chapter of the Sierra Club. He has also been leader of the Route 2 Coalition and an active member of the National Center for Atmospheric Research Standards Committee.

Harold Keohane — Partner, Keohane and Detore, Mr. Keohane is a specialist in regulatory and energy law and former chairman of the Massachusetts Public Utility Commission, and regional administrator for the Department of Energy. He currently serves as a senior advisor and counsel for major New England utilities.

Steven Kuhrtz — Director of Environmental Affairs, Cabot Corporation, a national energy and chemical firm based in Boston, MA, Mr. Kuhrtz is a former senior staff member of the US Environmental Protection Agency and New Jersey Department of Environmental Protection.

Joan Martin-Brown — Director, U.S. Liaison Office, United Nations Environment Program, Ms. Martin-Brown is a specialist in international environmental issues. She is a founder of the Bolton Institute and was Director of Public Awareness, U.S. EPA, during the Carter administration.

Claudine Schneider — Congresswoman from Rhode Island, Ms. Schneider is a member of Congress's Science and Technology and Merchant Marine and Fisheries committees and treasurer of the Northeast/Midwest Coalition on acid rain. Prior to her election, she was actively involved in a broad range of energy and environmental issues in the state of Rhode Island.

Steven Sweeney — Chairman, Boston Edison Co., Mr. Sweeney has served with this major New England utility for 34 years. He brings to the Center extensive experience with the utility industry, energy, and public policy issues. He also serve on the Boards of The Bank of Boston Corp., First National Bank of Boston, Massachusetts Electrical and Gas Assn., New England Power Pool, and Dana-Farber Cancer Institute.

Virginia Tippie — Assistant Administrator, NOAA, Ms. Tippie is a coastal systems scientist and former director of EPA's Chesapeake Bay Program and the Center for Ocean Management Studies at the University of Rhode Island. A staff advisor to the Center's Georges Bank and Chesapeake Bay programs, she has also been President of the Coastal Society.

Eugene Trisko — Executive Vice President, Stern Bros. Inc., an energy holding company, Mr. Trisko is a former regulatory lawyer with the Federal Trade Commission. Active in current acid rain negotiations and a participant in the Center's AHARC program, he has been instrumental in bringing together mine workers, coal industry, and environmental interests in pursuit of new acid rain legislation in Congress.

Officers

Chairman of the Board

Susan Wiltshire — Specialist in energy and nuclear waste management with JK Associates of Massachusetts and Texas. Former President of the League of Women Voters of Massachusetts. A member of the Program Review Committee of the National Low-Level Radioactive Waste Program. She also serves on the Board on Radioactive Waste Management of the National Academy of Sciences and its Committee on Risk Perception and Risk Communication.

Thomas McCarthy — Environmental management consultant, Haley, McCarthy & Cie SA, Trelex, Switzerland, Mr. McCarthy is a specialist in international environmental management and President of an international issues group based in Geneva. Former Vice President, Environmental Affairs, Europe for Procter and Gamble, he was the organizer of the 1984 World Industry Conference on Environment and Development in Versailles, France.

Joseph Montville — Director of Research, Center for Study of Foreign Affairs, U.S. Foreign Service Institute, Arlington, VA, Dr. Montville, is foreign affairs scholar and originator of "Track II" diplomacy. His work has focused on bringing together disparate points of view, off the record, to deal with intractable international conflicts including those in the Middle East and between the USA and USSR. He is currently involved in low-intensity conflict resolution and development planning and has a special interest in international acid rain negotiations.

Thomas Moss — Dean of Graduate Studies, and Director of Research Administration, Case Western Reserve University, Cleveland OH., Dr. Moss is former staff director for several key congressional scientific committees. A physicist, he has also served as a senior industry researcher. He is currently a member of the scientific advisory committee for the Center for the Great Lakes and on the Planning Committee for the Geo Biosphere program.

Walter Palmer — Vice President of Public and Financial Relations, Raytheon Corp., Mr. Palmer is also former president of Associated Grantmakers of Massachusetts. A former vice president of corporate philanthropy for this major manufacturer of military hardware, he encouraged a strong presence as a good neighbor and supporter of education, cultural affairs and environmental management.

Gerald Prout — Director of Public Affairs for the FMC Corporation, Washington, D.C., Mr. Prout is responsible for government affairs on water, air quality and pesticide issues, particularly concerning the Chesapeake Bay and Great Lakes. He has advised the Center on acid rain and air toxics programs and serves as a member of the Citizens Advisory Committee for the Chesapeake Bay.

President

Thomas J. Scott — Chief executive of the Center for Policy Negotiation. Mr. Scott founded the Center in 1974 as an outgrowth of an Energy and Environmental consensus project of the Massachusetts Audubon Society. Since 1975, he has devoted his full energies to developing the concept and practice of policy negotiation. Current applications include acid rain, toxic risk management, growth management, and long-term regional electric power planning He is a former chief executive of an energy company.

Clerk and General Counsel

Vance Koven — Corporate attorney, Dennison Corporation, Waltham, MA., Mr. Koven has been a director and counsel to the Center since 1975. A former partner in Gray and Wendell, he specializes in international business transactions, corporate, and environmental law.

Treasurer

Frank Benson — Director of Finance and Administration, the Center for Policy Negotiation, Through 35 years of business experience, inclucing the CEO position in two major corporations, Mr. Benson has gained a sound understanding of how to deal effectively with a wide variety of problems, including financial and strategic planning, organizational development, and trouble shooting.