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GEF
THE WORLD BANK
Washington, D.C. 20433
U.S.A.
mixed

DATE: January 14, 1990
TO: See Distribution
FROM: E. Patrick Coady, U.S. Executive Director
SUBJECT: Global Environment Facility (GEF)

Summary

Recent conversations with Bank staff, U.S. government officials and the NGOs have revealed that a letter to UNEP proposing individual organizational ideas and projects for the Scientific and Technical Advisory Panel of the GEF would be a good idea. I plan to inform UNEP now of our interest and follow it up later with another letter containing our recommendation. For this second letter, I need your assistance in identifying individuals and possibly proposals.

Background

Bank staff tell me there was a meeting the week of January 3rd in New York chaired by UNEP that discussed the structure and potential make-up of the Scientific and Technical Advisory Panel. The structure, and how it is to do its work, is still undefined but the Panel's make-up, roughly 7-9 people, as now envisaged would consist mostly of scientists specializing in each of the areas covered, e.g., bio-diversity and global warming. The Chairman is likely to be a "recognized spokesman" of the Third World and the Panel would be rounded out by some economists or similar types to help integrate scientific recommendations into policy.

Staff believe that our ideas and recommendation would be welcomed and sooner rather than later. In their view, we are likely to be more successful if we acted before the formal invitations to submit ideas, etc. was issued to the participants of the Paris meeting by the UNEP office in Nairobi, which could be any time now.

I also understand the NGOs had a meeting on January 7, to identify possible individuals for the Panel but there was some uncertainty whether they were looking for just a possible chairman or potential U.S. scientists for the Panel. In any case, they are working to develop this information for a meeting here on January 16th. Additionally, some thought is also being given to whether someone from AID should be recommended.

Next Steps

I would like each agency to provide me, as soon as possible, but certainly no later than January 23, 1991:

- the names of scientists and their interests relative to the Panel's responsibilities, e.g., global warming, biodiversity, etc., for nomination;
- ideas with respect to organization and administration of the Panel; and,
- ideas for research and/or projects and, if possible, some indication of their priority and why.

FYI

According to Bank staff, the amount of time and commitment required of the individuals selected would be on the order of a week every two or three months, although nothing definite has been established. An honorarium of some type, as yet undetermined, would be paid.

cc: Deputy Assistant Secretary Folsom, U.S. Treasury
Mr. Nelson Coar, U.S. Treasury
Mrs. Anna Quandt, U.S.A.I.D.
Ms. Molly O'Neal, State Department

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- 3 -

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Smithsonian Institution

The Honorable D. Allan Bromley
Assistant to the President for Science & Technology
The White House

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

JANUARY 23, 1991

MEMORANDUM FOR E. PATRICK COADY

FROM:

D. ALLAN BROMLEY

Alan Bromley

SUBJECT:

GLOBAL ENVIRONMENT FACILITY, SCIENCE AND
TECHNOLOGY PANEL

In response to your request to provide you with names of scientists and their interests, I have listed a few prominent scientists who would all be very good candidates for the panel. These recommendations should provide a balance of expertise on the panel.

Area of interest: BIODIVERSITY

Dr. Peter Raven - from Director of Missouri Botanical Garden
P.O. Box 299, St. Louis, MO 63116-0299 314-577-5100
member of National Science Board

Area of interest: BIODIVERSITY

Tom Lovejoy - Smithsonian, PCAST

Area of interest: AGRICULTURE

Gary Evans - USDA

Area of interest: WATER

Pete Eggleston - MIT, faculty
Chairing NAS Water and Hydrology Board.

Area of interest: BIODIVERSITY

Craig Black - Director of the Natural Science Museum of L.A.
former member of National Science Board
213-744-3301

Area of interest: ATMOSPHERIC SCIENCE

John Knauss - Administrator, NOAA, Dept. of Commerce

Thank you



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GLOBAL ENVIRONMENTAL FACILITY
IMPLEMENTATION COMMITTEE MEETING
JULY 18, 1991

U.S. Comments on the First Tranche

Global Technical Assistance Projects

1. Global - Emissions of Global Warming Gases from Rice Soils

Based on the brief description provided, the project appears to have merit. However, we would be interested in STAP's assessments of its testing/demonstration contribution, and whether it fits into or otherwise contributes to the overall world research effort. We are aware that similar projects are currently underway or being proposed by a number of countries, including the United States, Japan, and China, and wonder whether GEF funding is appropriate. We would also have liked some discussion of the associated project.

2. Global - Monitoring of Ozone and Greenhouse Gases

The extension of the existing monitoring network for ozone and greenhouse gases in developing countries is a worthwhile objective, as it will provide vital scientific information in areas of the world where environmental changes are rapidly taking place. The project would establish a commitment to monitoring, demonstrate the effectiveness of regional monitoring in concert with global monitoring, and build on an existing program by expanding into developing countries to complete a global climate change detection system. However, it is unclear to us whether this represents an innovation or an extension of existing monitoring efforts.

We wonder whether the GEF is the appropriate funding mechanism for this activity, or whether funding should more appropriately come from conventional sources, such as, for example, WMO member nations, UNEP, and the Intergovernmental Oceanographic Commission (IOC). If in fact the WMO is unable to fund this project, and funding from more conventional sources is unavailable a case could be made for GEF funding of this project. However, the project brief does not address itself to criteria regarding demonstration/innovation or the applicability of lessons learned to future Bank lending operations.

Until such time as better documentation and substantiation can be provided, we cannot support this project within the framework of the GEF's stated criteria.

African Region Investment Projects

1. Congo - Wildlands Protection and Management Project

We have no argument with the importance of the Congo for the conservation of global biodiversity. We recognize also the need for the GEF to contribute to the implementation of an effective conservation program in that country. Nevertheless, the present proposal is so utterly vague regarding the expenditure of the GEF contribution of \$10 million that we have serious concerns regarding this project. Where would the funds go? How would they be divided between tasks? What are, in fact, the specific tasks in detail? Who would provide oversight?

The Technical Opinion and Project Brief note the possible conflicts of interest and institutional weaknesses of the Forest Economy Ministry. As the Project Brief does not explain how this project will be structured to address these concerns, it is impossible to judge whether or not this project will achieve the goal of promoting conservation of biological diversity. Scarce GEF resources should preferentially go to countries that have demonstrated a commitment to environment.

While the project concept is good, similar IBRD projects in the past have been associated with large conventional forest "development" (timber extraction) projects. It would not be appropriate to use GEF funds, with the right hand, to salvage with a few reserves from timber harvesting funded by the left hand.

According to the Technical Opinion, panel members recommended that Wildlife Conservation International play an active part in implementing this loan, but this opinion is not discussed in the Project Brief. The isolation of Wildlife Conservation International and the separation the Wildlife Directorate from the Economic Forestry Directorate could be an error given the objective is to integrate economic and conservation policies. The interfacing of these agencies is essential to accomplishment of this objective. The Brief also does not show any information on sustainability or government commitment to future lending.

There are also questions about national policy commitment and project design in the technical review. Will determining the legal status of the gazetted areas and of the Noubale region be a condition of project implementation? Alternatively, what assurance is there that any assessment program will have results?

The project description should include more information on the relation to Bank forestry projects in the region. An outside reviewer's recommendation on a study of hunting, its scope and alternative sources of satisfying demand for meat/protein should be incorporated into the project.

This proposal needs significantly more complete documentation

before being seriously considered for funding. Further, it appears to be a typical proposal involving outsiders coming in and performing tasks that local entities do not have the capacity to perform. It leaves no clear impression that local institutions will be more capable of implementing conservation activities than they were before. This issue needs serious attention.

2. **Kenya - Preservation of the Tana River Primate National Reserve**

The country's sound environmental policy framework and adequate institutional capability bode well for the success of this project. The development of economic alternatives, such as crocodile farms, appears to be innovative and to have a positive demonstration effect. The involvement of local communities is also commendable. The project appears to be self sustainable, as this is seed money that will finance activities that should eventually become profitable. However, more information is needed about the underlying Bank project. Will the objectives and activities of this GEF pilot project eventually be folded into the underlying loan? A discussion of the downstream effects of this project on the coastal ecosystem would also be useful.

3. **Mauritius - Bagasse Energy Sub-Project**

It appears that the country has in place the proper policy framework and institutional capacity to permit a successful project. The project concept appears to be innovative, but we would like STAP's assessment of the underlying technology. We also would like a description of the associated loan, as well as an explanation for assertion in the rationale that reduced emissions will not be realized unless investment is subsidized.

4. **Uganda - Bwindi Forest Gorilla Reserve**

The project description does not provide enough information for even a preliminary assessment. It appears to be straight budgetary support, but there is no indication of what part of the government will carry this out. As described, the project lacks innovation/demonstration effects. In addition, it seems to be premature, as the Government of Uganda is in the process of working with bilateral donors to develop an Environmental Action Plan. We feel this project could be folded into the overall effort to develop an environmental framework. We would also be interested in knowing whether there was any consideration given to linking this project to the East Africa regional project below.

African Region Technical Assistance Projects

1. **East African Regional - Institutional Support to Protect**

East African Biodiversity

We are very pleased to see the proposed strengthening of regional training institutions as put forth in this proposal. Nevertheless, while this and other proposal objectives are laudatory, there are few specifics regarding project implementation and the budget is so sketchy as to be useless. This proposal needs significant fleshing out before being seriously considered for funding.

Effective conservation requires the involvement of individuals versed in more than conservation biology, it requires a multi-disciplinary approach. Thus the education and training programs envisioned in this project are too one-dimensional.

While our assessment is that this project would not be done without GEF funds, the project does not appear to meet innovation/demonstration criteria, and \$10 million seems to us to be a large amount for the objectives described. The question also remains, who will pick up the costs of the "effective conservation units" once they are established?

The project documentation lacks information contained in the technical opinion and in the criteria reference sheet. None of the five "major elements" are described in terms that permit comment. Evaluation should be postponed pending better project description.

2. West/Central African Regional - Protecting Wildlife in Western and Central Africa

We support the regional approach this project takes in enforcing an important international wildlife protection treaty. With respect to the location of the office, we are aware that Kinshasa can be a difficult place in which to operate, but recognize that the office should be placed where it can do the most good to stop smuggling of endangered species. We would like more information, however, about the financing of recurrent costs. We feel that, realistically, the level of funding might need to be increased to accomplish the stated objectives.

Asia Region Investment Projects

1. Bhutan - Trust Fund for Environment Conservation

On the basis of the documentation provided, we could provide preliminary support for what appears to be innovative project that will test a new formula for sustainable community involvement in conservation efforts. That a large NGO has invested a considerable sum of its own funds will help ensure continued international interest in the success of the project. The project as described seems to fit well with the institutional

capacity of the country, which has a demonstrated commitment to environment.

One area of potential concern is "national policy". Timber and hydropower export are identified as posing the "risk of downward environmental spiral" the project is intended to avoid, yet the trust fund will "support demonstration projects" in "sustainable forestry" and hydroelectricity. Additionally, the project documentation does not address the inevitable pressures that will be created by population growth. This must be taken into account from the beginning to avoid the very real likelihood that population pressures overwhelm the trust's ability deal with their environmental impact. More discussion of the criteria for supporting such demonstration projects is needed. The IBRD does not have such criteria and its record in either sector is not good; nor is it clear how any "lessons" learned from this "demonstration" will be integrated into Bank operations in these sectors.

The covenant to maintain forest cover does not clearly define forest cover, and would apparently permit the substitution of fuel wood plantations for natural forest. This should not be condoned. It is also unclear whether the assurance that 20% of the area remains as national parks or reserves means that timbering, mining, etc. cannot occur in the park or reserve.

In the section on "Success Criteria," we suggest that a criterion be added that addresses the development of improved training and education facilities within Bhutan. This point is recognized as a critical need in Appendix I of the trust fund prospectus and must be implemented if conservation in Bhutan is to be viable over the long term.

2. China - Coal-Bed Methane Pilot Project

The country policy framework and implementation capability are improving. The project is innovative and demonstrational, includes worker safety and economic benefits, and, given the country's potential contributions to growth in global greenhouse gas emissions, could have major long term benefits for the global environment. The project, if successful, could be replicated elsewhere.

The combination of the pilot project, the national assessment, and the EPA-funded training program and clearinghouse will create a framework that ensures success. The pilot project will demonstrate the feasibility of larger-scale coal-bed methane recovery to China and other countries; the national assessment will identify additional areas for development; and the training program will provide the Chinese with the technical capabilities to develop the resource.

This project is a high priority for China because the Chinese need additional clean-burning energy resources, particularly natural gas. Because this project will enable the Chinese to exploit a natural gas resource in their coal reserves, potentially reducing their use of coal, it will have important global environmental benefits in terms of both methane and carbon dioxide reduction.

When the full life-cycle costs of developing coal and coal-bed methane resources in China are compared -- including production, transportation, consumption, and environmental externalities -- coal-bed methane is clearly a more cost-effective resource. The full costs are not currently recognized in China however, and the Chinese continue to emphasize less cost-effective investments in new coal production, powerplants, etc. This project will serve to demonstrate the value of coal-bed methane to China and will encourage the Chinese to devote additional financial resources to its development.

China's institutional framework clearly supports this project and the future of coal-bed methane. In February 1991, the Chinese Ministry of Energy signed an agreement under the Environmental Protocol to cooperate with the USEPA in the area of reducing methane emissions from coal mining. In addition, China is considering a national policy to include coal-bed methane recovered during mining in each coal miner's coal quota. This GEF project will provide additional impetus to the Chinese to enact this and other policies to promote the use of coal-bed methane.

3. China - Ports Waste Disposal

The creation of ports waste disposal facilities is an important step in addressing the environmental health of the oceans. The technology for the creation of such facilities exists and port planning is routine in developed countries. The development of these facilities in China is in keeping with the goals of the London Dumping Convention and MARPOL.

In projects with relatively large GEF components, it is important that the Bank specify the rationale for the breakdown in costs between the GEF and the Bank. The nature of GEF funding should be one of additionality, it should not provide the majority of funds for associated projects. In this case, the GEF portion appears lopsided relative to the associated funding and to the stated objectives of the project.

The project focuses on reviewing and proposing changes to the institutional structure for sustained control and treatment of marine pollutants; what is the government commitment to such change? In addition, we have questions about ports waste projects, and would like STAP's comments on what framework would

be necessary to make these candidates for GEF funding. (We feel the responsibility for cleaning commercial activities should lie with commercial entities. However, we could see GEF funds used as pilot programs to get to the stage of commercial responsibility, by enforcing monitoring and the application of user charges.)

We would like further information on the criteria used for designating the ports for the project, and the potential of the waste disposal plants to respond to future growth. We also agree with the STAP that the international water criteria should be expanded to include river basins and regional seas.

Given the documentational weakness of the project brief and the disproportionate share of GEF funding, we cannot support this project in its present form.

4. Lao PDR - Wildlife and Protected Areas Management

This is one of the most important remaining areas of biodiversity. If there is government commitment to environment and the project design is sound, this could be a worthwhile activity. However, the project description does not explain what will actually be done and leaves the impression that it may be straight budgetary support. We also need more information about the underlying loan, which we note is a forest loan that is not subject to environmental assessment. In addition, the justification for GEF funding appears to be need for concessional resources, which we do not find to be an adequate basis for access to GEF resources.

5. Philippines - Conservation Management of Priority Protected Areas

This project involves an area of high biological priority. However, we have concerns about the country's absorptive capacity for additional funding, given that there is a trust fund (financed by a debt/nature swap) to support conservation in this area. There is also a sizeable World Bank loan and we wonder what the additional benefit will be from the GEF component. Furthermore, we understand that this project had originally been intended to be part of ordinary Bank lending.

6. Philippines - Promotion of Geothermal Energy Development

Based on the information presented, this project appears to have little or no demonstration effect. Geothermal energy is already widely used; if a unique technology is involved, more information is needed about the potential for replication elsewhere. Given that a Leyte geothermal project has already received commercial funding on a concessional basis, we question the appropriateness of this project for the GEF. We also wonder whether an

environmental impact assessment has been conducted on this project. Will this project have any impact on the protected areas project above?

Asia Region Technical Assistance Projects

1. China - Limiting Emissions of Greenhouse Gases

The project is consistent with the series of country-specific studies or assessments that have been or will be carried out on a number of environmental issues, including climate change, ozone depletion, biodiversity, and forestry. The project should help enlist the country's participation in a climate change convention. Considering the large number of economic sectors affected, the costs appear to be reasonable. However, a number of countries are undertaking cooperative studies of emissions of greenhouse gases in China. Given the high level of activity, we question whether the use of GEF funds for this work is needed or appropriate. The project proposal is vague on how the proposed GEF work would interact with the ongoing assessments. As a general rule, Project Briefs should describe parallel ongoing efforts and describe how they will be related to/coordinated with the proposed GEF project.

2. South Pacific - Regional Biodiversity Conservation Project

The U.S. is a contributing member to South Pacific Regional Environment Program (SPREP), and supports this regional project in support of SPREP. We welcome also the project's public education and training component and assistance to ex situ preservation efforts. This GEF project could be replicated in other areas with small island ecosystems. We note and applaud the fact that the project will address two GEF objectives, preservation of biodiversity and promoting environmental management of coastal ecosystems in regional sea areas.

The project concept -- establishment of conservation areas, institutional capacity and public awareness -- is good, and the project would appear to be cost-effective and likely to provide global benefits.

The project document lacks information contained in the technical opinion and in the criteria reference sheet provided for in the projects discussed above, especially information regarding national policy commitment. The commitment and role of national governments appears to be very limited -- almost non-existent -- and there seems to be relatively few agreed upon channels by which project results can feed into government policies on agriculture, fisheries, industry, and tourism. At a minimum, the respective governments should commit to participation by non-governmental organizations in the in-country working groups. There is no provision for undertaking analyses of social, economic and environmental consequences of establishing areas, and sharing this

publicly prior to their establishment. This is at odds with the need for public disclosure and involvement in the lending process.

Overall, this a good proposal. Support of the SPREP is the appropriate mechanism by which to address biodiversity conservation among numerous small South Pacific islands. One significant concern not addressed by the proposal is how the program will be sustained after the five year grant expires. Also, the training component could use bolstering. The document does not propose a permanent staff position in this area and only suggests a few workshops. Some more permanent training institutional development should be envisioned.

3. Vietnam - Protected Areas and Wildlife Conservation

This protect appears to have the potential to contribute to achieving GEF goals, but the Project Brief provides too little specific information to assess this adequately. In addition, we would like more information about the proposed environmental strategy and framework for action mentioned in the Project Brief. Information is also needed on the specific goals and time frames of the project, as well as on the country commitment and absorptive capacity.

EMENA Region Investment Projects

1. Algeria - El Kala National Park

The U.S. finds this project conceptually attractive, because of the different type of ecosystem being protected and the large number of non-governmental organizations that are involved. In addition, it is linked to the RAMSAR Convention and could be linked to the Mediterranean Regional SEA Program, and this is an area that has a significant regional effect because of its importance for species migration between Europe and Africa. However, we would like more information on the associated forest project, which is not currently subject to an environmental assessment, as well as cost comparisons with similar projects in other countries. RAMSAR personnel should be actively involved in this project, to ensure that its design and impact are consistent with that international convention.

2. North Africa - Regional Screwworm Control

This project appears to be unrelated to existing and emerging conventions in the four areas of GEF priority. The precedent of using biodiversity preservation funds for pest control is unfortunate.

A \$56 million, twelve-country effort is already underway in attacking this problem. It is unclear what additional program elements are appropriate for GEF funding. This type of activity

should be funded through other channels (e.g., through the FAO).

The project would appear to be cost-effective, of high priority, and likely to provide at least regional benefits. However, it is not at all clear that the project relates to biodiversity, as claimed. Large number of animals may be at risk, but there is no evidence that species are at risk.

Within the bounds of the criteria specified for GEF project qualification, we cannot support this project.

3. **Poland - Protecting Forest Biodiversity**

The U.S. finds several attractive aspects to this project. It provides some balance to the work program, by focussing on a non-tropical forest ecosystem. The two gene banks represent an innovative approach. However, the appearance of straight budgetary support for the Department of Forests calls into question the project's sustainability, and we see no connection with future activities. We wonder whether this might be a candidate for a trust fund approach, in order to achieve sustainability and longer term effects.

EMENA Region Technical Assistance Projects

1. **European Regional - Environmental Management in the Danube River Basin**

The memorandum establishing the GEF specifies that countries and territories with per capita GNP at or below \$4000 in 1989 will be eligible for GEF funds. We would need to see strong justification for GEF financing for this region before we could consider the project as eligible for GEF.

Latin America/Caribbean Region Investment Projects

1. **Brazil - Biodiversity Conservation Units**

Given its importance to the global environment and its growing commitment on conservation, Brazil is a logical candidate for GEF funding. This project may have demonstration value; on the other hand, it appears to represent direct budgetary support. We also wonder whether the funds will be additional to previous pledges. What provisions have been made for future funding of recurrent costs?

2. **Mexico - Biodiversity Conservation**

The appropriate policy framework, institutional capacity, and linkages to associated Bank funding make this project worthy of support. We commend the incorporation of financial sustainability criteria in the selection process. However, as in many other

cases in this first tranche, in order to reach an adequate assessment, we need more information about the specific actions to be taken under this project and about the associated Bank loan. This project also highlights the need for STAP to comment on the role of ecotourism in biodiversity protection. While ecotourism contributes to sustainability, it could place development pressures on remote areas.

Latin America/Caribbean Region Technical Assistance Projects

1. **Brazil - Regional Strategies for the Conservation and Sustainable Management of Natural Resources in the Amazon**

It is not clear from the project description if the project will take place in Brazil only, or in several Amazon countries. We would strongly favor the latter approach. It is also unclear what the specific activities and objectives will be. If the project aims to achieve regional agreement and cooperation among Amazon countries and to strengthen local capacity, it will be genuinely innovative and a global priority. However, given the array of existing and proposed centers for study in the Amazon Region, we would urge the implementing agencies to explore opportunities for cooperative approaches among existing centers. Any consideration of a regional center should focus on prospects for sustainable funding or recurrent costs.

2. **Colombia - Conservation of Biodiversity in the Choco Biogeographic Region**

The Choco region is a very important area for biodiversity funding, particularly if it leads to regional efforts. Additionally, the project represents an interesting coastal issue: the protection of terrestrial and marine biodiversity through an ecosystem approach and an integral assessment of biological resources.

We welcome IDB co-financing; the participation of regional development banks should be encouraged. However, we need to know what will determine whether PLAIDECOP will be associated with this project? What are the goals and implementing agencies for this project, and how will these be related to the GEF project? A further discussion of the institutional structure available in Colombia to support this project and the project's relationship with regional environmental institutions would be helpful.

The GEF element appears to be overly "top down" in its approach, although we note the reference to NGOs. We recommend that the project be designed to maximize local participation and NGO input, particularly in identifying areas to be protected.

The project documentation does not show clearly how education, research and ecological zoning will alleviate problems of

unsustainable agricultural practices and population pressures, and protect the forests from slash and burn cultivation.

Some aspects of the project appear to offer experimental and demonstrational benefits, notably those which seek to introduce new production/economic models keyed to the sustainable use of the region's natural resources.

The components of the project -- ecological zoning based on biodiversity inventories, identifying alternative technologies, institutional strengthening, training of national scientists creation of conservation areas, and community involvement -- are excellent in general. However, little information is provided about: (1) defining the problems, (2) specifying how the components respond to the problems, (3) relating these project components to other projects (of the MDBs, NGOs, etc) in the region.

In paragraph D of the project documentation, under Immediate Objective 1, two additional activities should be incorporated. Activity 4 should be the analysis of the social and economic consequence (including opportunity costs) of the planned zoning. Activity 5 should reflect the involvement of indigenous and local communities in the zoning. Similar modifications should be made to Immediate Objective 5. Additionally, we believe the personnel involved in "using and management of biodiversity resources" need to be trained in both ecological and economic sciences, this should be incorporated into Immediate Objective 3.

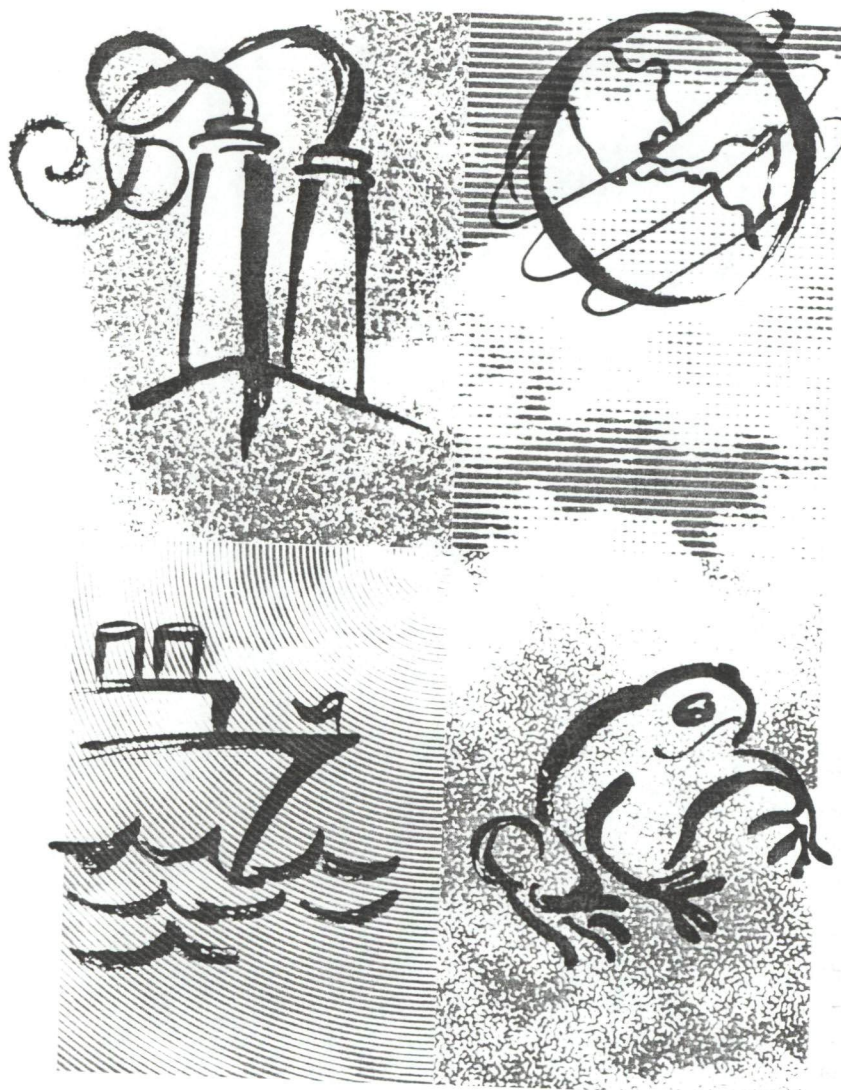
While this project touches on many elements necessary for an effective conservation program, the only component outlined in any detail is research. Each other component is addressed in but a single sentence. Also, the budget is far too vague. For example, \$1,140,000 is assigned for equipment with no breakdown as to specific needs. This proposal needs significant reworking before being considered for funding, it needs to be presented as much more than merely a broad-scale research project.

3. Guyana - Programme for Sustainable Tropical Forestry

While the country's demonstrated commitment to the environment and its efforts to increase institutional capacity merit support, the information provided in the Project Brief is not sufficient for an adequate assessment of the project. Several points need to be clarified. Is the proposed wilderness preserve adjacent to or located within already protected areas? If the latter, why does this warrant further protection? Will the project directly fund research in the preserves? Further details on what the preserve is to be used for would be helpful, as would STAP's assessment of the global benefits of this project.

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THE GLOBAL ENVIRONMENT FACILITY



SHARING RESPONSIBILITY FOR THE BIOSPHERE

DAVID REED
MULTILATERAL DEVELOPMENT BANK PROGRAM
WWF - INTERNATIONAL



THE GLOBAL ENVIRONMENT FACILITY

SHARING RESPONSIBILITY
FOR THE BIOSPHERE

David Reed
Multilateral Development Bank Program
WWF-International

EXECUTIVE SUMMARY

With the creation of the Global Environment Facility (GEF), the international community approaches a new threshold of collaboration in addressing the growing environmental problems that threaten the ecological balance of the planet. Participating governments have committed US\$ 1.4 billion for grants and concessional loans to finance projects in developing countries, generating global environmental benefits not possible under normal lending operations of the multilateral financial community.

Considered a three-year experimental operation, the GEF will be managed by the three sponsoring agencies: the World Bank, the United Nations Development Programme (UNDP), and the United Nations Environmental Programme (UNEP). Activities to be funded include projects involving protecting the ozone layer, limiting greenhouse gases, protecting biodiversity, and protecting international waterways.

The GEF will offer new possibilities of strengthening the involvement of nongovernmental organizations (NGOs) with multilateral development banks (MDBs), agencies of the United Nations system, and host governments of developing countries in identifying, implementing, and monitoring GEF-funded projects.

World Wide Fund for Nature (WWF) strongly endorses the stated objectives and new opportunities offered by the creation of the GEF. In this collaborative spirit, WWF has submitted a series of projects, endorsed by host governments, to be considered

by this financial facility. WWF will try to support implementation of other GEF activities in ways keeping with our institutional strengths and limitations.

WWF's support for the GEF is not, however, without qualification. WWF believes that the existing institutional and policy framework for addressing environmental issues within official lending and development agencies must be significantly improved to accomplish the objectives established by the GEF. To enhance the long-term contribution of the GEF, WWF offers three recommendations to donor governments and the three sponsoring agencies. Those recommendations include establishing a multifaceted evaluation function; ensuring public participation in GEF activities; and promoting respect for the principles of Primary Environmental Care.

In presenting this report, WWF hopes to explain its perception of the significant opportunities offered through the creation of the GEF and thereby encourage broad public participation in its activities. The first part of this report summarizes the social context in which this facility has evolved. The next two parts review the organizational and procedural arrangements of the GEF's operations, followed by a short review of the opportunities for NGO participation in GEF activities. The report concludes with WWF's assessment of the GEF and presentation of specific recommendations for strengthening protection of the planet's biosphere.

SOCIAL CONTEXT AND GENESIS OF THE GEF

In many ways, the GEF was created as a culmination of a decade-long search for ways to channel increased financial resources into programs designed to reverse the declining state of the global environment. By the same token, the GEF may be the precursor of new levels and forms of international cooperation required to protect the future organic carrying capacity of the planet.

As the 1980s witnessed a major shift in global geopolitical relations, so, too, did the decade mark a fundamental shift in public awareness of the severity of threats to the environment. That awareness gave rise to recognition that unprecedented levels of international cooperation were required to halt environmental decline. The growing public demand for governmental and international action accelerated the rigorous accumulation of pertinent scientific data on which a wide range of important international conventions and protocols were formulated and, in many cases, ratified by the international community. Notable among these conventions were the United Nations Law of the Sea, the Montreal Protocol on Substances that Deplete the Ozone Layer, and the Basel Convention to control transboundary movement of hazardous waste. Other conventions covered continents or regions of the world, such as Antarctica, Europe, or the Caribbean, or specific polluting activities, such as sulphur emissions and marine and atmospheric pollution.

While international consensus was slowly emerging over the course of action to be pursued, agreement over who was to fund new environmental programs and how to administer these funds proved more difficult to reach. Responses of industrialized and

developing country governments to this new demand for financial resources ranged from enthusiasm and innovation to reluctance and denial, from efforts to reformulate policies and funding mechanisms to defense of prevailing analytical and development approaches.

Many innovative responses evolved as developing country governments and bilateral aid agencies sponsored experimental programs to promote a new partnership between different levels of government and community groups. Preparation of national environmental strategies became both the priority and, later, a requisite for additional environmental bilateral assistance. Resistance to the shifting order of financial priorities was expressed by claims of external interference, of violation of national sovereignty, or simply of lack of scientific evidence to justify a new course of action.

While bilateral assistance has become one of the principal mechanisms for facilitating the transfer of financial resources from industrialized to developing countries, public and private sectors explored many other mechanisms for facilitating this resource transfer. The establishment of UNEP in 1980 opened a new funding channel to build environmental institutions and strengthen environmental programs with member governments. The World Resources Institute 1989 report, *Natural Endowments: Financing Resource Conservation for Development*, broadened the parameters of public debate on innovative financial mechanisms. International environmental organizations, including WWF, further expanded the menu of mechanisms for financing environmental programs through innovative approaches, including

debt-for-nature conversions. Other nontraditional funding proposals included levies on traded goods, a tax on carbon emissions, and a private-sector project facility.

By the late 1980s, multilateral lending institutions had changed from being cautious, if not resistant, to seeking a more central role in the search for new sources and forms of international environmental funding. Following protracted initial discussions, the French and German governments presented a proposal outlining the general contours of the Global Environment Facility during the September, 1989, meeting of the World Bank's Development Committee, providing a major impetus to MDB involvement. Commitment of funds by those two governments gave their proposal a sense of immediacy and feasibility. Staff of the three sponsoring agencies—the World Bank, UNDP, and UNEP—submitted, in the ensuing 18 months, operational and policy guidelines of increasingly greater detail for further review by donor governments.

During that 18-month gestation period, a series of questions were posed by many nations, including major donor countries, on points such as the following:

- Would the new funding facility influence the ongoing investment activities of the World Bank and other international agencies so they would reorder the priority given to environmental concerns? Or would GEF resources be used to graft environmentally sensitive activities onto ecologically unsound development projects without stimulating a reassessment of MDB investment priorities?
- Would the proposed facility be viewed as experimental in character, with a real commitment to increasing the international community's knowledge about how to address deepening environmental problems? Or would the GEF facility become an institutional asset whose significance would be measured primarily by the volume of funds moved?
- Would funding for the facility come from additional, that is, new, resources, and would those resources be made available on highly concessional terms? Or would donor nations simply reprogram already allocated development assistance into environmental activities?

By the November, 1990, meeting of donor governments, held in Paris and convened by the World Bank, a basic agreement had been reached on the objectives, organizational structures, and financial arrangements for the three-year experimental facility. A consensus was also reached that: the facility was experimental in character; additional funding would be used as the primary source of funds but parallel financing arrangements would be accepted; and the facility would promote an ongoing reassessment of present lending operations. These and other concerns still are, however, very live issues in GEF operations and will remain critical points of evaluation when the GEF nears the end of its mandate in 1995.

A Qualitative Step Forward

When viewed in the context of the decade-long effort to increase and consolidate transfers from North to South for global environmental problems, this three-year funding experiment represents a significant step forward for several reasons:

- implementation of the GEF's mandate will require a new level of coordination among publicly-funded multilateral banks, development agencies of the United Nations system, and developing country governments;
- the GEF program has an indicative allocation of \$1.4 billion in new funds; those resources will be made available through grants or concessional loans to developing countries to undertake environmental activities that will generate global environmental benefits;
- the world's foremost experts in the areas of biodiversity, atmospheric pollution, degradation of international waterways, energy efficiency, and environmental economics must be brought together, in an ongoing operational effort, to implement GEF's mandate; and
- international organizations, recipient governments, and NGOs in both developing and industrialized societies must expand and deepen their collaboration to fulfill the objectives of the GEF.

ORGANIZATION ARRANGEMENTS

The Global Environment Facility

Given the complex and accelerated evolution of the GEF during the past two years, it is important to clarify the exact character of the new funding mechanism that has been created. The Global Environment Facility is actually an umbrella administrative mechanism for a wide range of environmental financing operations to be housed at the World Bank. Its purpose is to administer funds committed by the international community for environmental purposes. The World Bank will administer the facility under a managerial arrangement that includes the UNDP and UNEP.

At present, two distinct funding operations are located under the administrative umbrella of the Global Environment Facility. The first of these is the Ozone Layer Protection Trust Fund (OTF), established by the signatories of the Montreal Protocol on Substances that Deplete the Ozone Layer. This approximately \$160 million Interim Multilateral Fund is to be used exclusively for purposes delineated under the terms of that international treaty. An executive committee, composed of 14 of the total 54 parties to the protocol, will determine how its financial resources will be used. (It should be remembered that shared political control of the executive committee, and hence the fund, between industrial and developing countries was, and remains one of, the sensitive issues that will determine the effectiveness of the protocol.)

The second multilateral environmental trust fund that will be administered by the facility is the Global Environment Trust Fund or the GET. The GET will be the funding mechanism for

activities in three areas: limiting greenhouse gas emissions, protecting biodiversity, and protecting international waterways. Under special circumstances, resources from the GET could be used to finance activities complementary to the Montreal Protocol.

It is important to clarify this administrative arrangement because, as subsequent environmental conventions are signed by the international community, other trust funds will be established to implement their respective mandates. For example, if a Biodiversity Convention is reached in coming years, it, too, will need to establish a financial administrative mechanism, perhaps to be called the Biodiversity Trust Fund, to carry out its specific mandate. This new trust fund would be housed, in all probability, under the administrative umbrella of the Global Environment Facility. If a Biodiversity Convention is signed, the biodiversity funding activities included at the present time under the GET would likely be moved directly under the control of the trust fund corresponding to that new convention.

Final approval for use of the resources of these different funds depends on the governance mechanism established by the conventions for each of the funds. Program commitments from the OTF must follow approval procedures set forth in the Montreal Protocol; resources disbursed by the GET will be approved in accordance with the agreements among the three sponsoring agencies as endorsed by donor governments.

Major governmental donors foresee using the Global Environment Facility to house the administrative operations of future environmental conventions. Choosing the World Bank as the

institutional home of these funds is logical and necessary for several reasons. On one hand, donor governments do not want to create a separate administrative mechanism for each new environmental convention. Such an approach would, in all probability, create confusing, if not competing, administrative operations. On the other hand, the World Bank has a proven history of administering international funds. With the World Bank's recent commitment to environmental issues, no other multi-lateral institution, tangentially or directly involved in environmental protection, can offer a similar administrative capacity.

GEF's Tripartite Management Arrangement

From its conception, the GEF was viewed as a funding mechanism to be directed by the implementation committee, made up of representatives of the World Bank, the UNDP, and UNEP. This management arrangement was intended to draw on the relative strengths of the three organizations and provide the necessary combination of technical, policy, and administrative responses. As work plans and priorities are established in coming months for project preparation activities, institution building, scientific and technical contributions, and direct investment activities, the GEF implementation committee will distribute resources to the three agencies in accordance with their respective organizational capabilities.

The division of responsibilities among the three organizations is summarized below:

- UNEP will be responsible for ensuring the concordance between GEF funding activities and global environmental policy, particularly as expressed through global environmental

conventions. It will provide support for institution-building and training activities and will foster needs assessments by developing countries in areas suitable for GEF funding. UNEP will establish and guide the Scientific and Technical Advisory Panel (STAP) of eminent environmental experts, which will provide policy and technical advice to GEF management.

- UNDP will help coordinate preinvestment studies for investment projects, provide technical assistance to developing countries, and promote integration of environmental action plans into recipient countries' development strategies. A major function of UNDP will be to review projects on a country level and ensure coordination with recipient governments.
- The World Bank will administer the GEF. It will oversee day-to-day development of projects as they move through the prescribed project cycle and will convene meetings with the two other agencies and with donor governments.

Day-to-Day Operations

The operations of the GEF will be housed in the Policy, Research, and External Affairs complex of the World Bank, which also houses the Environmental Department. The GEF will have direct and ongoing relations with the Bank's operational complex in that all projects, as described below, will be developed under the aegis of regional environmental chiefs in the operational side of the Bank. To minimize operational costs, Bank management will try to limit the number of staff assigned exclusively to GEF operations; skills of present Bank staff will be drawn on as much as possible to support the GEF's operations.

GLOBAL ENVIRONMENT FACILITY

Managed by the World Bank, UNDP, UNEP

<i>Potential Trust Funds</i>		<i>Existing Trust Funds</i>	
<u>Other Trust Funds</u>	<u>Biodiversity Trust Fund (BTF)</u>	<u>Global Environment Trust Fund (GET)</u>	<u>Ozone Layer Protection Trust Fund (OTF)</u>
	• Governance mechanisms would be established by a biodiversity convention.	• Control and approval of GET resources for investment projects reside with World Bank management; approval of resources to be used for other activities is delegated to the appropriate cosponsoring agency, i.e., World Bank, UNDP, UNEP.	• Established to administer activities of the Montreal Protocol on Substances that Deplete the Ozone Layer. A 14-member executive committee established by the Protocol approves and controls use of resources in this trust fund.
	▪ Program activities to protect biodiversity would be moved from the GET to the BTF.	▪ Established to finance projects with global environmental benefits in areas of: □ limiting greenhouse gasses □ protecting international waterways □ protecting biodiversity.	▪ Program activities are limited to protecting the ozone layer.

INVESTMENT PROGRAM

Investment Projects

The GEF will fund projects with global environmental benefits that fall into three investment categories:

- *Type 1:* Projects in this category meet the World Bank's standard criteria of financial viability and, hence, would not normally qualify for GEF concessional funding. If, for special reasons, the project would not be implemented unless concessional lending were available, the resources of the GEF could be mobilized to guarantee project implementation. An example might be funding for an experimental energy-efficient technology in a Bank energy project. Without concessional lending new and potentially beneficial technologies might not be used and, consequently, global environmental benefits would not be achieved.
- *Type 2:* Projects in this category would not generate adequate, short-term financial benefits to justify investment by the implementing government. By obtaining concessional lending, the host government could justify its own investment while guaranteeing international environmental benefits. An example would be funding for forestry protection programs, which would provide biodiversity benefits but inadequate commercial return unless concessional funding were provided;
- *Type 3:* Projects in this category could, without GEF funding, guarantee a sound financial return on invested funds. However, by providing concessional funding for part of the project, additional global environmental benefits could be realized. An example would be a Bank energy project that would realize

additional energy efficiencies and environmental benefits if more sophisticated, though more expensive, technologies were employed in the project.

It is anticipated that the overwhelming percentage of GEF projects will be in categories 2 and 3.

These three investment categories embody a series of financial assumptions that have been spelled out in various GEF documents. For clarity, those assumed conditions are listed below:

- funding for the project will be forthcoming only if it has been demonstrated that financial resources could not be obtained from other sources, including bilateral aid agencies and internal sources;
- projects eligible for GEF funding would have to demonstrate they were not economically viable by normal lending criteria and thus would require grant or concessional lending to achieve viability; and
- when possible, GEF funding should be used to leverage additional investments from other donors or lenders.

Areas of Investment

Four priority areas of investment have been identified for this experimental phase of the GEF:

- *Area 1—Protecting the ozone layer:* The primary focus will be to help recipient countries develop and use substitutes for chloroflourocarbons (CFCs) that deplete stratospheric ozone. Projects in this area will be financed under the Montreal Protocol on Substances that Deplete the Ozone Layer.

- *Area 2—Limiting emissions of greenhouse gases:* The purpose of funding in this area will be to promote adoption of cleaner, more energy-efficient technologies in the agriculture and energy sector. Retrofitting and developing new technologies in mining, power, and industry sectors will be financed, as will improving forest management and reforestation.
- *Area 3—Protecting biodiversity:* Primary attention will be given to helping preserve areas of rich biodiversity in developing countries. Projects can include developing and strengthening management programs for critical biodiversity areas and rerouting infrastructure projects that threaten reserves or protected areas.
- *Area 4—Protecting international waterways:* Investments in this area will try to reduce industrial and waste-water pollution affecting water resources, increase the capacity of maritime nations to respond to toxic pollution, and receive and process discharges on international waterways.

As initially defined, the scope of each of these four areas is very broad, if not confusing. One of the immediate tasks of the GEF staff and policy-makers will be to narrow and define the scope of each of these four categories.

Selection Criteria

To be eligible for GEF funding, developing countries and territories must have a UNDP program and must have a per capita gross national product at or below \$4,000 in 1989. In addition, donors established additional project selection criteria:

- investments must be consonant with existing environmental conventions;
- investments must be consistent with a country's or group of countries' broader environmental strategies;
- GEF activities must demonstrate that global or transboundary environmental benefits would be derived from the investment activity made in a participating country; and
- projects must use technologies appropriate for the country context, financial constraints, and desired environmental benefits.

The Project Cycle

Projects submitted to the GEF can be of two kinds: first, new, stand-alone projects with no direct relation to a World Bank project under development, which could receive up to \$10 million of GEF funding per project; and second, add-on projects that will be grafted onto projects already in the World Bank pipeline. While it is expected that add-on projects will predominate in the GEF portfolio, both types of projects will follow a basic project cycle:

1. *Project identification:* At this early stage of GEF operational activity, projects are being solicited from many different quarters. For instance, Bank staff working on a country operational level have a number of projects that, given the availability of concessional funding through the GEF, could be included in Bank projects already under development. Likewise, bilateral aid agencies have an inventory of projects in varying stages of

development that can be presented for GEF consideration. Other important sources of project proposals are government agencies in developing countries and NGOs. WWF, for example, has submitted a number of project proposals to GEF staff for consideration in the initial project docket.

As GEF operations become routinized in the coming months, a more systematic process of project development can be anticipated. It is expected that World Bank staff will conduct more thorough reviews of country environmental strategies and identify projects once considered economically nonviable but could now be considered for GEF financing.

2. *Project submission:* Investment projects will be submitted to the GEF for formal consideration through two basic channels. The first will be new projects developed by recipient governments, by bilateral aid agencies with host government endorsement, or by NGOs with host government endorsement. The second channel will be project components arising from, and to be included in, World Bank or other multilateral development bank programs.

Prior to any formal review or appraisal of a project submitted by NGOs, the UNDP, through its corresponding resident representative, will verify that the project has obtained support of the host government.

3. *Project selection:* Once submitted to the GEF, each project will have to demonstrate that it meets the selection criteria listed above.

The actual process for reviewing and selecting the projects has been clarified by GEF staff and will proceed along the following steps:

i. Upon receipt, a promising project will first be assigned to the World Bank Regional Environmental Division Chief in the region corresponding to the country's geographical area (Latin America, Africa, Asia, EMENA). Once assigned to the proper region, the project will be routed to the country desk officer or task manager of a relevant project being developed by the Bank.

ii. At this point, the appropriate World Bank staff will write a three- to five-page Initial Executive Project Summary to assess the project's compliance with all pertinent criteria, whether its intended benefits justify an investment from GEF resources, and whether the panel believes it should be given further review.

iii. If the initial assessment recommends further action, the project will then be reviewed by a technical panel composed of experts from within the Bank and outside consultants. A list of potential consultants will be maintained by each regional environmental office. This technical panel will then issue a more thorough technical report, the Final Executive Project Summary. At this point, the project will be appraised by the World Bank with input from UNDP and UNEP.

4. *Project Appraisal:* Project appraisal involves a formal view of the technical, organizational, and financial dimensions of the project in accordance with the methodologies established by the respective sponsoring GEF organizations. This differs from the appraisal of a normal World Bank project in that cost-effectiveness

will take into account the environmental benefits of the project rather than the financial returns.

5. *Project Approval*: Following appraisal, the project can follow two courses of action. If an add-on project, it will be integrated into an existing World Bank project as a concessional loan or grant component to an otherwise economically viable project. This larger project is then appraised as any Bank project must be to guarantee its technical, financial, and institutional viability. Once appraised, the entire project is then submitted to the World Bank's Executive Board, which will approve the Bank project and review the GEF component. The GEF component will then be submitted to Bank's management for final approval.

If the project is a stand-alone activity, it must similarly be submitted to, and obtain final approval from, Bank management.

6. *Project Implementation*: At this stage, formal project activities can begin. The specific actions and responsibilities of governments and other participating organizations will be spelled out in the contractual agreement established in accordance with standard World Bank procedures.

7. *Project Monitoring and Feedback*: Given the often experimental character of the activities funded by GEF resources, implementing agencies will conduct regular monitoring functions and report findings to the respective agencies and the STAP.

GEF PROJECT CYCLE FOR INVESTMENT PROJECTS

1.

IDENTIFICATION

Possible GEF activities are identified by governments, bilateral aid agencies, NGOs, local communities.

2.

SUBMISSION

Formal submission takes place through two channels:

- New projects are proposed by recipient governments, bilateral aid agencies, or by NGOs with host government endorsement; and
- Project components arise from ongoing World Bank and MDB activities.

3.

SELECTION

- Project is assigned to appropriate World Bank Regional Environmental Division Chief;
- Initial Executive Project Summary (IEPS) is prepared by Bank staff;
- Final Executive Project Summary (FEPS) is prepared by Bank staff.

4.

APPRAISAL

Formal review of the project's technical, organizational, and financial aspects are carried out in accordance with World Bank procedures.

7.

MONITORING & FEEDBACK

Implementing agencies conduct monitoring functions and report findings to GEF participant governments at semi-annual meetings and to STAP.

6.

IMPLEMENTATION

Formal project activities begin. Actions and responsibilities of governments and participating organizations are delineated in a contractual agreement issued by the World Bank.

5.

APPROVAL

If an "add-on" GEF activity, the World Bank project to which it is attached is approved by the Bank's Executive Board; the GEF activity is then approved by Bank management.

If a "stand-alone" project, final approval is given by World Bank management.

OPPORTUNITIES FOR NGO PARTICIPATION

The overwhelming majority of GEF resources will be channeled into investment projects to be implemented by developing country governments. There are, however, no *a priori* constraints on NGO participation. NGOs can, in principle, participate in identifying projects, conducting required scientific studies, implementing and managing projects, and evaluating project results. GEF staff recognize that participation of NGOs, particularly local groups, may be vital to the successful use of GEF resources.

One important consideration that NGOs should bear in mind is that all projects must have the official endorsement of host governments before any action can be taken through the GEF.

The GEF is under pressure from donors to demonstrate its operational viability by investing approximately \$1.4 billion during a three-year period. Of that \$1.4 billion, \$160 million is earmarked for OTF operations. The United States and Japan have each committed \$100 million and the Swiss government \$10 million for cofinancing operations. Consequently, slightly more than \$1 billion must be spent from GEF resources within the established three-year period. GEF anticipates that \$300–400 million will be appropriated during its first year, about \$600–700 million the second, and the balance in its final year of activity. Not untypical of World Bank operations, an institutional premium will be placed on moving considerable sums of money in a relatively short time.

The implications of this institutional situation for NGOs are multiple. First, the GEF will likely give priority to larger projects as opposed to small projects, to which NGOs are more accustomed.

Second, GEF funds will likely be used for projects that can produce demonstrable results in a short or medium time span as opposed to activities covering a decade or more. Third, to guarantee cost-effective use of its time and resources, the GEF is likely to establish an intermediary management system to handle smaller projects involving NGOs. This “small grants window” may be the mechanism through which most NGOs participate in GEF-funded activities.

Further, as the GEF’s project inventory builds, it is certain that additional refinements in the lending portfolio will be identified. A number of such limitations can be pointed out even at this early date. For instance, land purchases, an activity historically avoided by the Bank, will pose considerable challenges in developing a clear, consistent policy. A clear preference has been expressed for short-term, fast dispersing environmental trust funds as opposed to long-term endowments. In light of opposition by some governmental donors, debt-for-nature conversions will not be accorded priority in the GEF investment portfolio.

Despite some of these constraints, WWF believes the GEF is an important opportunity for NGOs to engage the World Bank and other international institutions in a creative partnership to address environmental problems of global character. NGO involvement in these activities will require growth and change of the NGOs as well as of the international organizations. NGOs will necessarily have to work with and find common interests with their respective governments in identifying, presenting, and implementing viable projects. In many cases, NGOs will have to demonstrate, if not expand, their technical expertise

and managerial capabilities if they are to become viable project partners.

In such a partnership, multilateral institutions will have to be far more attentive to the needs and aspirations of local communities if they want to ensure successful implementation of

many projects. The official lending community will to revise its long-held standards and criteria used to "development" to integrate a more comprehensive acknowledgment of the role of the environment in the development if their schemes are to be successful.

WWF'S RECOMMENDATIONS

WWF strongly endorses the enhanced level of international cooperation to be fostered through the GEF. Our support is reflected in the initiative taken by WWF-International and the WWF National Organizations in presenting a number of project proposals to the GEF, participating in discussions with GEF staff on policy and operational issues, and exploring possibilities of participating in management of GEF-funded activities.

WWF's overall endorsement and commitment to the GEF should not hide the fact that we have a number of concerns about its ability to address problems of global environmental deterioration—concerns regarding, in particular, the institutional and policy framework within which the GEF will operate.

We introduce WWF's recommendations with a brief review of those institutional and policy issues.

The magnitude of the global environmental crisis is a direct reflection of the problems and limitations of the industrialization model pursued by northern industrial societies and embraced by many developing countries. The environmental shortcomings of industrialization in northern societies have, in fact, been largely responsible for creating the urgency in addressing environmental problems in the developing world today. Further, the environmental problems now besetting the developing world have been aggravated by the failure of international financial institutions to integrate adequate environmental protection into their projects and policies.

Underlying the approach of these financial institutions is the premise that economics and economic development in which income-generating activities are being created can operate

independently from the environment. That implicit, yet pervasive, notion is reflected, for example, in the rates of extraction and conversion of raw materials often considered to be either inexhaustible or substitutable, and, on the other end of the production cycle, in the pervasive disregard for the by-products of such activities. It is frequently assumed that the discharge of by-products from industrial, extractive, or agricultural activities into the environment will not jeopardize the viability of the economic activity itself or the physical surroundings where production is taking place.

WWF's fundamental concern is that the GEF should ultimately help change the role accorded environmental considerations in the lending operations of the World Bank, and by extension, to other international development institutions. In this regard, WWF is encouraged by the position enunciated by E. Patrick Coady, United States' Executive Director to the World Bank, on the occasion of the donors' meeting held in Paris in November, 1990:

"A major purpose [of the GEF] would be to incorporate global environmental concerns into the Bank's regular and ongoing work. . . . Such a facility, with its clearly defined mandate and definite life span, would not constitute a separate window for global environmental purposes. We believe that the primary funding for all environmental purposes must come from the regular windows of the Bank. This is needed to assure that environmental considerations are integrated into the other activities of the Bank."

From WWF's point of view, the objective of incorporating

environmental concerns more fully into the Bank's lending operations poses two fundamental challenges to its development approach. First, a major shift must take place in the MDBs' lending portfolio to diminish the importance of expanding extractive and industrial enterprises and increase, in relative and absolute terms, the funding given to rebuilding natural capital, the natural resource base on which sustained economic development depends. Many natural resources are depletable and are, in fact, being depleted at ever faster rates. Many depletable resources have no substitutes to replace them once existing stocks are exhausted. Unless the investments of the World Bank and other development agencies strike a better balance between development of man-made capital and natural capital, they will continue to compromise the long-term economic opportunities of many countries while further aggravating the global environmental crisis.

Second, WWF believes a far more rigorous effort must be undertaken to account and pay for the environmental costs of development projects. Most MDB investments do not internalize their environmental costs, nor have MDBs adequately encouraged developing countries to establish macroeconomic and sectoral policies to pay for those costs. Either those costs have been deferred to future generations or they are passed on to society as a whole or differentially distributed to sectors, quite often to the most vulnerable sectors, of a given society. Changing this pattern is, admittedly, a daunting task. Nonetheless, WWF believes the GEF can make an important contribution in this regard.

The GEF performs one basic function: it provides resources to finance environmental protection activities that will generate environmental benefits above and beyond those accruing to the host nation. The support provided by the GEF is designed to distribute the costs of obtaining those global environmental benefits to members of the world community who can most afford to pay and who will actually derive the most benefit. Without concessional external financial support, most of these environmentally beneficial activities would not be economically viable.

WWF believes that this North-to-South transfer of resources to pay for reduction of future global environmental damage is vitally needed. Previous economic development activities have enjoyed a sustained public subsidy in that they have not been compelled to pay for their environmental costs. The costs of maintaining the biosphere infrastructure of our planet have simply been ignored to the point that environmental deterioration threatens the viability of many economic activities as well as life on the planet itself.

Viewed in this perspective, the creation of the GEF is a long-overdue recognition of the fact that the global community must assume responsibility for these planetary maintenance costs. It further acknowledges that the industrial societies, which have been the primary contributors to global environmental deterioration and the primary beneficiaries of the public subsidies, must assume the principal burden of paying for those maintenance operations.

WWF believes that transfers such as those made under the GEF will be required until such time that several significant

changes take place, including: developing countries have cost-effective technologies that will not exacerbate environmental deterioration; major advances are made in valuing environmental assets and internalizing environmental costs; and qualitative steps have been taken to restore the global "biosphere infrastructure." In this regard, it is important to point out that the GEF addresses only the environmental impact of future development activities; it does not compensate for or rectify the environmental damage done through prior economic activities. And unless funding for global restoration and repair projects is made available, industrialized societies will continue to be the primary beneficiaries of decades of past subsidies.

In offering the following recommendations, WWF hopes to strengthen the contribution of this innovative funding operation in preventing further environmental decline. WWF also hopes these recommendations will contribute to the GEF's efforts to make such financial transfer less urgent in coming years.

1. EVALUATING THE EFFECTIVENESS OF THE NORTH-TO-SOUTH FINANCIAL TRANSFERS SHOULD BE ONE OF THE PRIMARY OBJECTIVES OF THE GEF.

WWF proposes that the GEF establish an evaluation function that covers three distinct, yet interrelated, areas:

Cost Effectiveness of the Projects

The first purpose of the evaluation function should be to determine what additional environmental benefits have been derived from the GEF resources. Has this additional funding reduced the contaminating by-products of development projects? What have been the real costs of those environmental benefits? To what degree would the inclusion of the mitigating or protective activity have threatened the overall economic viability of the project if concessional funding had not been available? Are there more efficient ways of generating the same environmental benefits? It is important to assess the impact of specific expenditures in generating per-unit environmental benefits. This data can benefit future investment strategies by providing more accurate calculations for internalizing the environmental costs in the four targeted areas. This evaluation activity can also contribute to global understanding of what technologies can achieve the most significant environmental benefits at least cost.

Incentives for Environmental Protection

The use of GEF incentives for alleviating global environmental problems will be ineffectual if the incentive structure under which governments act is not altered as well. The GEF provides external incentives to developing country governments to generate environmental benefits that will accrue to the international community while also benefiting the recipient country. These external incentives are often required because recipient governments have policies and incentive structures that make it far

more attractive to destroy, rather than protect, the environment.

The evaluation activity of the GEF should analyze whether its own "environmentally friendly" incentives conflict with environmentally damaging incentives currently in place in recipient countries. And, if so, the GEF evaluation should identify what policy changes need to be effectuated in recipient countries to complement, rather than detract from, the purposes of the GEF.

Although the primary focus of GEF operations is the global environment, the evaluation function should also determine what environmental benefits have accrued to the recipient country as a result of the external funding. The impact of environmental incentives on the country's natural resource base and the national economy must be documented to strengthen the case for eliminating market distortions based on destructive environmental practices. Such documentation can increase recognition of the value of natural assets to national economies and help policy-makers factor costs of environmental protection into national development strategies.

Sustainable Resource Use

The third evaluation activity is to assess whether GEF funding has helped place development projects and, by extension, national economies on a sustainable resource-use basis. Have GEF funds helped set new sustainable resource-use criteria within MDB development projects to which GEF financing is being attached? Have sustainable resource-use criteria been extended into sectoral and macroeconomic development goals of the MDBs or the recipient government? Have they been extended to MDB projects in general?

This evaluation activity should have particular relevance to the World Bank in determining whether the GEF experience is influencing the design of its productive, extractive, or infrastructure activities. To be consistent with the position articulated by Mr. Coady, the evaluation function must have a direct intersection with development operations and assumptions of the Bank's normal lending. Otherwise, the GEF risks becoming an environmental palliative that allows the World Bank to continue to apply its present methods of economic analysis and to pursue its development strategies without modification.

Guaranteeing the Caliber of the Evaluation Function

A comprehensive evaluation mechanism must be set in place from the outset of GEF operations. While the GEF has recognized the importance of evaluation, the three areas listed above significantly broaden the evaluation function envisioned by the GEF at the present time. WWF is firmly committed to the proposition that a comprehensive, penetrating evaluation approach can render the GEF a historically relevant funding mechanism. However, only by rigorously examining these three dimensions of environmental funding can the GEF experience help policy-makers address some of the critical issues of the 1990s and strengthen the importance given to the environment in future development strategies. WWF believes a comprehensive review of GEF's accomplishments in furthering international knowledge in these three areas should be one of the principal criteria for evaluating

the facility's performance at the end of its three-year mandate.

Overall responsibility for this monitoring and evaluation function might best be placed under the purview of the Scientific and Technical Advisory Panel. Participation of bilateral aid agencies and nongovernmental organizations will help guarantee an objective assessment of GEF's performance.

2.

ALL INFORMATION RELATING TO THE GEF, FROM INITIAL PROPOSALS TO MONITORING AND EVALUATION REPORTS, SHOULD BE MADE AVAILABLE TO THE CONCERNED PUBLIC IN A TIMELY MANNER.

To carry out its evaluation function and to create optimal conditions for informed public participation, all information relating to the environment, be it on a local, national, or global level, must be placed before the concerned public in a timely manner without constraint or modification.

During its 45-year existence, the World Bank and other MDBs have invoked "client privilege," that is, a confidential relationship between the Bank and borrowing country government, to avoid disclosing information to the broader public. Client privilege was adamantly supported by Bank shareholders when investment activities within a nation's borders seemed to have no transborder or global consequences. The fallacy and folly of that posture contributed to the promotion of development projects that have seriously damaged the environment. The very creation of the GEF mechanism bears proof that private and public development activities have had a devastating impact on the local, regional, and global environment.

The choices before the World Bank and its companion institutions regarding disclosure of information are quite clear. Either the World Bank continues to invoke its claim of client privilege with recipient governments and thus prevents divulging information that could affect the lives of millions of people, or the Bank accepts the growing demands of communities that want to regain control of their environmental patrimony and makes available information that will contribute to that public aspiration. The first option would further erode the public credibility of the institution and continue to degrade the planet's environment. But, by choosing the latter option, the Bank would make a bold move by not only correcting one of its major shortcomings but by setting new standards in the MDB community for addressing the global environmental crisis.

WWF is keenly aware of the challenges and difficulties that broadening public participation poses to the operations of the MDBs. Nonetheless, the GEF offers a unique opportunity for the World Bank to move beyond this antiquated operational premise by declaring the GEF a testing ground for expanding public access to information and by strengthening participation of local groups in its project planning and implementation. WWF is committed to working with the GEF to explore ways of using this three-year experiment as a viable living laboratory and to develop a rigorous evaluation of the GEF experience so

that it can be a spring board for broadening public involvement in Bank operations thereafter.

Until such a clear commitment is made by the Bank, WWF recommends that all governments, aid agencies, NGOs, and individuals participate in GEF financial operations with the stipulation that they will not be bound by any confidentiality clause or commitments that might impede timely public access to pertinent information.

3.

ANY GEF ACTIVITY INVOLVING LOCAL POPULATIONS SHOULD RESPECT THE CRITERIA ENUNCIATED IN PRIMARY ENVIRONMENTAL CARE (PEC) GUIDELINES OF COMMUNITY INVOLVEMENT AS A MEANS OF ENHANCING PROJECT SUCCESS. SIMILARLY, ANY GEF-FUNDED PROJECT INVOLVING LOCAL COMMUNITIES SHOULD ACTIVELY PROMOTE THE OBJECTIVES OF PRIMARY ENVIRONMENTAL CARE AS ONE OF THE PROJECT'S PRINCIPAL LONG-TERM OBJECTIVES.

The development approach of the World Bank and other development institutions promotes privileged relationships with

the governments of developing countries. However, the systematic exclusion of local affected populations from policy and project decisions that fundamentally alter their lives has been and remains one of the major weaknesses of Bank operations.

A Global Environment Facility will accomplish little if it fails to touch the lives and engage the interest of the millions of people who seek daily to meet their most basic needs of fuel, food, water, and shelter. The GEF now represents only the first half of the "Think Globally, Act Locally" equation. Unless it makes positive and unprecedented moves toward community involvement and participation in all its activities, it will never secure the second part of the equation. That being the case, the end result may be a failed experiment.

The Primary Environmental Care concept holds a promising key to how the experience of individuals and communities can be harnessed more fully to achieve local, national, and, ultimately, global environmental objectives. The 11 preconditions for fostering Primary Environmental Care, found in Annex I of this report, include the requirement that communities be empowered to participate in all government policy-making and aid-assisted activities. This empowerment will not be achieved in an information vacuum or in the absence of learning mechanisms to discover community problems and priorities.

WWF therefore recommends that the basic PEC approach and guidelines be adapted to all GEF-funded activities whether they originate from governmental or nongovernmental sources.

ANNEX I

CONDITIONS FOSTERING SUCCESS IN PRIMARY ENVIRONMENTAL CARE

Capacity to Organize, Participate

All community members need to be able to play a role in decision-making that affects livelihoods. In particular decisions over access, control, and management of common resources. This implies that right to set up community gatherings and organizations. Women must be able to fully participate in these processes and capitalize on their role as environmental managers for the benefit of themselves, their households, and the whole community.

Capacity to Influence Development Priorities

Development programmes need to be oriented according to the priorities felt and expressed by communities, in full partnership with the national authorities and the aid agency that may be assisting in the process. As a result, the entry point for external assistance for environmental programmes may not always be an environmental priority but a community need such as employment, housing, or health care.

Integration of Local Knowledge and Awareness of the Environment

Communities need to be involved in the assembly and analysis of environmental data. The provision of external environmental information and advice should be based on a dialogue with the community. Building on and integrating traditional knowledge and skills is essential.

Access to Natural Resources

Communities need access, equitable internal distribution and security of tenure for all the natural resources necessary to their livelihood. Security of land tenure in urban and rural settings is particularly important, since only when tenure is safely secured will motivations for long-term improvements emerge.

Access to Financial Resources

Communities need access to loan and credit facilities not constrained by their lack of collateral, but rather reliant on their record of repayment.

Access to Environmentally-sound Technologies

Communities need access to environmentally sound technologies. These are best developed by way of participatory research, to assure that they respond to felt needs and are adapted to local conditions, gender-appropriate, affordable, efficient, usable, and repairable by locals. In particular, there is a strong need of environmentally sound alternatives to the "unsound" technologies presently in use.

Governmental Support

Governments are the prime and indispensable partners of communities in PEC. They need not only to allow the process of

community-based environmental management to take place, but also to support it actively. To do so, a legislative framework for environmental protection including monitoring and enforcement and an integrated set of sectoral services that can address community needs are vital. Administrative decentralization is another very important encouragement to the PEC process.

Access to Information and Public Accountability

These need to be provided in governmental policy and decision-making and in all aid-assisted activities. Community empowerment cannot be achieved in an information vacuum or without a chance for the community to evaluate and discuss responsibilities.

External Support

Institutions (governmental and nongovernmental) that can offer experience, expertise, and skills in support of the PEC process at community level need to be developed and strengthened. Also, a network of multidisciplinary institutions capable of carrying out relevant research and training for PEC is needed.

Appropriate Time Frame and Adaptive Planning

A longer-term time frame compared with capital-intensive approaches is indicated. (Experience with other community-based approaches suggests 10-year programmes as realistic, although benefits should occur far earlier.) Also, great flexibility in project planning by an iterative approach ("learning" rather than "blueprint") and adequate monitoring are needed. Donors must be prepared for low initial levels of disbursement and for changes in priorities.

Access to Environmentally Sound and Socially Responsive Practices

Communities need access to environmentally sound and socially responsive practices and techniques. Participatory research, action-research, and community-mapping of environmental risks.

(Taken from: *Supporting Primary Environmental Care*, a report of the PEC Workshop, Jan. 29-Feb. 2, 1990, by the Italian Ministry of Foreign Affairs for the Development Assistance Committee of the Organization for Economic Cooperation and Development.)

MISSION FOR THE 1990s

WWF'S MISSION IS TO ACHIEVE THE CONSERVATION OF NATURE
AND ECOLOGICAL PROCESSES BY:

PRESERVING GENETIC, SPECIES, AND ECOSYSTEM DIVERSITY;

ENSURING THAT THE USE OF RENEWABLE NATURAL RESOURCES IS
SUSTAINABLE BOTH NOW AND IN THE LONGER TERM,
FOR THE BENEFIT OF ALL LIFE ON EARTH;

PROMOTING ACTIONS TO REDUCE, TO A MINIMUM, POLLUTION AND THE
WASTEFUL EXPLOITATION AND CONSUMPTION OF RESOURCES AND ENERGY.

WWF'S ULTIMATE GOAL IS TO STOP, AND EVENTUALLY REVERSE,
THE ACCELERATING DEGRADATION OF OUR PLANET'S NATURAL ENVIRONMENT,
AND TO HELP BUILD A FUTURE IN WHICH HUMANS LIVE
IN HARMONY WITH NATURE



MULTILATERAL DEVELOPMENT BANK PROGRAM
WWF-INTERNATIONAL

env-by:

9122558

FACSIMILE TRANSMITTAL
FROM
THE OFFICE OF THE U.S. EXECUTIVE DIRECTOR - WORLD BANK
1818 H Street, N.W., Room D-1320
Washington, D.C. 20433

---- "FAX" NUMBER - (202) 477-2967 ----

DATE: May 1, 1991

TO: Ms. Nancy Maynard, OSTP

Ms. Vikki Sutton, OSTP

FROM:

E. Patrick Coady, U.S. Executive Director - Phone: 202 458-0110

Mark T. Cox, IV, U.S. Alternate E.D. - Phone: 202 458-0115

Ronald E. Myers, Advisor to the U.S.E.D. - Phone: 202 458-0112

Brian G. Crowe, Assistant to the U.S.E.D. - Phone: 202 458-0114

X Nancy Katz, Assistant to the U.S.E.D. - Phone: 202 458-1549

Janice Mazur, Procurement Liaison - Phone: 202 458-0118

Sandra Shank, Senior Staff Assistant - Phone: 202 458-0119

COMMENTS: Patricia Bliss-Guest, CEQ, asked that I forward the attached to you.

Number of Pages Including Cover Sheet 8

GEF: FIRST TRANCHE

Evaluation of Proposed Projects:

Criteria:

- (a) Country commitment to environment, project occurs within an environmental framework, implementation/absorption capability
- (b) Project testing of different approaches and technologies, with potential for demonstration of the feasibility of conventional funding, including regular World Bank or commercial sources
- (c) Because of the country costs and global benefits, the project would not be undertaken without GEF funding

PROJECT	CRITERIA		
	(a)	(b)	(c)
1. Global: Emissions of Global Warming Gases from Rice Soils	+	?	+

Comments: Looks ok from brief description. However, wonder whether this is already being done. (Is the U.S. doing this -- OSTP?) What is STAP's assessment of the testing/demonstration contribution of this project? Does the project fit into or otherwise contribute to the overall world research effort?

2. Global: Monitoring of Ozone and Greenhouse Gases	+	?	?
---	---	---	---

Comments: The extension of the existing monitoring network for ozone and greenhouse gases in developing countries is a worthwhile objective. The question is whether GEF funds should be used for this purpose, or whether the responsibility rests more appropriately with WMO member countries, Contracting Parties to the Vienna Convention, the Intergovernmental Panel on Environmental Change (IPCC), international scientific channels.

3. Congo: Wildlands Protection and Management Project	-	?	?
---	---	---	---

Comments: The Technical Opinion and Project Brief note the possible conflicts of interest and institutional weaknesses of the Forest Economy Ministry. As the Project Brief does not explain how this project will be structured to address these concerns, it is impossible to judge whether or not this project will achieve the goal of promoting conservation of biological diversity. According to the Technical Opinion, panel members recommended that Wildlife Conservation International play an active part in implementing this loan, but this opinion is not discussed in the Project Brief. The Brief also does not show any information on sustainability or government commitment to future lending. Scarce GEF resources should preferentially go to countries that have demonstrated a commitment to environment. [ISSUE: WOULD IT BE DONE WITHOUT GEF??]

4. Kenya: Preservation of Tana River			
--------------------------------------	--	--	--

Primate Natural Reserve

+ + +

Comments: The country's sound environmental policy framework and an adequate institutional capability bode well for the success of this project. The development of economic alternatives, such as crocodile farms, appears to be innovative and have a positive demonstration effect. The involvement of local communities is also commendable. The project appears to be self sustainable, as this is seed money that will finance activities that should eventually become profitable. However, more information is needed about the underlying Bank project. Will the objectives and activities of this GEF pilot project eventually be folded into the underlying loan?

5. Mauritius: Bagasse Energy Sub-Project

+ + ?

Comments: It appears that the country has in place the proper policy framework and institutional capacity to permit a successful project. The project concept appears to be innovative, but we would like STAP's assessment of the underlying technology. We also would like a description of the associated loan, as well as an explanation for assertion in the rationale that reduced emissions will not be realized unless investment is subsidized.

6. Uganda: Bwindi Forest Gorilla Reserve

? - ?

Comments: Project description is very vague. The project appears to be straight budgetary support, and there is no indication of what part of the government will carry this out. The project is lacking in innovation. It may also be premature, as the Government of Uganda is working with bilateral donors to develop an Environmental Action Plan; this project could be folded into the overall process to develop a country program on environment. Did the implementing agencies consider linking this project to the East Africa regional project (#7)?

7. Regional: Institutional Support to
Protect East African Biodiversity

+ - +

Comments: We strongly favor a regional approach, and feel this approach should be exploited wherever possible through the GEF. We also support participation by NGOs. Our assessment is that this project would not be done without GEF funds. However, the project does not appear to meet innovation/demonstration criteria. Also, \$10 million appears to be a large amount for the objectives described.

8. Regional: Protecting Wildlife in
Western and Central Africa

+ + ?

Comments: The U.S. support the regional approach this project takes in enforcing an important wildlife protection treaty. We would like more information about the financing of recurrent costs and wonder whether, realistically, the level of funding is low in

comparison with the stated objectives. Is sustainability achievable?

9. Bhutan: Trust Fund for Environment
Conservation

+ + ?

Comments: The U.S. supports this innovative project, which will test a new formula for sustainable community involvement in conservation efforts. That a large NGO has invested a considerable sum of its own funds will help ensure continued international interest in the success of the project. The project as described seems to fit well with the institutional capacity of the country, which has a demonstrated commitment to environment. We would like clarification on whether the initial funds or the interest will finance the activity; we would prefer the latter.

10. China: Coal Bed Methane Pilot Project

+ + ?

Comments: The policy framework and implementation capability are improving. The project is innovative, includes worker safety and economic benefits, and, given the country's potential contributions to growth in global greenhouse gas emissions, could have major long term benefits for the global environment. The project, if successful, could be replicated elsewhere, including the United States.

11. China: Ports Waste Disposal

? ? ?

Comments: In projects with relatively large GEF components, it is important that the Bank specify the rationale for the breakdown in costs between the GEF and the Bank. In this case, the GEF portion appears lopsided relative to the associated funding, as well as to the stated objectives of the project. We also question whether ports waste projects are candidates for GEF funds, rather than conventional Bank lending operations. It would be an undesirable precedent to provide GEF grants for this activity, which does not require demonstration. Could STAP comment on these concerns?

12. Lao PDR: Wildlife and Protected
Areas Management

? ? ?

Comments: This is one of the most important remaining areas of biodiversity. If there is government commitment to environment and the project design is sound, this could be a worthwhile activity. However, the project description does not explain what will actually be done and leave the impression that it may be straight budgetary support. We also need more information about the underlying loan. Project rationale is based on the country's need for concessional resources, which is not an adequate basis for GEF funding.

13. Philippines: Conservation Management
of Priority Protected Areas

? + ?

Comments: This project involves an area of high biological priority. However, we have concerns about the country's absorptive capacity, as a trust fund, financed by a debt/nature swap, has already been established to support conservation in this area. In addition, the country's institutional capacity is poor.

14. Philippines: Promotion of Geothermal
Energy Development

- - -

Comments: Based on the information presented, this project appears to have little or no demonstration effect. Geothermal energy is already widely used. If a unique technology is involved, more information is needed about the potential for replication elsewhere. Given that a Leyte geothermal project apparently has already received commercial funding on concessional basis, we question the appropriateness of this project for GEF funding.

15. China: Limiting Emissions of
Greenhouse Gases

+ ? ?

Comments: The project is consistent with the series of country-specific studies or assessments that have been or will be carried out on a number of environmental issues, including climate change, ozone depletion, biodiversity, and forestry. The project should help enlist the country's participation in a climate change convention. Considering the large number of economic sectors affected, the costs appear to be reasonable. However, we are aware of other financing for limiting greenhouse gas emissions. As a general rule, the Project Briefs should describe parallel ongoing efforts and describe how they will be related to/coordinated with the proposed GEF project.

16. South Pacific: Regional Biodiversity
Conservation Project

+ + +

Comments: The U.S. is a contributing member to SPREP, and supports this regional project in support of SPREP. We welcome also the project's public education and training component and assistance to ex situ preservation efforts. This GEF project could be replicated in other areas with small island ecosystems. We note and applaud the fact that the project will address two GEF objectives, preservation of biodiversity and reducing pollution of international waters.

17. Vietnam: Protected Areas and
Wildlife Conservation

? ? ?

Comments: This protect appears to have the potential to contribute to achieving GEF goals, but the Project Brief provides too little specific information to assess this adequately. In addition, we would like more information about the proposed environmental strategy and framework for action mentioned in the Brief.

18. Algeria: El Kala National Park

? + ?

Comments: The U.S. finds this project conceptually attractive, Conceptually, because of the support for a type of ecosystem that has received less attention. We would like more information on the associated forest project, as well as cost comparisons with similar projects in other countries.

19. North Africa: Regional Screwworm
Control

- - -

Comments: According to scientific reports, no positive screwworm cases have been detected in Libya since February 20, 1991. Only five cases have been reported in the first three months of this year, compared with 386 for the same period in 1990. A \$56 million, twelve-country effort is already underway in attacking this problem. It is unclear what additional program elements are appropriate for GEF funding. This raises concerns about the technical review process, and illustrates the need for broad scientific and technical review, coordinated by the STAP, throughout the project development process.

20. Poland: Protecting Forest Biodiversity

+ + ?

Comments: The U.S. finds several attractive aspects to this project. It provides some balance to the work program, by focussing on a non-tropical forest ecosystem. The two gene banks represent an innovative approach. However, the appearance of straight budgetary support for the Department of Forests calls into question the project's sustainability, and we see no connection with future activities. We wonder whether this might be a candidate for a trust fund approach, in order to achieve sustainability and longer term effects.

21. Regional: Environmental Management in
the Danube River Basin

- ? ?

Comments: The memorandum establishing the GEF specifies that countries and territories with per capita GNP at or below \$4000 in 1989 will be eligible for GEF funds. We would need to see strong justification for GEF financing for this region before we could consider the project as eligible for GEF.

22. Brazil: Biodiversity Conservation
Units

+ + ?

Comments: Given its importance to the global environment and its growing commitment on conservation, Brazil is a logical candidate for GEF funding. This project may have demonstration value; on the other hand, it appears to represent direct budgetary support. We also wonder whether the funds will be additional to previous pledges. What of recurrent costs?

23. Mexico: Biodiversity Conservation

+ ? ?

Comments: The appropriate policy framework, institutional capacity, and linkages to associated Bank funding make this project worthy of support. We commend the incorporation of financial sustainability criteria in the selection process. However, as in many other cases in this first tranche, in order to reach an adequate assessment, we need more information about the specific actions to be taken under this project and about the associated Bank loan.

24. Brazil: Regional Strategies for
Conservation and Sustainable Management
of Natural Resources in the Amazon

+ ? ?

Comments: It is not clear from the project description if the project will take place in Brazil only, or in several Amazon countries. We would strongly favor the latter approach. It is also unclear what the specific activities and objectives will be. If the project aims to achieve regional agreement and cooperation among Amazon countries and to strengthen local capacity, it will be genuinely innovative and a global priority. However, given the array of existing and proposed centers for study in the Amazon Region, we would urge implementing agencies to use these funds to explore opportunities for cooperative approaches among existing centers, rather than to create a new one.

25. Colombia: Conservation of Biodiversity
in the Choco Biogeographic Region

+ + ?

Comments: The Choco region is a very important area for biodiversity funding, particularly if it leads to regional efforts. We also welcome IDB cofinancing; the participation of regional development banks should be encouraged. However, we need to know more about the associated project. What will determine whether PLAIDECOP will be associated with this project? What are the goals and implementing agencies for this project, and how will these be related to the GEF project? In addition, the GEF element appears to be overly "top down" in its approach, although we note the reference to NGOs. We recommend that the project be designed to maximize local participation and NGO input, particularly in identifying areas to be protected.

26. Guyana: Program for Sustainable
Tropical Forestry

+

?

?

Comments: While the country's demonstrated commitment to the environment and its efforts to increase institutional capacity merit support, the information provided in the project brief is not sufficient for an adequate assessment of the project. Several points need to be clarified. Is the proposed wilderness preserve adjacent to or located within already protected areas. If the latter, why does this warrant further protection. Will the project directly fund research in the preserves? Further details on what the preserve is to be used for would be helpful, as would STAP's assessment of the global benefits of this project.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121568

FROM: LEONARD, H. Jeffrey: GLOBAL ENVIRONMENT FUND

TO: Dr. D. Allan Bromley

DATE OF
CORRESPONDENCE:

SUBJECT: A COPY OF THE GLOBAL RESEARCH FUND'S ANNUAL REPORT.

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REQUIRED:

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ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
ENVIRONMENT

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS: Enclosure to DAB.

DATE RECEIVED: 05/31/91

FILE: ENVIRONMENT

GLOBAL
ENVIRONMENT
FUND, L.P.



1250 24th Street, N.W.
Suite 600
Washington, D.C. 20037
Tel: (202) 466-0529
Fax: (202) 466-6454

RECEIVED

31 MAY 31 AIO: 36

H. Jeffrey Leonard, PhD.
President
GEF Management Corp.

TO: H. JEFFREY LEONARD
DIRECTOR

Dear Alan:

I thought you might
like to see a copy of our
recent Annual Report.

Sincerely,

Jeff Leonard



GLOBAL
ENVIRONMENT
FUND, L.P.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121733

ORIGINATOR: 02

STATUS I

DIRECTORATE STATUS

FROM: SCHMALENSEE, Richard: COUNCIL OF ECONOMIC ADVISORS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 06/11/91

SUBJECT: RE: INTERNATIONAL ENVIRONMENTAL ECONOMISTS

file - GET

DIRECTORATE
ASSIGNED:

STAFF
ASSIGNED:

ACTION
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SENDER'S DUE DATE:

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STAFF DUE DATE
DATE COMPLETED/DEPT:

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CONTACT PERSON:
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REMARKS:

OSTP RECEIVED: 06/13/91
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FILE: INTERNATIONAL*ENVIRONMENT

MEMORANDUM

COUNCIL OF ECONOMIC ADVISERS

RECEIVED

June 11, 1991

91 JUN 13 P 4: 36

MEMORANDUM FOR ALLAN BROMLEY

FROM: RICHARD SCHMALENSEE

SUBJECT: International Environmental Economists

OFFICE OF THE
DIRECTOR

This is a belated response to your request for the names of economists, particularly non-U.S. economists, who might usefully serve on scientific advisory committees attached to the World Bank's new environmental facility. While I very much applaud and appreciate your interest in adding economists to these group, I must report that the suitable population outside the U.S. is small. I offer the following suggestions:

Climate: The globally optimal choice is your Yale colleague **Bill Nordhaus**.

Ozone: The best person here seems to be **Lester Lave** from Carnegie-Mellon. Lester helped at the White House conference and is very sound on issues of risk assessment and policy design.

Should either of these folks be unwilling or unable to serve, I would ask **Paul Portney** of Resources for the Future. Paul is a good, broad environmental economist. On climate, a possible non-U.S. backup is **Michael Grubb** of the Royal Institute of International Affairs in the U.K., an apparently able fellow who advises Tolba.

Oceans: Nobody has done much here, but **David Newbery**, of the Department of Applied Economics, Cambridge, is an exceptionally able fellow who has done (broadly) related work and could certainly make a real contribution.

Biodiversity: Again, there are no economists who have done significant work. A good choice on broader grounds would be **David Pearce** of University College, London.

Should either of these be unwilling or unable to serve, or should it be critical to pick somebody from someplace other than the U.S. and the U.K., I would try **Karl-Goran Maler** of Stockholm. He is an able environmental economist who is unfortunately rather greener than the others on this list.

GEF

GLOBAL ENVIRONMENTAL FACILITY

U.S. Comments on the Freestanding Projects of the First Tranche

African Region Investment Projects

1. Congo - Wildlands Protection and Management Project

U.S. Position: We support this project; however we wish to bring the following concerns to the attention of the Implementing Committee (IC).

We have no argument with the importance of the Congo for the conservation of global biodiversity. We recognize also the need for the GEF to contribute to the implementation of an effective conservation program in that country. Nevertheless, the present proposal is vague regarding expenditures of the GEF contribution of \$10 million. Further elaboration is needed on implementation issues such as the delineation of tasks, responsibilities, and the application of funds.

The Technical Opinion and Project Brief note the possible conflicts of interest and institutional weaknesses of the Forest Economy Ministry. As the Brief does not explain how this project will be structured to address these concerns, it is difficult to judge whether or not this project will achieve the goal of promoting conservation of biological diversity. While we recognize that an Environmental Action Plan (EAP) is being prepared by the Congo, the current institutional weaknesses and the novelty of the EAP within the country cause concern with regard to the viability of environmental programs/activities.

While the project concept is good, similar IBRD projects in the past have been associated with large conventional forest "development" (timber extraction) projects. It would not be appropriate to use GEF funds, on the one hand, to salvage a few reserves from timber harvesting that has been funded by the other hand.

According to the Technical Opinion, panel members recommended that Wildlife Conservation International play an active part in implementing this loan, but the precise role of this NGO is not clearly outlined in the Brief. The Brief also does not show any information on sustainability or government commitment to future lending.

The Brief should include more information on the projects relationship to Bank forestry projects in the region. An outside reviewer's recommendation on a study of hunting, its scope and alternative sources of satisfying demand for meat/protein should also be incorporated into the project.

African Region Technical Assistance Projects

1. **East African Regional - Institutional Support to Protect East African Biodiversity**

U.S. Position: We do not support this project for the following reasons.

While our assessment is that this project would not be done without GEF funds, the project does not meet innovation/demonstration criteria, and \$10 million seems to be a large amount for the objectives described in the Brief. The question also remains, who will pick up the costs of the "effective conservation units" once they are established?

There are few specifics regarding project implementation and the details of the budget are inadequate for making judgements. Much more detailed and elaborative documentation should be provided for such a project.

The education and training programs envisioned in this project are one-dimensional. An effective conservation program requires the involvement of individuals versed in more than conservation biology. It requires a multi-disciplinary approach.

Asia Region Investment Projects

1. **Bhutan - Trust Fund for Environment Conservation**

U.S. Position: We support this project; however we wish to bring the following concerns to the attention of the IC.

On the basis of the documentation provided, this appears to be an innovative project that will test a new formula for sustainable community involvement in conservation efforts. The fact that a large NGO has invested a considerable sum of its own funds will help ensure continued international interest in the success of the project. The project as described seems to fit well with the institutional capacity of the country, which has a demonstrated commitment to environment.

One area of potential concern is national policy. Timber and hydropower export are identified as posing the risk of the downward environmental spiral the project is intended to avoid, yet the trust fund will support demonstration projects in sustainable forestry and hydroelectricity. More discussion of the criteria that will be employed for supporting such demonstration projects is needed.

The covenant to maintain forest cover does not clearly define forest cover, and would apparently permit the substitution of fuel wood plantations for natural forest. This should not be

condoned. It is also unclear whether the assurance that 20% of the area would remain as national parks or reserves means that timbering, mining, etc. cannot occur in the park or reserve.

The project documentation does not address the inevitable pressures on forested lands that will be created by population growth. These pressures should be taken into account up front.

In the section on "Success Criteria," we suggest that a criterion be added that addresses the development of improved training and education facilities within Bhutan. This point is recognized as a critical need in Appendix I of the trust fund prospectus and must be implemented if conservation in Bhutan is to be viable over the long term.

2. China - Coal-Bed Methane Pilot Project

U.S. Position: We support this project.

This project is a high priority for China because of the need for additional clean-burning energy resources, particularly natural gas. Because this project will enable the Chinese to exploit a natural gas resource in their coal reserves, potentially reducing their use of coal, it will have important global environmental benefits in terms of both methane and carbon dioxide reduction.

The combination of the pilot project, the national assessment, and the EPA-funded training program and clearinghouse should create a framework that is necessary for success. The pilot project should demonstrate the feasibility of larger-scale coal-bed methane recovery to China and other countries; the national assessment should identify additional areas for development; and the training program should provide the Chinese with the technical capabilities to develop the resource.

When the full life-cycle costs of developing coal and coal-bed methane resources in China are compared - including production, transportation, consumption, and environmental externalities - coal-bed methane is clearly a more cost-effective resource. The full costs are not currently recognized in China however, and the Chinese continue to emphasize less cost-effective investments in new coal production, powerplants, etc. This project should serve to demonstrate the value of coal-bed methane to China and should encourage the Chinese to devote additional financial resources to its development.

China's institutional framework clearly supports this project and the future of coal-bed methane. In February 1991, the Chinese Ministry of Energy signed an agreement under the Environmental Protocol to cooperate with the USEPA in the area of reducing methane emissions from coal mining. In addition, China is considering a national policy to include coal-bed methane

recovered during mining in each coal miner's coal quota. This GEF project should provide additional impetus to the Chinese to enact this and other policies and to promote the use of coal-bed methane.

Asia Region Technical Assistance Projects

1. South Pacific - Regional Biodiversity Conservation Project

U.S. Position: We support this project.

The project concept is good, and the project would appear to be cost-effective and likely to provide global benefits. Support of the South Pacific Regional Environment Program (SPREP) is the appropriate mechanism through which biodiversity conservation among numerous small South Pacific islands should be addressed. However, one significant concern not addressed by the proposal is how the program will be sustained after the five year grant expires. The training component of the project also needs strengthening. The document does not propose a permanent staff position in this area and suggests only a few workshops. A more permanent training institutional development effort should be envisioned.

The commitment and role of national governments appears to be limited and there seems to be relatively few agreed-upon channels through which project results can feed into government policies on agriculture, fisheries, industry, and tourism. At a minimum, the respective governments should commit to substantive participation by NGOs in the in-country working groups. There is no provision for undertaking analyses of social, economic and environmental consequences of establishing areas, and sharing this publicly prior to their establishment. This appears to be at odds with the need for public disclosure and involvement in the lending process.

EMENA Region Investment Projects

1. North Africa - Regional Screwworm Control

U.S. Position: We do not support this project for GEF funding; it falls outside the boundaries of the criteria for GEF project qualification.

While this project would appear to be cost-effective, of high priority, and likely to provide important regional benefits, it would be stretching the criteria very far to include this particular project. It cannot be directly related to the protection of biodiversity. A large number of animals may become at risk if the screwworm is not effectively contained; however, there is no evidence that any particular species, themselves, would be at risk.

A \$56 million, twelve-country effort is already underway and attacking this problem. It is unclear that any additional program elements would be appropriate for GEF funding. This type of activity should be funded through other channels.

Latin America/Caribbean Region Technical Assistance Projects

1. Colombia - Conservation of Biodiversity in the Choco Biogeographic Region

U.S. Position: We do not support this project as it is currently written, the project document needs to be substantially rewritten to more clearly describe the relationship between specific objectives and the overall goal of the project as well as the relationship between activities and objectives. Is the project a four year or five year activity? The "estimated duration" of the project is four years, but the budget is broken into two phases, one of two years and another of three years. Which activities are to be carried out in phase one and which are to be carried out in phase two?

The Choco region is a critical area in terms of funding for biodiversity, particularly if it leads to regional efforts to conserve the biodiversity on the western slopes of the Andes and below, including coastal areas, mangroves, and important marine areas.

We welcome IDB co-financing; such participation by regional development banks should be promoted.

Will the project be associated with PLAIDECOP? Will the project emphasize the development of sustainable economic potential of the biological and physical resources of the region through direct participation of local populations? If so, the proposed GEF project, with some reordering and clarification of priorities, may be an appropriate response to support the economic development of the region. However, if the GEF project's research and ecological zoning activities will not be used as input to update and refine economic development plans for the area, the project should not be approved.

The proposed activities should support concurrent development activities, not precede them. Assuming that habitat destruction is progressing as rapidly in the Choco as in other areas of Latin America, development activities, based on existing knowledge, which contribute to the conservation of natural resources should be initiated quickly without necessarily waiting for further research results. Research can, and should, be carried out concurrently both to feed new information into the development activities and to provide an alternative source of income for local populations who would otherwise be involved in the destruction of natural resources. Research and related

activities should make the maximum possible use of local human resources. The project documentation does not show clearly how ecological zoning, research, and training will be utilized to alleviate the problems of unsustainable agricultural practices and population pressures to protect the forests from destruction.

Some aspects of the project appear to offer experimental and demonstrational benefits, notably those which seek to introduce new production/economic models keyed to the sustainable use of the region's natural resources. How are the results of these efforts to be disseminated to a wider group of beneficiaries?

A further discussion of the institutional structure available in Colombia to support this project and the project's relationship with regional environmental and development institutions would be helpful.

Assuming that the objectives and activities have been presented in order of priority, the priorities should be reordered. The top priority, perhaps after some rapid initial/tentative delimiting/zoning, should be involvement and capacity strengthening of local communities; followed by development of human resources, strengthening of institutional capacity, and the development of management activities to conserve natural resources. Research activities should be developed to support the refinement of the management activities and further definition of ecological zones. Activities under Objective 5 should begin as soon as possible with the participation of local communities.

In paragraph D of the project documentation, under Immediate Objective 1, two additional activities should be incorporated. Activity 4 should be the analysis of the social and economic consequences (including opportunity costs) of the planned zoning. Activity 5 should reflect the involvement of indigenous and local communities in the zoning. Similar modifications should be made to Immediate Objective 5. Additionally, we believe the personnel involved in using and management of biodiversity resources need to be trained in both ecological and economic sciences - this should be incorporated into Immediate Objective 3.

While this project touches on many elements necessary for an effective conservation program, the only component outlined in any detail is research. Other components are addressed in single sentences. Also, the budget is too vague. For example, \$1,140,000 is budgeted for equipment with no further detail as to specific needs.

This proposal needs substantial reworking before being considered for funding. It needs to be presented as a development project involving active participation of local communities rather than a broad-scale research project. We look forward to reviewing a

document which clearly describes a project to develop the sustainable economic potential of the biodiversity resources of the Choco region.

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A WORLD OF DIFFERENCE

REPORT OF THE
TASK FORCE ON GLOBAL
CLIMATE CHANGE



NATIONAL GOVERNORS' ASSOCIATION

A WORLD OF DIFFERENCE

REPORT OF THE
TASK FORCE ON GLOBAL
CLIMATE CHANGE

The National Governors' Association, founded in 1908 as the National Governors' Conference, is the instrument through which the nation's Governors collectively influence the development and implementation of national policy and apply creative leadership to state issues. The association's members are the Governors of the fifty states, the commonwealths of the Northern Mariana Islands and Puerto Rico, and the territories of American Samoa, Guam, and the Virgin Islands.

The association has seven standing committees on major issues: Agriculture and Rural Development, Economic Development and Technological Innovation, Energy and Environment, Human Resources, International Trade and Foreign Relations, Justice and Public Safety, and Transportation, Commerce, and Communications. Subcommittees and task forces that focus on principal concerns of the Governors operate within this framework.

The association works closely with the administration and Congress on state-federal policy issues from its offices in the Hall of the States in Washington, D.C. The association serves as a vehicle for sharing knowledge of innovative programs among the states and provides technical assistance and consultant services to Governors on a wide range of management and policy issues. The Center for Policy Research serves the Governors by undertaking demonstration projects and providing anticipatory research on important policy issues.

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CHAIRMAN'S

FOREWORD

As events in Eastern Europe unfold daily and affirm the values and principles of a democratic and free enterprise system, we look optimistically toward the twenty-first century. Today in the United States we have an unprecedented opportunity to set standards of excellence for ourselves and for the world.

A safe and clean environment and an effective educational system are essential to achieving and maintaining a high standard of living in every democratic nation. That is why this year I challenged the Governors to address these important issues. Meaningful change, accompanied by long-term commitment, is critically needed in both areas.

To meet this challenge, the National Governors' Association established three task forces this year—on Global Climate Change, Solid Waste Management, and Education. Each task force was charged with identifying reasonable and achievable national goals and practical ways to achieve them. Equally important, the task forces have focused on the things states can do in each area.

Over the past several months we have sought to build a national consensus on the environment and education and establish ambitious goals that can direct our actions in these areas during the decade ahead.

Together the Governors have sought a Consensus for Change—a consensus on the steps that must be taken to ensure that our children have the skills they need to compete in the world marketplace, that they understand the privileges and responsibilities of living in a democracy, and that they can fulfill the responsibilities of citizenship. The ability of our citizens to meet the challenges of the next century is directly related to the quality of our schools.

However, it is not enough to focus solely on education; we must also concentrate on the world in which we live. Our quality of life is affected by the air we breathe, the water we drink, and the food we eat. To protect our environment and ensure that the world we leave to future generations is healthy and safe, we must address our most pressing environmental

problems with insight and wisdom. The decisions we as a nation make on these issues today will determine the quality of life for our children and grandchildren tomorrow.

To be sure, our efforts have been comprehensive. Each task force has worked with government and business leaders and other interested parties. We have gathered information from citizens and experts from virtually every walk of life. This process has reminded me of the strength, diversity, and ingenuity of the people in this land.

When the Governors and President Bush met in Charlottesville, Virginia, in September 1989 for the historic education summit, we were bound together by a common concern and a shared commitment. Despite the diversity of our states and our citizens, all Governors share the belief that education is the cornerstone of the future.

That spirit of cooperation led the Task Force on Education through its work with the President to develop bold education goals for the nation. Adopted by the Governors and embraced by the President in February, the nation's goals for education will chart the course for education reform in this decade. The task force has also developed state strategies to achieve the goals, and a mechanism for measuring progress toward achieving those goals.

The Task Force on Solid Waste Management studied innovations in waste disposal management from coast to coast. The recommendations and report of this task force will provide states with a valuable resource as states assess and redirect their efforts in this area.

This is the report of the Task Force on Global Climate Change. Few issues demonstrate more clearly the delicate balance between human beings and the natural environment. Although there is considerable uncertainty about the rate, magnitude, and effects of global climate change, and the costs of prevention could be substantial, we must take action. For the sake of future generations, we must take the issue of global climate change with the utmost seriousness.

To build consensus on an appropriate course for the 1990s, Task Force Chairman Governor James R. Thompson of Illinois and Vice Chair Governor Madeleine M. Kunin of

Vermont convened meetings in Charlottesville, New York City, Sacramento, Washington, D.C., New Orleans, and Burlington to discuss the issues with distinguished scientists and government officials from the United States and other countries. The task force heard from experts and advisers drawn from the academic community and from a wide range of business and environmental groups. The task force reviewed and analyzed research from all available sources. The result is a consensus on goals for dealing with global climate change and an action plan to realize those goals.

Some of the goals identified by the Task Force on Global Climate Change will not be easily or quickly achieved. But working together we *can* begin. Governors are well positioned to lead the effort and serve as catalysts for change. We *can* and *will* make a difference. Together we will make the world a better place for tomorrow's children.



Governor Terry E. Branstad, Iowa
Chairman, National Governors' Association

EXECUTIVE SUMMARY

AND STATEMENT OF GOALS

The atmosphere acts like a greenhouse around the earth. Certain gases, most of which naturally occur in the atmosphere in minute quantities, trap the sun's heat and warm the planet. Without this natural occurrence, the planet would be some 60 degrees Fahrenheit colder than it is now; the seas would be permanently frozen, and life as we know it could not exist.¹ We literally owe the habitability of our planet to the phenomenon commonly known as "the greenhouse effect."

In recent years, evidence that human activities are changing the composition of the atmosphere has caused increasing concern. The world energy system, industrial and land-use practices, agriculture, and population growth are adding certain greenhouse gases to the atmosphere faster than they can be removed by natural processes. As concentrations of greenhouse gases increase, the heat trapping properties of the atmosphere also increase, like a more efficient blanket around the globe. Almost all scientists believe that this increase in greenhouse gases results in a theoretical increase in average global temperature. However, there is debate about the extent, rate, and timing of future temperature and climate changes. The U.S. Environmental Protection Agency and others have predicted that a doubling of atmospheric carbon dioxide or its equivalent in some combination of greenhouse gases—expected by the middle of the next century—could raise the earth's average temperature by 3 to 10 degrees Fahrenheit (1.5 to 4.5 degrees Celsius).² In January 1990, the National Academy of Sciences estimated that 4 degrees Fahrenheit (2 degrees Celsius) is the most likely temperature rise.³

Although the implications of such a temperature increase are not well understood, they could include an increase in the frequency and severity of climate extremes such as droughts and storms; changes in rainfall patterns; rising sea level with consequent shoreline and beach erosion, flooding of estuaries, and loss of wetlands; desertification; and migration of

agricultural and forest zones, among others. Some scientists believe that a warmer world could bring some benefits, such as lengthening the growing season in northern regions.

For several reasons, global climate change may be the most complex environmental and economic problem humankind has ever faced. First, there is substantial scientific uncertainty about the rate, magnitude, and regional effects of future climate change, and this uncertainty is likely to persist for some time. This scientific uncertainty and the difficulty in accurately predicting climate change are compounded by the existing natural variability of meteorological and biological systems. Second, the social and economic costs of the measures that might reduce the threat are not yet well understood, and a comprehensive assessment of the available options has only recently begun. Finally, mitigation and adaptation to climate change is an issue that can be effectively addressed only with the cooperation of all nations. It is likely that unilateral measures by any one country will be quickly overwhelmed by events elsewhere if other nations do not cooperate in a coordinated response. Some maintain that unilateral actions now could reduce American bargaining power in future international negotiations.

To address this important issue, NGA Chairman Governor Terry E. Branstad created the Task Force on Global Climate Change, chaired by Governor James R. Thompson of Illinois and vice chaired by Governor Madeleine M. Kunin of Vermont. The task force was charged with developing recommendations for the nation for the 1990s, and illuminating the role that states can play in addressing the problem of global climate change. To accomplish this mission, the task force held hearings across the nation, met with senior scientists and policymakers from several nations, and engaged in constructive dialogue with business and environmental leaders, whose support is crucial in any response to this problem.

After careful deliberation, the task force makes the following findings:

First, atmospheric concentrations of greenhouse gases are increasing due to human activities. Over the last 100 years, atmospheric concentrations of carbon dioxide have increased by about 25 percent.⁴ Concentrations of methane have increased by approximately 140 percent since the middle of the nineteenth

century, and there have been significant increases in concentrations of other greenhouse gases, including chlorofluorocarbons (CFCs) and nitrous oxide.⁵

Second, a broad scientific consensus has developed that increasing the concentration of carbon dioxide and other greenhouse gases will increase the atmosphere's heat-trapping ability and warm the climate to some degree. There is debate and uncertainty, however, about the magnitude and timing of the warming and the implications of that warming for the earth's climate system, environment, and economies.

Third, controlling emissions is central to reducing potential climate change. For carbon dioxide, change in energy policy is the primary strategy for stabilizing or reducing emissions. Other measures, such as slowing the loss of forests, are also critical.

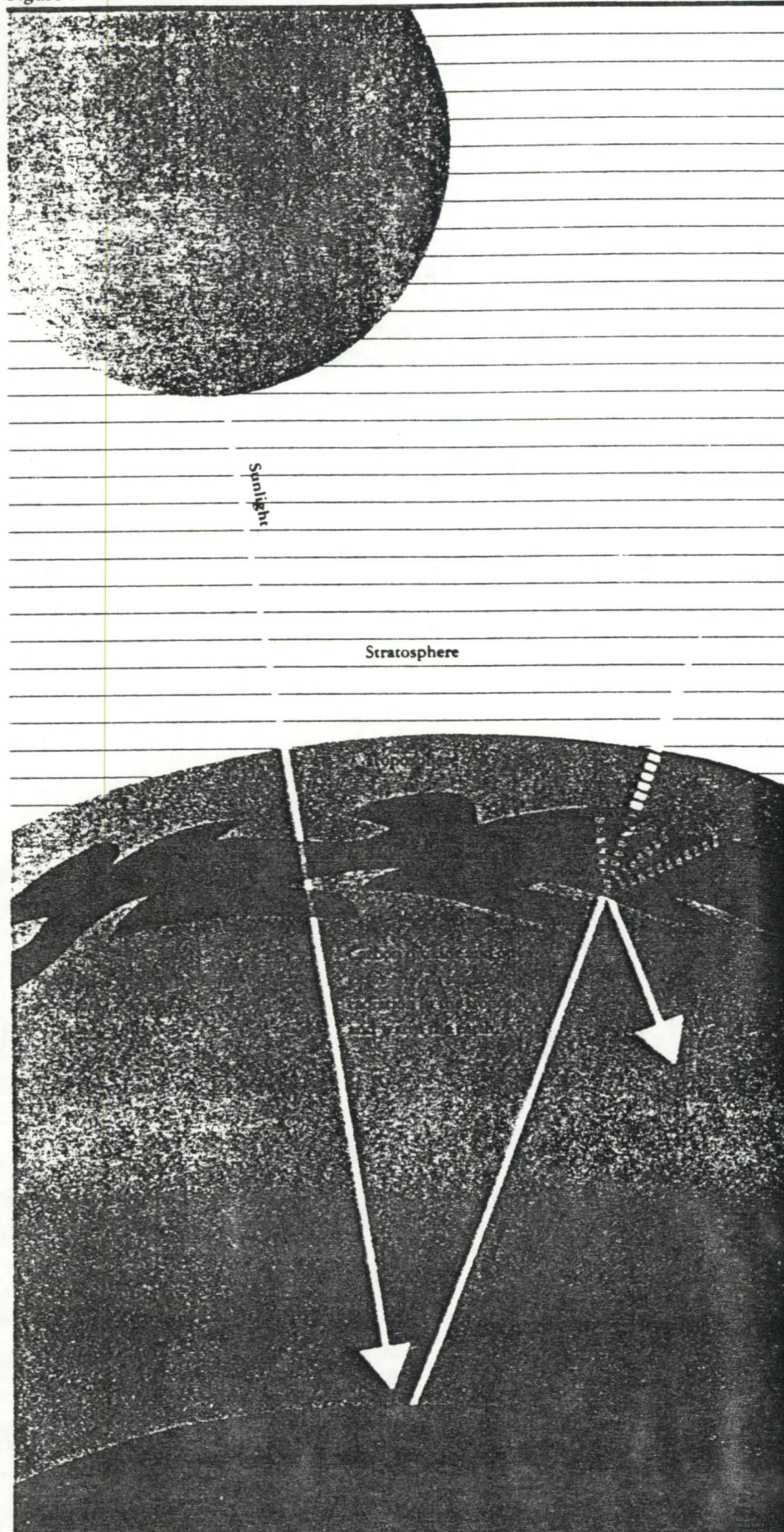
Fourth, states have an important role to play in addressing this problem because of their authority over utilities, land-use, transportation, taxation, and other means of affecting change in the environment.

Fifth, any effective solution or response to global climate change must necessarily include sustained action by the federal government and the international community. Developing nations, whose emissions may grow rapidly in the future, must be full partners in the international negotiations.

The central question facing policymakers—and the primary issue facing the task force—is whether enough is known about global climate change to warrant taking action now to reduce it. Although considerable uncertainties must be acknowledged, some scientists and government agencies in several countries have predicted that significant global climate change could be evident within the next several decades.⁶

The social and economic costs of the measures that may be necessary to reduce greenhouse emissions are still being evaluated. Economists have estimated these costs for the United States to range from virtually nothing to 5 to 6 percent of gross national product.⁷ Overreaction could have serious effects on the economic well-being of the nation, depending on the actual cost. The next generation deserves to inherit the healthiest possible economy as well as the healthiest possible environment.

Figure 1 How the Greenhouse Effect Works



The costs of responding to the threat of climate change must be weighed against the possibly severe environmental and economic consequences associated with global warming and the risks associated with delay. Because greenhouse gases can remain in the atmosphere for centuries, emissions have a cumulative impact on the climate. Although the magnitude and timing are uncertain, today's emissions are likely to "commit" the planet to some degree of warming. In its 1989 report on global warming policy options, EPA found that early governmental response to global climate change would result in less severe problems in the next century. Starting a policy response in 1990 could reduce the severity of the problem by 40 percent more than if the same policies were initiated in 2010.⁸

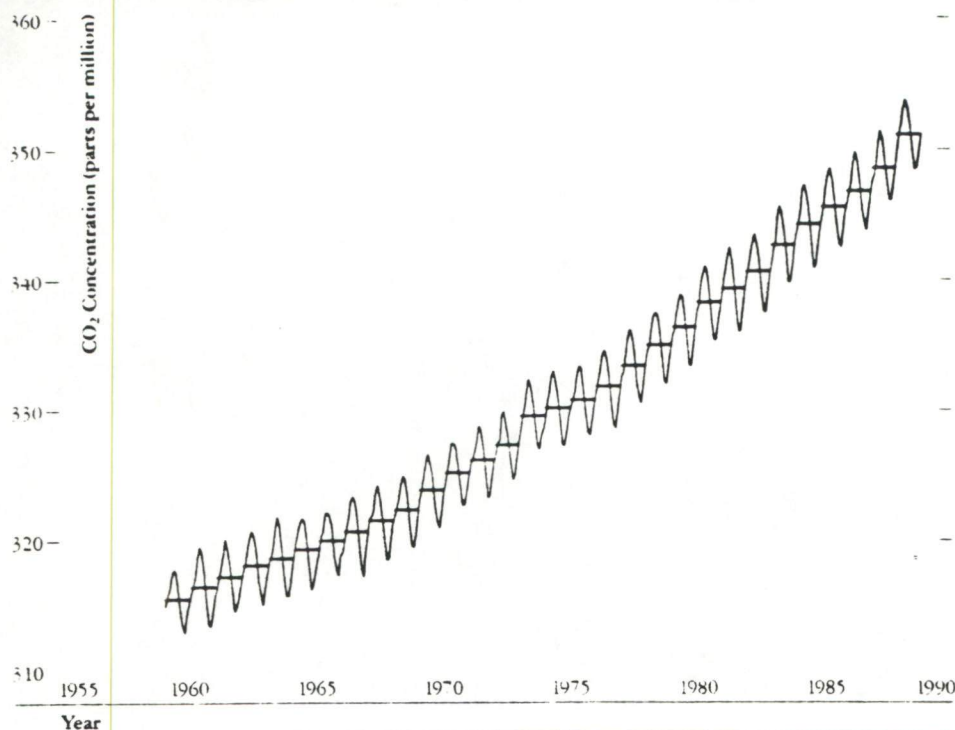
Considering the evidence and the risks of both overreaction and underreaction, the task force recommends taking steps now that provide a reasonable return on investment and offer other social and economic benefits. These prudent measures should be undertaken even in the presence of scientific uncertainty.

If the following goals are achieved for reasons apart from the challenge of global climate change, such as reduction in pollution, greater energy efficiency, or greater economic competitiveness in the global market, they will have been worthwhile even if later scientific evidence diminishes concerns over global climate change.

In view of these findings, the task force embraces seven key goals for the United States in the 1990s. They include the following:

- 1 Develop an international agreement to protect the atmosphere. The United States cannot significantly reduce the rate or magnitude of global climate change through unilateral action; the cooperation of all nations is required. It is particularly important that U.S. reductions in carbon dioxide emissions are not offset by a net increase in other countries. America should use its pre-eminent position to lead the development of appropriate agreements as soon as possible to assure a coordinated international approach to the threat of climate change.

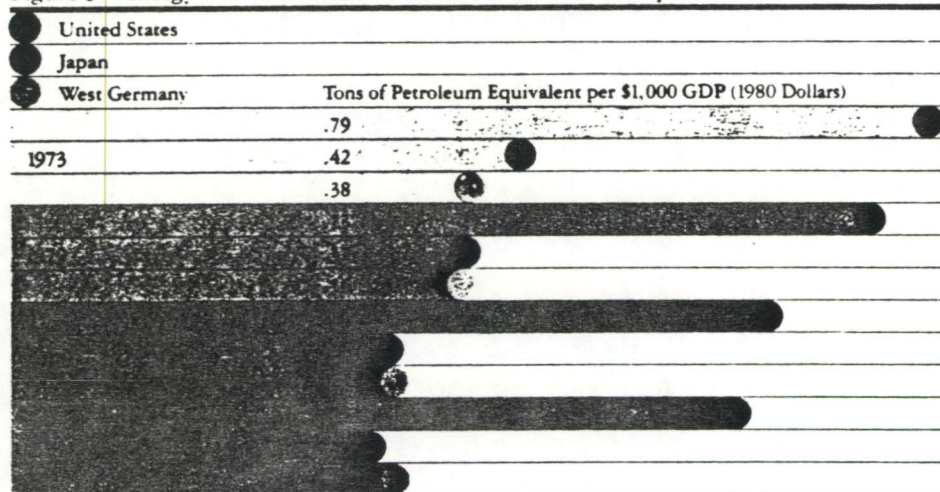
Figure 2 Carbon Dioxide Concentrations, 1958-1988



Note: This figure depicts monthly concentrations of atmospheric carbon dioxide at Mauna Loa Observatory in Hawaii. The yearly oscillation is explained mainly by the annual cycle of photosynthesis and respiration of plants in the northern hemisphere. Horizontal bars indicate average annual concentrations.

Source: U.S. Department of Energy, Multi-Laboratory Climate Change Committee, *Energy and Climate Change* (Chelsea, Mich.: Lewis Publishers, Inc., 1990), p. 35.

Figure 3 Energy Used Per Dollar of Domestic Economic Output, 1973-1985



Note: Energy demand has increased little since the early 1970s, while GNP has grown by 40 percent. Energy-efficiency improvements now save the U.S. economy \$160 billion annually. Nevertheless, Japan and West Germany use half as much energy per unit of economic output as the United States.

Source: William U. Chandler, Howard S. Geller, and Marc R. Ledbetter, *Energy Efficiency: A New Agenda* (Washington, D.C.: American Council for an Energy-Efficient Economy, 1988), p. 2.

2 Utilize cost-effective energy conservation and efficiency measures to stabilize U.S. emissions of carbon dioxide. Between 1973 and 1986, the U.S. economy grew by more than one-third with no significant increase in carbon dioxide emissions, due largely to increases in energy efficiency. The United States should take cost-effective steps to extend that record by improving the efficiency of energy generation and use sufficiently to allow economic growth while stabilizing carbon dioxide emissions. States have numerous opportunities to reduce their carbon emissions through utility regulation reform that encourages efficiency. Building, lighting, appliance, and transportation efficiency measures also can yield substantial reductions in carbon emissions by reducing the amount of fuel we use.

3 Stop production of and recycle chlorofluorocarbons, and use cost-effective strategies to stabilize or reduce other greenhouse gases. The Montreal Protocol should be amended to eliminate the production of chlorofluorocarbons and to require that those already in use be recycled so they are not released into the environment. In addition, steps should be taken wherever possible and cost-effective to stabilize or reduce U.S. emissions of methane, nitrous oxide, ozone, and other greenhouse gases. Methane recovery from waste should be encouraged. Research in agriculture and animal diets has discovered ways to reduce greenhouse gases from these sources. Implementation of these discoveries should be encouraged.

4 Develop and commercialize alternative energy systems, including clean fossil, renewable energy sources, and safe nuclear power. Federal and state governments should take steps to ensure that clean and renewable energy sources make the maximum possible contribution to the nation's energy needs. A wide array of energy sources that would reduce carbon emissions from current levels is available, including clean fossil technologies, cogeneration, solar energy, wind power, geothermal energy, biomass fuels, hydroelectricity, and a new generation of safe nuclear power. These alternative

energy systems should be further developed and marketed so that the energy needs of the nation can be met without increasing greenhouse gas emissions.

- 5 Implement forestry programs to reduce the effects of global climate change.** The severity of climate change can be reduced by taking steps to remove greenhouse gases from the atmosphere. Planting trees, particularly in urban areas, can help reduce the severity of climate change because they take up carbon dioxide as well as provide shade. Responsible management and expansion of our existing forest resources can improve the quality of forest ecosystems, increase our production of wood, and reduce atmospheric carbon dioxide.
- 6 Plan and act now to adapt to a changing climate.** Some degree of future climate change due to human activities or natural phenomena appears likely. A planned response to this change should be developed promptly. Particular attention should be given to problems related to water resources, sea level rise, and agricultural and forestry practices. The task force recommends that programs in these areas consider the possibility for future global climate change.
- 7 Pursue an aggressive research program to reduce key uncertainties about global climate change.** The world's response to the threat of global climate change must be based on the best possible science. We must enhance our ability to understand, monitor, and predict the forces that are shaping the climate. It is imperative that the United States, as the world's leader in scientific research, support a program of research to better define the potential magnitude and timing of future climatic changes; the possible ecological effects of such changes; and the cost and effectiveness of various response options, including changes in energy sources.

In embracing these goals, the task force believes the federal government bears a special responsibility for assisting states or industries that may be adversely affected by a move to a less energy- and carbon-intensive economy. The

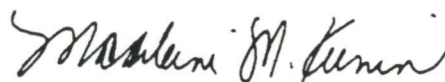
federal government must plan for and provide a transition so that our national goals do not become unreasonable limitations on the growth and development of particular states or industries.

Finally, the task force recognizes that our lifestyles, the actions we take as consumers, and our attitudes toward the natural world directly affect the planet. Continued economic growth must occur within a framework that recognizes the long-term need for sustainability. The task force supports the development of environmental education programs and other efforts to provide greater insight into the ways in which our actions knowingly or unknowingly affect the environment. We must foster an environmental ethic promoting stewardship of the earth for present and future generations.

The following chapters examine these goals in greater detail and suggest strategies that could be used to achieve them.



Governor James R. Thompson, Illinois
Task Force Chairman



Governor Madeleine M. Kunin, Vermont
Task Force Vice Chair

Members of the Task Force



Governor Steve Cowper, Alaska



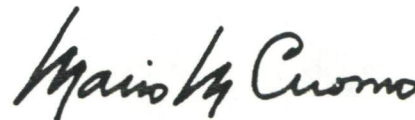
Governor Michael N. Castle, Delaware



Governor Buddy Roemer, Louisiana



Governor Stan Stephens, Montana



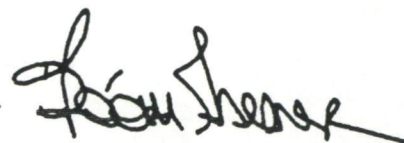
Governor Mario M. Cuomo, New York



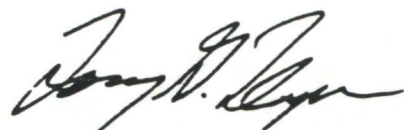
Governor George A. Sinner, North Dakota



Governor Henry Bellmon, Oklahoma



Governor Booth Gardner, Washington



Governor Tommy G. Thompson,
Wisconsin

WORLD OF DIFFERENCE

REPORT OF THE TASK FORCE ON GLOBAL CLIMATE CHANGE

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attribute to increasing sulfur dioxide emis-
sions. They hypothesize that sulfur dioxide, a
principal cause of acid rain, may be delaying
global warming.¹⁰

In addition, there is uncertainty about other
various effects that counteract or reinforce
increases in the global temperature. For
instance, it is possible that carbon dioxide
fertilization, which makes plants grow faster,
increases their uptake of carbon dioxide and
removes more carbon from the atmosphere.
Similarly, increased activity by soil microbes
in response to higher temperatures may increase
natural emissions of nitrous oxides. There may
be hundreds or thousands of such feedbacks,
each acting to enhance or reduce the magnitude
of global climate change; their number and
the net effect on the climate are unknown.¹¹
Because these relationships and the overall
sensitivity of the world's climate system are
not well understood, the magnitude of climate
change as the result of doubled carbon dioxide
remains subject to considerable uncertainty.

The timing of any change in global temperature
is also highly uncertain. Models can predict a
new average global temperature for the climate
in equilibrium, but cannot estimate how long
it will take to realize that new temperature or
whether the climate will change smoothly or
abruptly. The atmospheric system and the
oceans take a long time to warm up due to
thermal inertia. There is an unknown lag time
that occurs between a change in the atmospheric
composition and a change in surface
temperature. Thus scientists speak of increased
levels of greenhouse gases resulting in a
"commitment" to higher temperature without
certainty about when it will actually occur.¹²

Finally, current models necessarily focus on a
large geographic scale, while regional or local
effects remain uncertain. Scientists expect that
temperatures will increase more at higher
latitudes than closer to the equator. Even a
modest increase in global average temperature
can include dramatic and economically
important regional events, some positive and
some negative, such as increased growing
seasons, changes in rainfall patterns, heat waves,
or storms.¹³

Increases in atmospheric concentrations of
certain greenhouse gases during the last century
are known, so it should be possible to directly
test the models—if the global average
temperature in the last century can be

Table 1 Summary Table of Greenhouse Gasses

Greenhouse Gas	Current Contributions to Warming (%)	Major Global Sources (%)	Atmospheric Concentration (parts per million)	Annual Increase (% per year)	Life Span (yrs.)	Climate Effect (CO ₂ = 1)
Carbon Dioxide	49		351.3	0.4	100	1
Fossil Fuels	35-45	75-90				
Deforestation	4-15	10-25				
Methane	18		1.675	1.0	11	25
Natural Wetlands		20-40				
Rice Paddies		12-35				
Ruminant Animals		12-20				
Landfills		6-15				
Natural Gas Drilling		5-10				
Coal Mining		3-9				
Chlorofluorocarbons	14		.000225	5.0	75-111	15,000
CFC-11			.000226	4.0	75	
Foams		55				
Aerosols		31				
Refrigerators		8				
CFC-12			.000392	4.0	111	
Refrigerators		49				
Aerosols		32				
Foams		13				
Nitrous Oxide	6		.31	0.2-0.3	150	230
Natural Soil and Ocean Releases		50-60				
Fossil Fuels		7-20				
Deforestation		7-15				
Fertilizer Use		2-17				
Tropospheric Ozone	?		02-1	?, but increasing	hours	2,000
Carbon Monoxide	?		.20	2	.4	NA
Fossil Fuels		10-25				
Deforestation		8-35				
Oxides of Nitrogen	?		.01-1.0	?	1-7	NA
Fossil Fuels		28-55				
Deforestation		16-25				

Sources: Christopher Flavin, *Slowing Global Warming: A Worldwide Strategy*, Worldwatch Paper 91 (Washington, D.C.: Worldwatch Institute, 1989), p. 13; Daniel A. Lashoff and Dennis A. Tirpak, eds., *Policy Options for Stabilizing Global Climate Change—Draft Report to Congress* (Washington, D.C.: U.S. Environmental Protection Agency, 1989), pp. 11, 51-58; Florentin Krause et al., *Energy Policy in the Greenhouse* (El Cerrito, Calif.: International Project for Sustainable Energy Paths, 1989), pp. 1.1.9-11.

established to provide a base line. Two scientific groups—one in the United States and one in England—have independently surveyed the historical record and found a temperature increase of about 0.9 degrees Fahrenheit (0.5 degrees Celsius) over the last 100 years.¹⁴ This increase is about half the levels predicted by most models, based on observed increases in greenhouse gases. The discrepancy between observed and predicted temperature increases over the last 100 years keeps most scientists from stating with confidence that global warming has been observed.

Despite these uncertainties, scientists do not dispute the increase in atmospheric concentrations of greenhouse gases or the basic physics of the greenhouse effect. Several climate models developed and used independently in different countries have resulted in roughly similar estimates of future global temperature increases, in the range of 3 to 10 degrees Fahrenheit, assuming the greenhouse gas equivalent of doubling preindustrial levels of carbon dioxide. Such a warming would be unprecedented in human history. At the upper end of this range, it would approximate the temperature increase since the depths of the last ice age and would occur several hundred times faster.

Global Climate Change

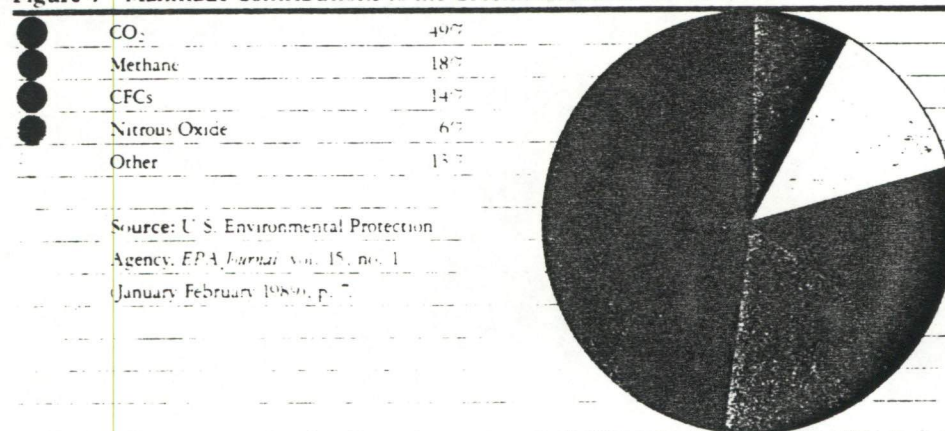
Policymakers worldwide have noted these predictions and the severe consequences of a global warming of this magnitude. The principal concern is not global temperature increase alone, but rather the fact that the global temperature governs the earth's weather and climate in fundamental ways. Climate is determined largely by ocean and atmospheric currents, which in turn are driven by differences in temperature between warmer and cooler parts of the oceans, land masses, and atmosphere. The complex interactions of the earth's climate system are directly fueled by the planet's energy balance. If global temperature changes, so too must the climate.

Table 2 Global Carbon Dioxide Balance

Carbon Dioxide Released Source	Amount per Year (in 10 ⁹ tons)	Percentage
Natural Sources		
Oceans (Ocean-atmosphere interactions, upwelling from deep oceans)	581	60
Land (Biological decomposition releases from soils, forest fires)	216	56
Total Natural Sources	597	96
Human Sources		
Fossil fuel use (Utilities, automobiles, heating, etc.)	18	5
Land use (Deforestation)	-	1
Total Human Sources	25	4
Total from all Sources	622	100
Carbon Dioxide Removed		
Source		
Ocean (Ocean-atmosphere interaction: photosynthesis, biological activity)	592	65
Land (Photosynthesis)	220	35
Total	612	98
Carbon Dioxide Accumulated in Atmosphere		
Total	10	1

Source: Florentin Krause et al., *Energy Policy in the Greenhouse* (El Cerrito, Calif.: International Project for Sustainable Energy Paths, 1989), p. 1, 5-28.

Figure 4 Manmade Contributions to the Greenhouse Effect in the 1980s



Source: U.S. Environmental Protection Agency, *EPA Journal*, vol. 15, no. 1 (January-February 1989), p. 7.

While the science of global climate change is relatively new, studies have been conducted to examine the potential effects of a global temperature increase. These studies indicate that a doubling of atmospheric carbon dioxide could result in far-reaching—even disastrous—changes in the earth's climate. EPA's report to Congress, *The Potential Effects of Global Climate Change on the United States*, compiles data from numerous studies and analyzes the results region by region and sector by sector. The numerous

effects described in the report suggest that global climate change may be among the greatest threats humanity has ever faced.

Water Resources

Significant global temperature increases could cause more frequent and more severe droughts and floods. It is not yet known whether an increase or decrease in average rainfall is likely to result from the greenhouse effect, but most

predictions point to increases in extreme weather events such as droughts and floods.¹⁵ The regional and seasonal distribution of rainfall may also shift. Several studies suggest that mid-continental areas—such as the American Midwest—will become drier.

Other effects could include:

- Greater demand for water and decreasing supply. Irrigation and electric power production could be adversely affected in many areas.
- Lower river flows, negatively affecting hydropower, navigation, aquatic ecosystems, wildlife, and recreation.
- Earlier winter melts and the replacement of snow with rain, exacerbating seasonal flooding problems.
- Greater variability in the levels of rivers and lakes between months and years, which greatly complicates water management.
- Decreased water quality due to lower river flows and lake levels.

As mentioned earlier, today's state-of-the-art climate models cannot confidently predict regional climate change effects. The regional data that exists indicates that areas that currently experience water supply difficulties would face even greater problems associated with global warming.

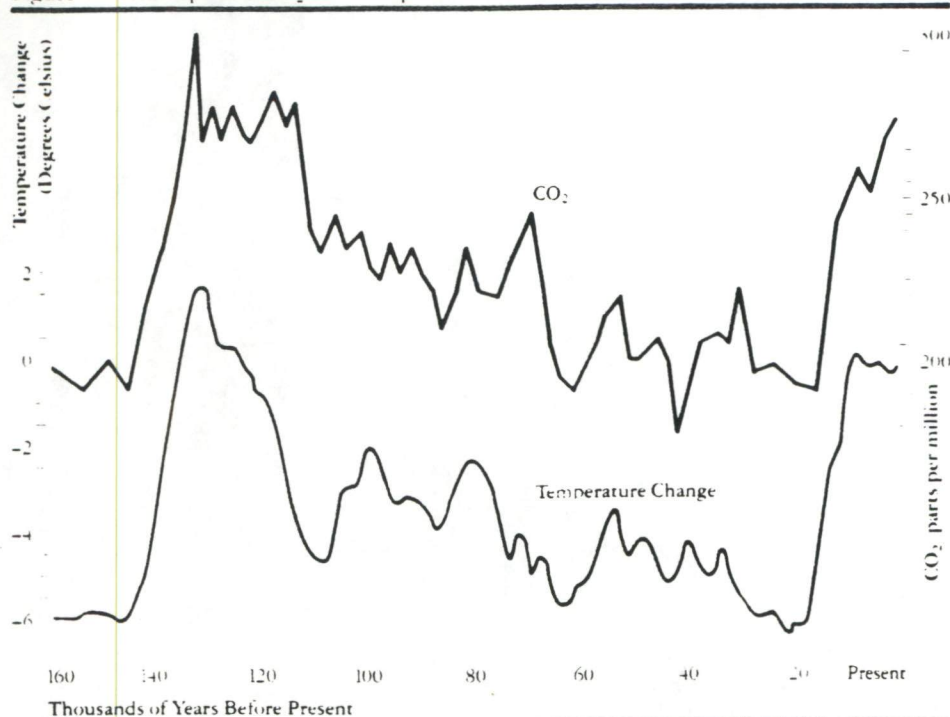
Agricultural Changes

The effects of global warming on agriculture are uncertain but potentially serious.¹⁶ The stress from increased heat, lower moisture, irrigation pressures, and expanded pest ranges must be balanced against any potential improvements in plant growth that result from increased concentrations of carbon dioxide and

"Global climate change poses a wide-ranging threat to the entire world. We must take reasonable steps now to reduce this threat and at the same time achieve other benefits such as increased energy efficiency and cleaner air."

- Governor James R. Thompson
Illinois

Figure 5 Atmospheric CO₂ and Temperature for Past 160,000 Years



Source: U.S. Department of Energy, Multi-Laboratory Climate Change Committee, *Energy and Climate Change* (Chelsea, Mich.: Lewis Publishers, Inc., 1990), p. 85.

longer growing seasons. EPA studies suggest that:

- Yields of corn, soybeans, and wheat would probably be reduced in all but the northernmost regions of the United States, which could have a longer growing season. If the "fertilization benefits" of carbon dioxide on crop yields are significant, some areas might overcome the negative effects of climate change. However, these fertilization benefits under field conditions are still uncertain.
- There may be a small to moderate aggregate reduction in agricultural output. This reduction should not threaten domestic food supplies, but it could negatively affect world food supplies and the U.S. trade balance.
- Farmland dependent upon natural rainfall could become less reliable, and the demand for irrigated acreage is likely to increase. This could put stress on regional water demand and lead to further degradation of surface and groundwater.

- Higher temperatures probably would increase the range and survivability of agricultural pests. More pests would survive winter, produce more than one generation per year, and affect crops earlier in the growing season. Pesticide usage probably would increase to combat the growing pest population.

In the aggregate, EPA studies suggest that the United States would probably not suffer a large net loss in agricultural production as the result of climate change. Any benefits of climate change, however, would not be uniform. Severe changes would necessitate continued technological improvements in agriculture. The shift of growing regions northward may be impeded

"I inherited this farm from my parents, and I will pass it on to my children. I know there are uncertainties, but no scientist has told me the pollution is good for my trees."

- David Marvin
Vermont Maple Sugar Producer
Burlington Regional Hearing

by different soil conditions. The shifts in agriculture necessary to accommodate a change in climate would burden many farmers and threaten the economies and ecosystems of some agricultural regions.

At the task force's regional hearing in Burlington, Vermont, speakers expressed serious concerns over the ability of local agricultural economies to adapt to fundamentally different climates. The Vermont maple syrup industry, for example, has suffered from the combined effects of acid rain, ozone pollution, and heat stress. According to industry representatives, areas in Canada that produced no maple syrup twenty years ago are now enjoying bumper crops. It is likely that the predicted climate change will push the southern boundary of sugar maples and many other crops further northward, causing further economic disruption in northeastern agricultural communities.

Sea Level Rise

As water warms, its volume increases. Global warming in the range of most predictions could raise the ocean level from one and one-half to six feet over present levels by the year 2100, though recent estimates suggest the probable actual increase would be one to two feet.¹⁷ During the last ice age, when global temperatures were about 9 degrees Fahrenheit lower than today, sea level was more than 300 feet lower than it is now. Conversely, during the last interglacial period (100,000 years ago), when temperatures were about 2 degrees warmer than today, sea level was approximately twenty feet higher.¹⁸ Land-based glaciers, which store huge amounts of water, also influence sea level by slowly growing and shrinking. While most global warming predictions include declining glaciers, recent satellite data indicates that some glaciers are growing.

More frequent tropical storms and higher storm surges would exacerbate any increase in average sea level. While predictions suggest global warming could cause the loss of several hundred feet of shore or more, most U.S. recreational beaches are already less than 100 feet wide at high tide.

Many beaches and barrier islands could require massive adaptive efforts or face complete destruction. Flooding could increase along the

Table 3 Effect of a One-Foot Sea Level Rise

Area	Beach Erosion
Northeast to Maryland	50-100 feet
Carolinas	200 feet
Florida Coast	100-1,000 feet
Louisiana	several miles
California	200-400 feet

Note: These numbers represent averages for the coastal regions listed; local beach erosion could be considerably higher where it coincides with other erosion problems.

Source: Joel B. Smith and Dennis Tirpak, eds., *The Potential Effects of Global Climate Change on the United States*. Report to Congress (Washington, D.C.: U.S. Environmental Protection Agency, 1989), pp. 126-127.

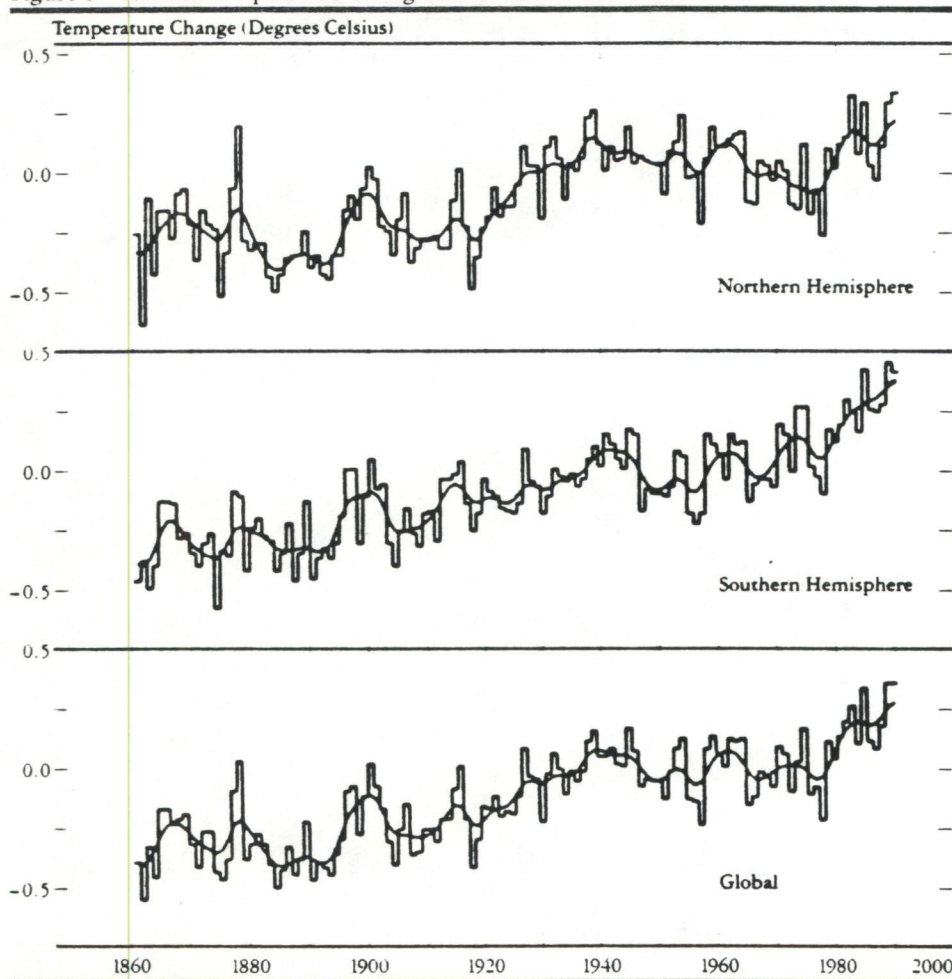
coast as higher sea levels boost storm surges, reduce coastal drainage, and raise the water table. In the face of a three-foot sea level rise, EPA estimates it would cost \$73 billion to \$111 billion to protect barrier islands and developed mainlands through 2100.¹⁹ This estimate measures only the cost of shore protection. The financial losses of coastal industries such as tourism and fishing could be much higher.

A rise in sea level also would allow saltwater to infiltrate farther into rivers, bays, wetlands, and aquifers. Increased salinity has already damaged oyster harvest in the Chesapeake Bay and pressured water supplies in Florida and

New Jersey. According to EPA, a three-foot rise in sea level could eliminate up to 82 percent of continental U.S. wetlands, a crucial ecological resource.²⁰ In addition to changes in the level of the sea, some scientists predict that major changes could occur in ocean currents such as the Gulf Stream, with virtually unpredictable effects on fishing or local weather.

At a regional hearing in New Orleans, Louisiana, the task force Governors heard evidence from experts on the potential climate-related devastation in the region. In Louisiana, shorelines are already retreating at a rapid pace; climate-induced sea level rise is expected to intensify this destruction.

Figure 6 Annual Temperature Changes for Land and Ocean Areas



Source: U.S. Department of Energy. Multi-Laboratory Climate Change Committee, *Energy and Climate Change* (Chelsea, Mich.: Lewis Publishers, Inc., 1990), p. 89.

Impact on Forests

Forests are particularly sensitive to climate and rainfall. Climate change could force the southern ranges of many forests northward by hundreds of miles. Unfortunately, forest migration will probably occur too slowly to keep up with favored climate conditions, and large areas of forest could die. Temperature increases of the magnitude predicted would make forests more susceptible to fires, pest attacks, and replacement with low-value trees, grasslands, and shrubs. In addition, changes in forests could reduce their biological diversity, aquifer recharge, wildlife habitat, and recreational uses. Precipitation runoff and soil erosion could increase in many areas.²¹

Scientists at the task force meeting in Burlington discussed the implication of climate change for forest ecosystems. The intricate relationships between climate and forest growth, insect ranges, and diseases complicate predictions of forest impacts. But several scientists feared that the multitude of pressures on forests, including climate change, could cause a widespread loss of whole ranges of tree species. According to the U.S. Forest Service, valuable commercial forests stretching from Texas to Virginia have experienced declining growth in recent years. Trees have the unique ability to absorb carbon dioxide from the atmosphere as they grow. This benefit to the climate could be reduced by heat stress, which stunts tree growth and reduces carbon dioxide uptake.

"One of the most tragic consequences of global climate change will be the rise of sea level. This can be expected to cause widespread erosion and flooding of coastal areas, loss of wetlands and estuaries, and incalculable damage to buildings and structures."

• Governor Buddy Roemer
Louisiana

Effects on Biological Diversity

Unlike most other effects, the loss of a species is irreversible. Many species of plants and animals live within narrowly prescribed climate bands and may not be able to migrate or adapt quickly enough to adjust to climate changes. Reduced biological diversity could have serious implications, and untapped resources for research in agriculture, medicine, genetics, and industry could be irretrievably lost. Changes in habitat, location of wintering ground for migratory birds, and breaks in the food chain could cause ecological devastation.²²

Changes in Air Quality

Higher temperatures speed the reaction rates among chemicals in the atmosphere. As a result, the formation of ground-level ozone, which is the result of reactions of oxides of nitrogen and volatile organic compounds, would increase in many areas. Emissions of hydrocarbons, nitrogen, and sulfur oxides from human and natural sources also would increase with temperature. Under higher temperatures, sulfur and nitrogen oxides would oxidize more rapidly, increasing the formation of acid rain and snow in the atmosphere. EPA estimates that in the Midwest and Southeast, a 7 degree Fahrenheit temperature increase could triple the number of areas exceeding the National Ambient Air Quality Standards for ozone.²³

Human Health Effects

It is possible that deaths related to extreme temperatures could be increased in the summer and decreased in the winter. At present, the United States experiences more weather-related deaths during summer than in the winter months. Increases in temperature may be linked to higher infant mortality, outbreaks of malaria and Dengue fever, heart attacks, strokes, and respiratory diseases. In addition, populations and ranges of disease-spreading vectors such as mosquitoes and ticks may increase. Lung

cancer has been linked to increases in ozone levels, which are likely to increase as temperatures increase. In general, EPA reports that "unless the U.S. population becomes fully acclimated to higher temperatures, climate change will be associated with a rising number of summer deaths."²⁴

Changes in Climate Extremes

The most common prediction of global climate change is expressed in terms of average temperature, but the global average masks great variation from place to place and from season to season. In particular, summer heat waves could intensify considerably. The number of days in which an area reaches a certain temperature threshold would be greatly increased in some areas. Some predict these changes will be enough to become noticeable to the population within the next decade. For example, one study speculates that the average number of days in a year when the temperature exceeds 100 degrees could increase from three to twenty-one in Omaha, assuming a doubling of atmospheric carbon dioxide.²⁵ Furthermore, the changes may come in the form of sudden climate jumps rather than following a smooth curve. One study of U.S. temperatures since 1900 has shown an increase in average nighttime temperatures and little change in average daytime temperatures. The study suggests that if global climate change takes place in the form of higher nighttime temperatures, some of the biological effects would be reduced.²⁶

Meteorological Events

One of the first effects likely to be felt is an increase in weather variability from season to season and from year to year. This change could bring more frequent and intense droughts and floods. Many sectors of the economy, particularly those relying on water resources, depend on reasonably predictable rainfall patterns. In addition, the warmth of ocean water is a determinant of the strength of hurricanes. Under the global warming scenarios studied, hurricanes would become more frequent, violent, and widespread. Winter snow melts would occur earlier and rain would replace snow in some areas.²⁷

Environmental Refugees

These effects may make some parts of the world much less hospitable than at present. Increased desertification, sea level rise, or flooding could require evacuation of some areas. America's

Pacific Trust Territories, for example, could be hard pressed to support their current population due to low elevation and susceptibility to damage from tropical storms. Indeed, some nations, especially low-lying or island countries, could cease to exist if sea level rises as much as some have predicted. These changes could result in an international flood of environmental refugees — people fleeing not from political or economic systems, but from ecological disaster.

Other Effects

Urban infrastructures may well be affected by increasing temperatures. The net effect is difficult to predict; some cities might have lower snow removal and street repair costs but higher air conditioning costs, for example. During the heat wave of 1988, Amtrak was forced to close major sections of track as a result of heat damage that warped the rails.²⁸ Annual costs of new electric facilities needed to meet increased demand from climatic changes could reach \$3 billion to \$6 billion by 2010. Climatic change could add between \$33 billion and \$73 billion to capital costs in this sector by 2055, depending on GNP growth, according to EPA.²⁹

In addition to these effects, many other unanticipated effects could take place. The predictions outlined above cannot be considered immutable; they indicate the adaptation and displacement that may be necessary to cope with significant climate change. In some cases, such as species loss, the damage would be permanent. Other changes, such as agricultural effects, could require a massive restructuring.

Climate change in the range predicted by most models would place the earth's temperature at its highest point since humans appeared on earth.³⁰ The effects on climate-sensitive ecosystems and human activities would be unprecedented.

"Every generation owes a sacred trust to the future that requires us to pass to succeeding generations the planet itself, unbroken and unspoiled. We do not own the earth; rather, we are its stewards."

• Governor Madeleine M. Kunin
Vermont

DEVELOP AN INTERNATIONAL AGREEMENT TO PROTECT THE ATMOSPHERE

All nations will be affected by global climate change, and the challenge it poses cannot be met by the United States alone. Indeed, unilateral American efforts to respond to the threat of climate change will be seriously devalued if other countries do not also take action. Projections of population growth, energy use, and land-use indicate that emissions from developing countries are likely to increase rapidly and to overshadow America's emissions in the future. According to EPA predictions, energy consumption in developing nations could increase by a factor of 2.5 to 4 by the year 2025, and it could account for the bulk of the carbon dioxide emitted to the atmosphere by the year 2050.³¹ At the same time, many developing nations lack the capacity to adapt to climate change and to minimize their contribution to greenhouse gas buildup because they lack the resources and technologies they need for "clean" economic growth. Affluent nations will need to make financial and technological assistance available to developing countries in return for specific commitments to an environmentally sustainable development path. There are several necessary steps:

- The United States must assert its leadership within the international community to negotiate at the earliest possible date an international framework convention that ensures

"All nations are implicated in the prospect of global climate change, and the United States should not act alone to address the problem. The United States as a major market must require equal efforts in alleviating global warming from countries with which it trades. A coordinated international effort is needed, so that all nations contribute equitably."

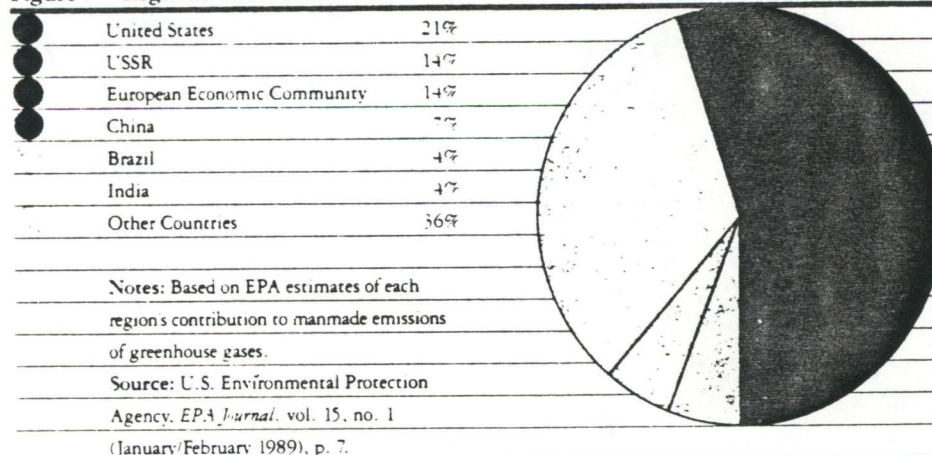
- Governor George A. Sinner
North Dakota

international cooperation to protect the atmosphere.

- Individual protocols or treaties containing specific commitments from all nations on greenhouse gases, energy efficiency, population growth, and other items should be negotiated as soon as possible.
- Agreements to stop deforestation of the earth's tropical belt should be given high priority.

While forestry programs are promising for the United States' response to global climate change, they are particularly applicable to the developing world. Numerous interrelated social and economic pressures have led to widespread deforestation in Latin American, Africa, and Asia. Population growth has required more land for agriculture and livestock. In debt-strained nations, the valuable agricultural commodities and forest products derived from cleared tropical forests provide much-needed foreign currency. In some countries, the need for fuel wood, often the primary energy source, has required the population to exploit every possible wood source. These pressures have led to widespread clearing of forests in the tropics: each year at least 27.5 million acres are lost, an area roughly the size of Illinois.³²

Figure 7 Regional Contributions to the Greenhouse Effect in the 1980s



UTILIZE COST-EFFECTIVE ENERGY CONSERVATION AND EFFICIENCY MEASURES TO STABILIZE U.S. EMISSIONS OF CARBON DIOXIDE

Meeting the challenge of global climate change will require cooperative action by the states, the federal government, and the private sector. A number of steps that would help minimize the rate and magnitude of global climate change are cost-effective and meritorious regardless of their climate benefits, and should be taken now. These steps include:

- reforming the regulation of electric utilities;
- improving building energy efficiency standards;
- improving appliance efficiency standards;
- improving transportation energy efficiency; and
- expanding state government energy efficiency programs.

Improving energy efficiency is the most effective and immediate step to minimize global climate change. Measures to improve energy efficiency

"Improving energy efficiency is the single most important thing we can do to protect the global climate. Using energy more wisely will save consumers money as well as enhance the environment."

- Governor Mario M. Cuomo
New York

can be put in place over a relatively short period. Benefits can be realized immediately. Moreover, a wealth of opportunities are available for cost-effective energy efficiency improvements in the American economy and worldwide. For efficiency investments that pay for themselves over the life of the equipment through reduced energy costs, the accompanying reduction in carbon dioxide emissions is essentially a cost-free by-product of a more efficient economy. Efficiency improvements also can reduce emissions of other pollutants, improve economic competitiveness, and enhance U.S. environmental quality, energy independence, national security, and public health.

The energy decisions made in the next decade will have a major bearing on the environmental quality of this nation in the next century and beyond. While the federal government has a critical role to play, states are the primary mechanism for influencing and implementing energy efficiency policy objectives. At the same time, the federal and state partnership in meeting the nation's energy and environmental goals must be strengthened.

More specifically, states and the federal government should pursue energy policy options that not only are prudent, cost-effective, and practical, but also have the potential for playing a key role in minimizing carbon dioxide emissions.

Figure 8 U.S. Carbon Dioxide Emissions by Sector

● Utilities	35%
● Transportation	32%
● Manufacturing	20%
● Residential Commercial	13%

Note: Active carbon dioxide emissions by agriculture are excluded because they are small and associated with transportation.

Source: U.S. Department of Energy, Office of Environmental Analysis, *A Compendium of Options for Government Policy to Encourage Private Sector Responses to Potential Climate Changes*, vol. 1 (Washington, D.C.: U.S. Department of Energy, 1989), p. 2.6.

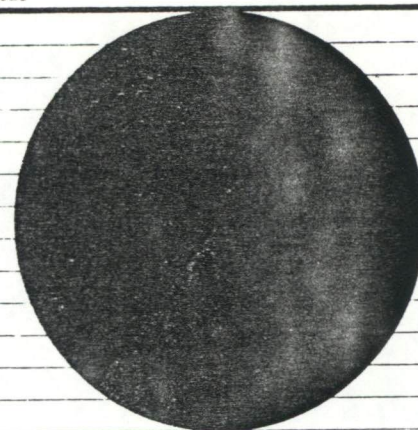


Table 4 Annual U.S. Carbon Dioxide Emissions Per Capita

Activities		Emissions (in equiv. lb. of CO ₂)
Residential	Appliances	3,100
	Space heating	3,000
	Water heating	1,200
	Air conditioning	660
Transportation	Automobiles	6,400
	Air travel	1,100
	Rail (freight and passenger)	350
	Buses	110
	Bicycles	approx. 0
	Other (incl. trucks, boats, pipelines, military, and off-road)	6,600
Industrial & Commercial		21,600
Total		44,000

Source: The National Audubon Society, "The Audubon Activist Carbon Dioxide Diet" (New York, N.Y.: The National Audubon Society, 1990).

STRATEGY: Promote Utility Regulatory Reform. States, through their public utility commissions, have the primary authority to regulate and affect the ability of electric and gas utilities to improve the efficiency of electricity and natural gas use. Several specific tools available to states can encourage improvements in the generation and use of electricity and natural gas, including least-cost planning and rate design reform.

Integrated Resource Planning for Energy. Integrated resource planning (least-cost planning) focuses on meeting a state's future energy needs at the lowest possible cost considering all factors. Using this process, utilities identify and implement all practicable and cost-effective efficiency opportunities that meet energy needs. If utilities need additional supply, they may purchase them at auctions either from independent energy service companies, who may be able to find unexploited energy efficiency opportunities, or from independent power producers offering new electricity generation projects. In a fully developed and integrated competitive bidding system, the environmental benefits and costs of energy efficiency should be explicitly considered in ranking bids for new capacity. New York, Vermont, and several other states are now implementing competitive bidding systems that account for external environmental costs in the evaluation of alternative energy supply systems. Currently, seventeen states have approved utility bidding programs, while eight states are reviewing the option.

Utility energy requirements can be met by a combination of sources, including energy efficiency and demand-side management programs. The Edison Electric Institute (EEI) estimates that nationwide since 1977 electric utilities have increased the number of energy efficiency and demand-side management programs by nearly tenfold, from more than 130 programs to nearly 1,300 programs today. EEI estimates that these programs have deferred the need for investing more than \$21 billion on new electric generating capacity. The best electric utility demand-side management programs in the country are reducing customer electricity use by 10 to 30 percent (depending on end-use and building type), and are reducing utility peak load growth by up to 5 percent at an estimated cost of less than four cents per kilowatt-hour.³³ The EEI estimates that by the year 2000, savings from such efficiency programs will exceed 45,000 megawatts of capacity and \$45 billion in investment.

The importance of using integrated resource management to meet the nation's future electricity needs is underscored by the increasing importance of electricity in America's energy supply mix. Electricity currently accounts for 37 percent of U.S. energy use. Although total U.S. energy use has risen by less than 7 percent since 1972, electricity use has increased by 55 percent, and electric utilities currently account for about one-third of U.S. carbon dioxide emissions.³⁴ Because a typical power plant converts fossil fuel to electricity with about 33 percent efficiency, an improvement in electricity end-use efficiency will yield a threefold reduction in carbon dioxide.³⁵

Another series of promising efficiency improvements increases the efficiency of existing power plants by actions ranging from increased maintenance to "repowering" (i.e., replacing a major portion of an existing plant, such as the boiler, while retaining other portions of the plant, such as the steam generation equipment). A repowered plant using new boiler technology can significantly increase its efficiency.

Rate Design Reform

Utilities traditionally generate revenue by selling energy supplies. To successfully use utility demand-side management and efficiency to meet environmental goals and future load growth, the utility's current disincentive to saving energy must be removed. States can begin to reconcile shareholder and ratepayer interests by giving utilities proper incentives to implement programs that improve the efficient use of energy by all ratepayer classes. This can ensure that it is as profitable for utilities to save energy as it is to develop new supplies. The options include:

- breaking the link between utility sales and profits so that utility profits do not fall in lockstep with conservation and efficiency improvements;
- allowing rate-basing and incentive rates of return for utility investments in customer conservation measures;
- encouraging financial incentives in the form of equipment rebates, low-cost loans, or shared savings arrangements to all classes of customers; and
- offering energy audits and technical assistance to homeowners, businesses, and industries.

STRATEGY: Improve Building Energy Efficiency Standards. The residential, commercial, and industrial sectors are estimated to contribute more than 35 percent of the nation's carbon dioxide emissions. This figure climbs to 50 percent if electricity use in these sectors is included. Significant potential exists to improve the efficiency of buildings through efficiency measures aimed at lighting, heating, cooling, ventilation, and building envelopes. The tools available to states include building codes, loans for conservation investments, and mortgage subsidies for energy-efficient buildings.

A number of states have documented significant energy and carbon dioxide savings from building energy efficiency programs. The Illinois Home Energy Loan Program, for example, provided grants and low-interest loans for home energy efficiency improvements and reduced the average heating bill by 22 percent for participating homes. This program resulted in an average reduction of more than one and one-half tons of carbon dioxide annually from each home. Vermont offers technical assistance through its Industrial Energy Conservation Advisory Program and estimates its program has resulted in a 20 percent saving in fossil fuels and a 10 percent saving in electricity use in more than 700 industries visited since 1980. This program has reduced annual carbon dioxide by an estimated 3,600 tons.

One of the more ambitious energy-efficient home programs in the nation is operated in the Pacific Northwest, through the Northwest Power Planning Council, the Bonneville Power Administration, state governments in Washington, Oregon, Idaho, and Montana, and northwest utilities. The Super Good Cents Program, a private-public partnership between government and utilities, certified more than

6,000 energy-efficient homes last year. The states and utilities have provided training for builders, consumers, lenders, appraisers, and realtors to build the infrastructure necessary to increase energy efficiency throughout the region. Utilities within the Northwest have also paid a portion of the incremental cost of building to the high standards to guarantee that new homes use cost-effective energy efficiency measures.

In 1989 Iowa saved more than \$1 million in fuel costs and nearly 40,000 tons of carbon dioxide from state buildings as the result of its building energy management program. The state operates a similar program for schools and institutions. The state of Washington has had a residential building energy efficiency code since 1977, and the latest standards include insulation specifications by fuel type for the state's two climate regions. These standards have reduced annual space heating by approximately 60 percent in homes heated with electricity and 43 percent in homes heated with natural gas. In partnership with the federal government, states should establish an aggressive model building efficiency code and

"Many practical opportunities exist for states to reduce the risk of climate change. Such actions make sense for a host of environmental reasons and set the stage for a safer and more productive future."

• Governor Steve Cowper
Alaska

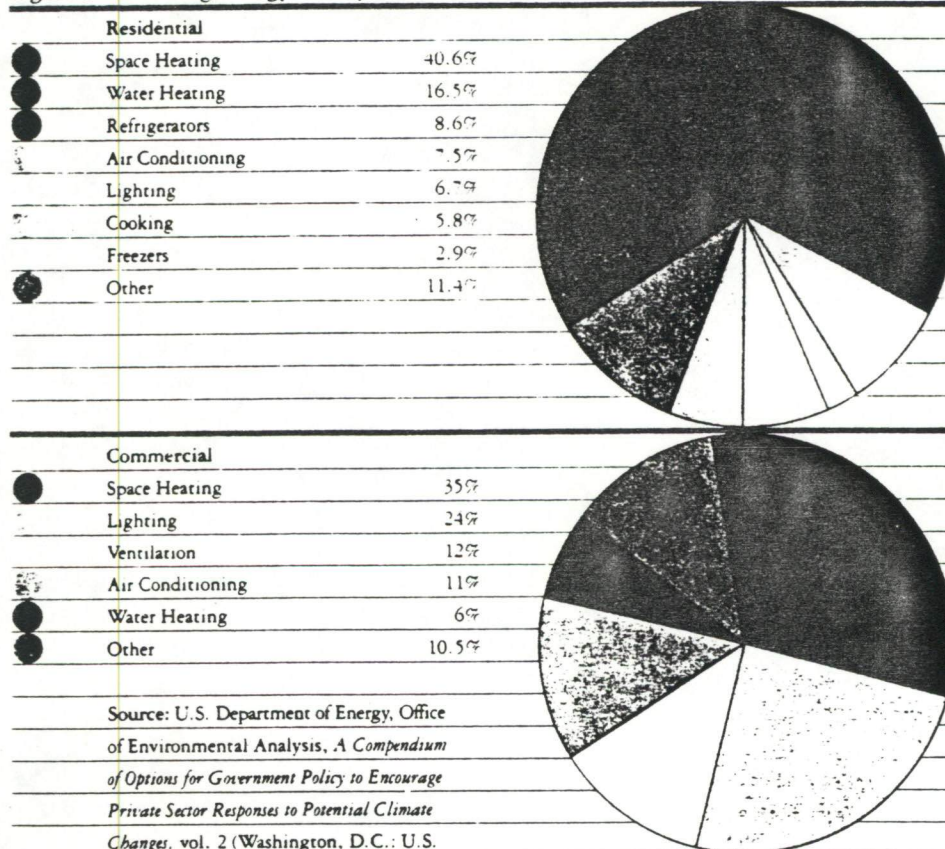
urge its adoption and enforcement in all jurisdictions throughout the country where no such standards currently exist.

STRATEGY: Improve and Adopt Appliance Efficiency Standards. Similarly, states and the federal government should pursue the potential for improving the efficiency of appliances, lighting, and electric motors. States and the federal government could act in concert to build on the National Appliance Energy Conservation Act (NAECA) and the U.S. Department of Energy's recent rules on refrigerators and freezers to implement more stringent national standards for fluorescent and incandescent lamps and fixtures.

Lighting accounts for 20 percent of the electricity used in United States—25 percent if air conditioning and ventilation needed to remove heat from inefficient lights is included.⁴⁶ Using currently available high-efficiency lighting technology could cut the amount of electricity used for lighting by 50 to 92 percent.⁴⁷ Dramatic improvements also have been made in the efficiency of electric motors, which are estimated to account for more than 60 percent of all electrical consumption in the commercial and industrial sectors. Adopting minimum motor efficiency standards for new and replacement motors could result in significant electricity savings. These efficiency gains also cut carbon emissions significantly by reducing the need for electricity generation.

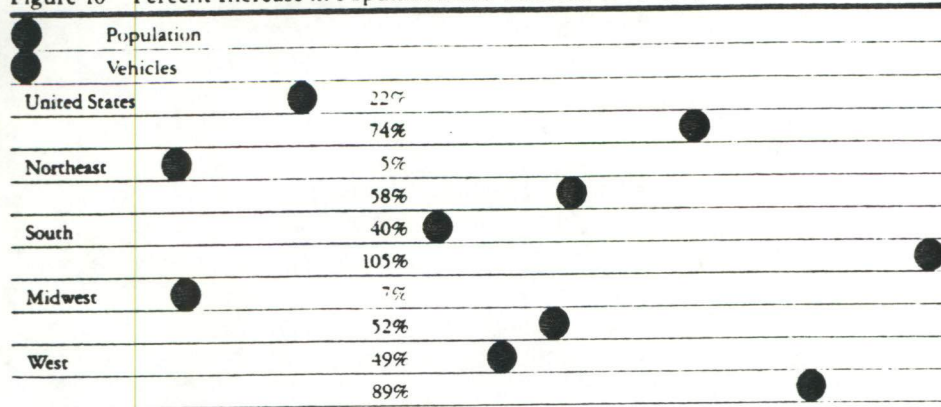
STRATEGY: Improve Transportation Efficiency. The nation's transportation sector contributes nearly one-third of the nation's carbon emissions. Although much of our transportation policy is established at the federal level through the corporate average fuel economy (CAFE) standards and federal excise taxes, states also can improve the efficiency of the transportation sector through such measures as gas guzzler taxes on automobiles, carpool

Figure 9 Building Energy Use by End-Use Function and Fuel Type, 1984



Source: U.S. Department of Energy, Office of Environmental Analysis, *A Compendium of Options for Government Policy to Encourage Private Sector Responses to Potential Climate Changes*, vol. 2 (Washington, D.C.: U.S. Department of Energy, 1989), p. 11.8.

Figure 10 Percent Increase in Population and Vehicles, 1970-1989



Source: Population Reference Bureau, Inc., "America in the 21st Century: Environmental Concerns"

(Washington, D.C.: Population Reference Bureau, 1990), p. 6.

Table 5 Carbon Dioxide Emissions for Various Transportation Modes

	Amount of Carbon Dioxide Released (in pounds per mile)
Automobile	1.15
Air travel	0.9
Bus (urban)	0.7
Bus (intercity)	0.2
Railway or Subway	0.6

Note: Figure for automobiles assumes a fleetwide average fuel economy of 19 miles per gallon.

Source: The National Audubon Society, "The Audubon Activist Carbon Dioxide Diet" (New York, N.Y.: The National Audubon Society, 1990).

requirements, promotion of alternative automotive fuels, mass transit improvements, and control of traffic patterns. All potential alternative fuels, including ethanol, methanol, compressed natural gas, electricity, and reformulated gasoline, should be fairly considered.

The imperative to improve transportation efficiency is particularly compelling in urban areas. Many such areas are already suffering from the pressures of congestion and air pollution from mobile sources. At current rates of population and GNP growth, the Federal Highway Administration estimates that vehicular miles traveled will increase by 70 to 140 percent by the year 2020.³⁹ Counteracting this trend, and the automotive emissions associated with it, will be a formidable challenge to policymakers.

To date, efforts to control growth in vehicular miles traveled have resulted in modest reductions in transportation growth rates. Most programs have focused on commuters, who account for 30 percent of all miles. An estimated 20 percent of all commuters carpoolled in 1983, resulting in a 4 percent reduction in trans-

portation energy use.⁴⁰ Consumer preferences in transportation are strongly motivated by fuel costs and the high value placed on privacy. By making carpooling more appealing through high-occupancy vehicle benefits and other incentives, commuters can be encouraged to reduce both vehicular miles traveled and greenhouse gas emissions associated with transportation.

The task force recommends a multifaceted approach to improve transportation efficiency:

- The federal government should increase the corporate average fuel economy beyond the current standard of 27.5 miles per gallon. The technology to improve fuel efficiency has already been developed by both domestic and foreign automakers. Some of these prototypes have achieved efficiencies of more than 100 miles per gallon, without compromising vehicle interior space, comfort, and safety.⁴¹
- All levels of government should encourage the use of transportation modes that release less carbon dioxide. Depending on their energy source, electric-powered subway and rail systems

result in significant carbon dioxide savings while reducing congestion and air pollution. On average, switching from automobiles to subways reduces carbon dioxide emission per mile traveled by about half.

- Telecommuting holds great potential for energy savings, by allowing greater work at home via personal computers and modems and reducing travel between home and office. A major pilot program is now underway in the state of Washington, where rapid urban growth in the Puget Sound area has caused substantial traffic congestion. The telecommunications program will document motor fuel savings as well as employer/employee benefits and problems.
 - Government should encourage increased utilization of ride sharing and high-occupancy vehicle lanes, especially where public transit is not practical. These programs limit the number of cars on the road and can reduce carbon dioxide emissions as well as pollutants responsible for ozone pollution.
- STRATEGY: Expand State Government Energy Efficiency Programs.** States play a critical role in delivering objective energy information, technical assistance, and financial incentives to improve energy efficiency. State energy efficiency programs target all end-users and all fuel forms. State strategies that improve energy efficiency and also reduce air emissions include the following:
- providing financial incentives or rebates to improve the efficiency of appliances and residential furnaces and boilers;
 - developing energy rating systems for new housing to provide consumers with objective energy efficiency information;
 - implementing energy audit programs for small and medium-sized commercial and industrial facilities;
 - establishing financial incentive programs to provide lower cost financing, through interest breaks or principal reduction, for implementing energy efficiency improvements in commercial, industrial, agricultural, and multifamily housing facilities; and
 - stimulating the increased use of state-of-the-art solar designs and renewable resources in home and business design and construction.

States currently operate a range of programs from energy hotlines to energy audits and lower cost financing for implementing identified energy efficiency measures. For example, Georgia operates two programs designed to help agricultural producers save energy. The program aimed at irrigation saves farmers more than \$3.5 million annually, while eliminating 50,000 tons of carbon dioxide, at a cost of about one dollar per ton. Georgia also has developed a program for dairy farmers, using the "waste" heat in fresh milk to heat wash water in the dairy. It takes about two years for the average dairy to recoup costs through energy cost savings.

Among other energy programs, Pennsylvania has developed a research project aimed at demonstrating advanced weatherization technologies in the homes of low-income families. The project has demonstrated energy savings averaging 29 million Btu's per household—or about 34 tons of carbon dioxide per household if operated over twenty years—at a negative cost of about forty dollars per ton. The carbon dioxide reduction itself has a negative cost because the energy savings in the home more than pays for the weatherization services at current energy prices.

New York's national award-winning Energy Advisory Service to Industry provides free on-site energy surveys to small and medium-sized commercial and industrial firms throughout the state. To date, more than 8,500 audits have been performed. They are estimated to have saved more than 4 million gallons of oil, 14.3 million therms of natural gas, and more than 600 million kilowatt-hours of electricity. These savings translate into annual emissions reductions of more than 5,700 tons of sulfur dioxide, 1,400 tons of oxides of nitrogen, and nearly 700,000 tons of carbon dioxide.

In recent years, states have used petroleum overcharge recovery funds to implement the most aggressive energy efficiency programs in this nation's history. Unfortunately, the federal government has not maintained its support for state energy programs. The federal government should encourage state energy efficiency initiatives through increased emphasis and financial support to further tap the vast potential for energy efficiency improvements. Petroleum overcharge funds are diminishing at a time when the environmental dividends of energy efficiency are most needed.

G O A L ③

STOP PRODUCTION OF AND RECYCLE CHLOROFLUORO- CARBONS AND USE COST-EFFECTIVE MEASURES TO STABILIZE OR REDUCE OTHER GREENHOUSE GASES

Carbon dioxide accounts for about half of all greenhouse gases from human sources, and it has been the focus of much of the global warming controversy. However, any climate stabilization strategy must consider other climate-altering gases as well. In cases where controlling these other gases is not immediately feasible, further research is crucial. There are several important steps that should be taken as expeditiously as possible.

STRATEGY: Phase Out Chlorofluorocarbons. Chlorofluorocarbons are the strongest greenhouse gases on a per molecule basis and have been linked to stratospheric ozone depletion. With atmospheric life spans of up to hundreds of years, chlorofluorocarbons released into the atmosphere today will be trapping heat well into the future. Despite the ban on "nonessential" chlorofluorocarbon uses, U.S. emissions have grown rapidly over the last several years. Efforts to phase out the use of chlorofluorocarbons by the year 2000 or sooner have begun under the auspices of the Montreal Protocol. These negotiations mark a milestone in international environmental law and may serve as a model in future international negotiations on other greenhouse gases. The federal government should seek an international agreement phasing out chlorofluorocarbons at the earliest possible date and requiring the recapture and recycling of those currently in use. Improper disposal can have very destructive effects. An auto air conditioner, for example, contains the chlorofluorocarbon equivalent of 17,500 pounds of carbon dioxide if released

to the atmosphere. The average car emits the equivalent of 2,600 pounds annually through use, leakage, and servicing.⁴¹ In New Jersey, state fleet vehicles are required to recycle their automotive chlorofluorocarbons. Hawaii, Vermont, and Wisconsin are phasing out all chlorofluorocarbon-based auto air conditioners statewide and are requiring the recapture and recycling of existing chlorofluorocarbons.

STRATEGY: Recover Methane for Energy Use. When organic matter decays in oxygen-deprived conditions, methane is produced. Methane from waste can be captured and used to produce heat and electricity. Methane from landfills accounts for 3 percent of global methane emissions. This share is expected to increase significantly in the future. According to EPA, each ton of municipal solid waste produces between 1,000 and 7,000 cubic feet of methane.⁴² The United States generates approximately 148 million tons of municipal solid waste annually, enough to produce between 148 billion and 1,036 billion cubic feet of methane. About 17 percent of all municipal solid waste landfills recover, vent, or flare methane. Less than 2 percent of landfills recover the gas for energy use. EPA reports that the methane resource from landfills is equivalent to 1 percent of the nation's annual energy needs.⁴³

Coal seams are responsible for 3 to 10 percent of annual methane emissions.⁴⁴ Before the development of methane recovery technology, the gas was usually vented to the surface using high-powered fans. Today, recovery of methane from this source has become an economically viable alternative to atmospheric release. Energy companies are capturing the methane for use as natural gas. The Colorado School of Mines estimates that 95 trillion cubic feet of methane are economically recoverable from this source, more than four times the amount of natural gas

consumed annually in the United States. Federal tax credits have encouraged energy companies to capture methane from their coal seams.⁴⁵

STRATEGY: Expand Research into Animal Diets that Reduce Methane. In their digestive process, cows and other ruminants convert plant fiber into usable animal products. This process also accounts for 13 to 20 percent of the methane emitted annually.⁴⁶ With the cattle population growing at more than 1 percent annually, ruminant animals will continue to be a significant methane source in the future. Increasing the productivity of livestock decreases the amount of methane produced per unit of animal product. Livestock diets also can influence the amount of methane produced per animal.

STRATEGY: Improve the Efficiency of Fertilizer Application. Measurements of nitrous oxide in the atmosphere suggest that its sources are widely variable; furthermore, they are not all identified. Nitrogenous fertilizer use in agricultural crop production appears to be a major anthropogenic source and probably has the most potential for control. Use of this fertilizer is growing 1.3 percent annually in industrialized countries and 4.1 percent in developing countries.⁴⁷ In addition to its effects on atmospheric concentrations of nitrous oxide, increased fertilizer usage can degrade water quality. According to EPA, these emissions can be reduced by improving the efficiency of fertilizer application and using advanced fertilizers that inhibit nitrous oxide. These methods derive more fertilization benefits from a smaller amount of fertilizer, while reducing the associated nitrous oxide releases and increasing the farmer's profit margin. Through their departments of agriculture and agriculture extension services, states can encourage more efficient and environmentally sensitive use of fertilizers.

Table 6 Annual U.S. Releases of CFCs Per Capita from Use, Leakage, and Servicing

Item	Emissions (in equiv. lb of CO ₂)
Mobile air conditioners	2,600
Rigid plastic foam (insulation for walls)	1,800
Flexible plastic foam (seat cushions, car seats, packing material)	370
Residential refrigeration	110
Other (including retail refrigeration, building air conditioning, solvent cleaning, halon fire extinguishers)	6,200
Total	11,000

Source: The National Audubon Society, "The Audubon Activist Carbon Dioxide Diet" (New York, N.Y.: The National Audubon Society, 1990).

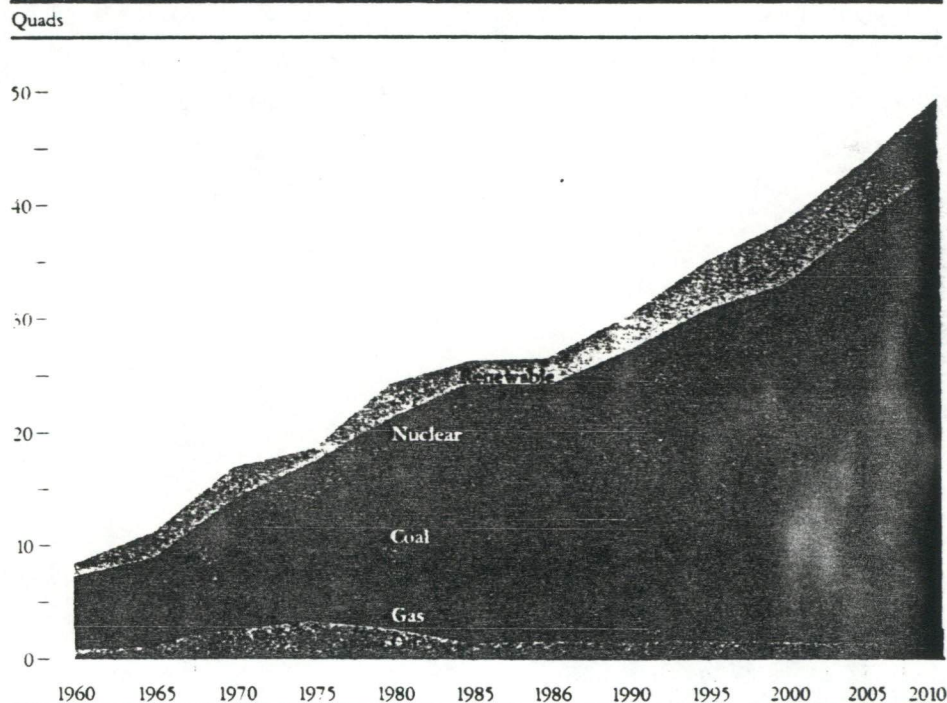
DEVELOP AND COMMERCIALIZE ALTERNATIVE ENERGY SYSTEMS, INCLUDING CLEAN FOSSIL, RENEWABLE ENERGY SOURCES, AND SAFE NUCLEAR POWER

Fossil fuels have been crucial in the development of the industrial age. The history of the industrial economies is one of increasingly intense energy use, as power substituted for labor as a factor of production. In recent decades, however, problems associated with the pollution inherent in energy use have become apparent. Cleaner energy for transportation and cleaner electric power generation are especially critical.

The nation is becoming increasingly electrified, and according to the U.S. Department of Energy, at least 77 gigawatts of new generating capacity will be needed by the year 2000, in addition to the 75 gigawatts already planned or under construction.⁴⁸ The use of alternative energy technologies can allow the country to meet this demand for electricity while minimizing carbon dioxide emissions. States have powerful tools available to affect the choice of generating technologies, including electric utility regulation, technology incubation and transfer programs, and tax incentives. Alternative sources for electricity generation include:

- cleaner coal and other fossil fuel technologies;
- cogeneration;
- solar energy;
- wind power;
- geothermal energy;
- biomass;
- hydroelectricity; and
- nuclear power.

Figure 11 Electricity Generation by Fuel Type



Note: Includes electricity generated by utilities and non-utilities.

Source: U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook—Long-Term Projections* (Washington, D.C.: U.S. Department of Energy, 1990), p. 45.

From a historical perspective, the mix of fossil-fired electric power generation in the United States in 1986 produced an average of 87.4 metric tons of carbon dioxide per gigawatt-hour, compared with 18 metric tons of carbon dioxide per gigawatt-hour for renewable energy technologies (solar, geothermal, wind, biomass, and hydropower). Renewable sources, primarily hydroelectricity, contributed about 11 percent of U.S. electric power generation in 1988. According to one DOE study, based on "conservative estimates of future energy use and renewable energy contribution," renewable energy technologies could displace 519 million tons of carbon dioxide (18 percent) in 2010, compared with an equivalent electric output from fossil-fired power facilities.⁴⁹

STRATEGY: Utilize Cleaner Coal Combustion Technologies. The United States has extensive coal reserves—almost 29 percent of the estimated global recoverable reserves—and cannot forego coal's contribution to the nation's energy supply. The only presently available technological option for removing carbon dioxide from conventional coal plants involves the use of scrubbers, which uses 25 to 50 percent of the plant's output of electricity to remove 90 percent of the carbon dioxide in the tail gas.⁵⁰ Moreover, the reuse or disposal of captured carbon dioxide is constrained by inadequate markets and uncertain disposal capacity. These considerations make carbon dioxide recapture infeasible at the present time.

There are several near-term options for the cleaner use of coal in electrical generation, including pressurized fluidized bed combustion and integrated gasification combined cycle technologies. Development of these technologies has been progressing rapidly, and many are on the market today. Because they are more efficient than conventional coal technologies, they use less coal and produce less carbon dioxide for a given electricity output. It is expected that carbon dioxide reductions of 10 to 20 percent are possible, compared

"The nation—and the world—needs a major investment in the development and use of clean fuels and energy technologies, not just out of respect for the global climate, but because of the energy security and other benefits it will bring."

• Governor Henry Bellmon
Oklahoma

with conventional technologies.⁵¹ These systems also control sulfur dioxide, oxides of nitrogen, and other pollutants more effectively.

In the longer run, even more efficient coal use is expected to be available through coal-based fuel cells and magnetohydrodynamics. These technologies will operate with thermal efficiencies of 45 to 60 percent, reducing carbon dioxide emissions 25 percent or more, compared with today's emission levels.⁵²

STRATEGY: Promote Cogeneration of Electricity and Heat. Another way to use fossil energy more effectively is to cogenerate electricity and heat. Most older power plants waste the heat remaining in their steam after it has passed through the turbines. Frequently those who generate steam for process purposes waste the opportunity to produce electricity as well. Cogeneration ties steam and electricity production together. At Iowa State University, for example, the central heating plant generates power for the university with a coal-fired steam turbine, then uses the spent "extraction steam" to heat campus buildings, drive steam chillers that produce 22,000 gallons of 40 degree water per minute used for cooling purposes, and compress air for university applications. Because so little heat is wasted, the plant is about 50 percent more efficient than a conventional power plant, and saves the institution some \$600,000 annually in fuel costs.

The Public Utilities Regulatory Policies Act (PURPA) encourages cogeneration by requiring utilities to buy power from small producers in order to avoid costs of building new capacity. Of the 62,000 megawatts that qualified for PURPA benefits from 1980 to 1987, almost three-fourths came from cogeneration.⁵³

STRATEGY: Utilize Solar Energy. Solar energy is perhaps the most familiar of the renewable energy resources developed in the 1970s. While virtually any region with normal sun exposure can benefit from solar energy applications, development of this source has been concentrated in the Southwest. No longer limited to simple pool heaters or small consumer electronics, solar energy can now provide baseload electricity to the power grid. It continues to have numerous other applications in everything from rechargeable street lights to Coast Guard buoys. Nationwide, more than 1.2 million buildings employ solar water heaters.⁵⁴ In Phoenix, a twenty-four-home subdivision of all-electric homes is powered by

"If built to their most cost-effective size, solar facilities will become economical in a much broader geographic range. I look forward to the day when clean and renewable sources of electricity will be adequate to meet the needs of many states."

• Patrick Francois
Executive Vice President
Luz International Limited
Sacramento Regional Hearing

a central photovoltaic grid-tied system. The system offsets more than 455 tons of carbon dioxide each year.

Photovoltaic cells are semiconductors that convert the energy of the sun directly into electricity. The task force toured a Sacramento research facility that produces about 20 kilowatts of photovoltaic power. Photovoltaic electricity still costs more than conventional power, but enormous technological advances have been made in recent years and the signs are encouraging that costs may decrease. Even with reductions in federal research support, photovoltaic prices have dropped to one-fortieth of their 1978 level.⁵⁵ At current prices, photovoltaic electricity is competitive in several niche markets including rural water irrigation, lighting, and communications.

In a solar thermal electric generating system, an array of mirrored solar collectors focus the rays of the sun onto a receiver, which heats a liquid, driving a turbine to produce electricity. The Luz facility uses this technology to produce 200 megawatts of electricity for the Southern California Edison Company at a cost of about eight cents per kilowatt-hour, competitive with conventional fossil-fueled power plants. The Department of Energy estimates that solar thermal electricity will become even more competitive by 1995. System costs for solar thermal plants would decline further if Public Utility Regulatory Policies Act regulations did not currently limit qualifying plant size to 80 megawatts, thus preventing economies of scale.⁵⁶ According to industry representatives, the entire electricity needs of Southern California Edison could be provided on as little as 1 percent of the Mojave desert. The electricity needs of Los Angeles could be provided on 150 square miles of the Mojave, an area about one-third the size of Edwards Air Force Base.⁵⁷

In the long term, solar energy also has the potential to be used as a transportation fuel through hydrogen production. Electricity generated from a solar thermal or photovoltaic plant can be used to divide water into hydrogen and oxygen through electrolysis. The hydrogen can then be burned as a transportation fuel. The only by-products of hydrogen combustion are water vapor and a small amount of oxides of nitrogen, which is easily controlled.⁵⁸ Currently, storage and transport limitations restrict the practicality of solar hydrogen. With continued research into solar power, fuel cells, battery technology, and storage systems, solar hydrogen could provide a substantial portion of transportation fuel while reducing carbon dioxide and air pollutant emissions.

STRATEGY: Utilize Wind Power. Wind turbines have been used for centuries to grind grain and pump water, but it was not until the 1970s that modern wind power came into being. The tax credits available in the late 1970s and early 1980s rushed wind power into the marketplace, sometimes without sufficient testing. In California, the incentives for utilities to use wind power were particularly great; key factors included a 15 percent federal energy tax credit, 10 percent federal investment tax credit, and 50 percent California state energy credit.⁵⁹

Part of the appeal of wind power is its simplicity: blades are mounted on a tower along a horizontal or vertical axis, which turns a generator to produce electricity. The amount of power produced depends primarily on the efficiency of the generator and the wind speed at the location. The environmental impact of wind energy is minimal; the most serious is sight pollution from large-scale "wind farms." In most cases, wind systems do not preclude other land uses. Prime wind sites in the San Geronio Pass, for example, produce between \$8,000 and \$12,000 of electricity per acre in addition to the income the land earns for cattle grazing. By comparison, prime farmland planted in corn produces about \$400 per acre per year.⁶⁰ Many of the advances that have brought wind power into the modern age have relied on lightweight materials and new designs for rotors. Future research should be directed at harnessing wind from medium- and low-wind sites in order to make more use of this energy source in more regions.

Figure 12 Geothermal Power Generation Capacity in the United States, 1975-1989

	Amount in Megawatts (Year-End Total in Net Megawatts Electricity)
1975	502
1976	502
1977	502
1978	502
1979	665
1980	926
1981	929
1982	1049
1983	1336
1984	1447
1985	1836
1986	1970
1987	2006
1988	2373
1989	2698

Source: Renew America, *Sustainable Energy* (Washington, D.C.: Renew America, 1989), p. 31.

Although the industry has suffered somewhat with the end of the tax credits in 1986, wind power can produce electricity at rates comparable with conventional energy sources. Advanced wind generators are currently producing 2 billion kilowatt-hours of electricity at a cost of seven to nine cents per kilowatt-hour. The next generation of wind power is expected to reduce costs even further. This installed wind energy offsets 11 million pounds of air pollutants and 304,000 tons of carbon annually.⁶¹ With improvements in engineering and siting, wind turbines have become highly reliable, achieving an average availability of 95 to 98 percent. Operation and maintenance costs average 1.2 cents per kilowatt-hour compared with 2.2 cents per kilowatt-hour for coal and 2.0 cents per kilowatt-hour for nuclear power plants.

As with most renewable energy sources, growth of the wind energy market is limited by the current low costs of fossil fuels. Oregon State University concluded that the Pacific Northwest could produce 19,000 megawatts of energy from wind systems.⁶² Since the region already has adequate existing power plants, however, wind energy has not been integrated into the region's energy system. With continued improvements in the technology, some studies indicate that wind energy could provide a significant portion of the U.S. energy needs.

STRATEGY: Utilize Geothermal Energy. Using the earth's heat, geothermal resources provide an opportunity in some areas to provide very inexpensive power virtually free of air

emissions. Moreover, the resource is renewable, at least for several thousand years. In some areas on the West Coast, geothermal electricity is being generated at costs that are actually lower than baseload costs at coal-fired power plants. The U.S. Department of Energy has estimated that the United States has about 1.2 million quads of technically recoverable geothermal resources.⁶³ Unlike other renewable energy sources, the technology to tap geothermal energy is largely developed and ready to be used. Since 1968, U.S. geothermal power capacity has grown from 78 megawatts to nearly 2,700 megawatts. Geothermal energy does not rely on wind, sunlight, or other unpredictable variables, and has earned a reputation for high reliability. Applications exist to use both medium- and high-temperature geothermal resources. In several areas in the world, geothermal is the largest source of residential heating.⁶⁴

STRATEGY: Develop Biomass Fuels. Biomass—essentially wood and plant products—is the oldest and most extensively used form of renewable energy. Before the development of coal and other fossil fuel resources, wood was the energy source of choice in the world. Currently, biomass provides only about 14 percent of all energy consumed in the world, but it is the only source of energy for more than 2 billion people.⁶⁵ In the United States, biomass supplies 4 percent of all energy, more than any other renewable source.⁶⁶ Because of its diverse sources and uses, biomass is very promising.

Figure 13 Electricity Generation from Biomass Feedstocks, 1979-1989

	Installed Capacity (Megawatts)
1979	250
1981	1100
1983	1700
1985	3800
1987	5600
1989	7700

Source: National Wood Energy Association, *BioEnergy*, vol. 6, no. 5 (November-December 1989/January 1990), p. 1.

Table 7 Projected Renewable Electricity Costs

Technology	Levelized Costs (in cents per kilowatt-hour)				
	1990	2000	2010	2020	2030
Conventional Electricity	5.0	5.25	5.5	5.75	6.0
Geothermal					
— Hydrothermal	4.4	4.2	4.1	4.3	4.5
— Magma	21.9	16.8	12.6	9.4	6.0
Hydropower	5.6	5.6	5.6	5.6	5.6
Photovoltaics	30.0	15.0	9.0	6.0	5.0
Solar Thermal	8.0	7.5	5.5	4.7	4.0
Wind	8.0	5.3	4.7	4.3	4.0

Notes: Based on business-as-usual scenario, which assumes currently projected conventional energy prices and demand and federal research and development funding for renewable energy at current levels. Costs include, where appropriate, capital costs, operation and maintenance, and fuel cost. Assumes a 6.1 percent discount rate.

Source: U.S. Department of Energy, *The Potential of Renewable Energy* (Golden, Colo.: Solar Energy Research Institute, 1990).

Table 8 Alternative Energy Resources

Resource	Current Use	Current Cost	Recoverable Resource ¹
Clean coal	Under development	\$.062-.068/kWh ²	19,040 Quads ³
Cogeneration	13 GW ⁴	N/A ⁵	100 GW ⁶
Solar	.06 Quads		100 Quads
Solar Thermal		\$.08/kWh	
Photovoltaics		\$.25-.35/kWh	
Wind	.02 Quads	\$.07-.09/kWh	10-40 Quads
Geothermal	2700 MW ⁴	\$.045-.055/kWh	1.2 million Quads
Biomass	3 Quads		13-26 Quads
Wood Fired Power Plant		\$.042-.054/kWh	
Ethanol		\$1.28/gallon ⁷	
Methanol		\$0.75/gallon ⁸	
Gasoline		\$1.60/gallon ⁸	
Hydropower	3 Quads	\$.03-.06/kWh	6 Quads
Nuclear	5.7 Quads	\$.043/kWh ⁹	5,162 Quads ¹⁰

Abbreviations: kWh = kilowatt-hour GW = gigawatt MW = megawatt

Notes: 1. Amount of energy recoverable if resource is used to its fullest technical extent, regardless of cost. 2. Cost range is for atmospheric fluidized bed combustion systems and integrated gasification combined cycle systems.

Costs are based on a 300-megawatt unit located in the Midwest using 3.5 percent sulfur coal. 3. Assumes the use of all U.S. proven mineable reserves. Based on an average of 25 million tons per quad. 4. Installed capacity.

5. Cogeneration prices are widely variable. 6. Installed capacity expected by industry in 2000. 7. Current selling price for ethanol produced from corn. 8. Cost per gallon. Does not include distribution, markups, taxes, etc. For comparison, the refinery price of normal gasoline is about \$0.68 per gallon, assuming crude oil cost \$20 per barrel.

9. Includes operation, maintenance, fuel, and capital costs. 10. Assumes the use of all U.S. uranium recoverable for less than \$130 and a conversion efficiency of 33 percent, which yields 3,800 kilowatt-hours per gram.

Sources: National Coal Association, 1990; U.S. Council on Environmental Quality, 1981; Atomic Industrial Forum, 1985; World Resources Institute, 1989; Renew America, 1989; U.S. Department of Energy, 1990; Union of Concerned Scientists, 1990; U.S. Environmental Protection Agency, 1989.

In terms of impact on global climate and other environmental problems, biomass can have a positive effect if managed responsibly. During photosynthesis, plants absorb carbon dioxide from the atmosphere. If these plants are later burned to produce fuel, electricity, or heat, the same amount of carbon is released into the atmosphere. If plant growth exceeds burning and decay, more carbon dioxide is absorbed than created. At least one company has harnessed this process by planting trees to reduce net carbon emissions from fossil-fired power plants.

The sources of biomass for energy production range from agriculture, forestry, and municipal wastes, to liquid fuels made from energy crops, plant oils, and exotic genetically engineered algae. The forestry industry produces between 150 million and 300 million dry tons of waste each year that can be used to produce energy.⁶⁷ Currently the industry provides much of its own power by consuming 100 million tons of biomass in its own power plants. In some cases, excess capacity is sold to the local power grid. In 1985, for example, the Hawaiian sugar industry supplied 58 percent of the electricity on the island of Kauai and 33 percent on the island of Hawaii.⁶⁸ Louisiana and Florida use 80 megawatts of power from similar power plants. Numerous technologies could help convert a portion of the 160 million tons of municipal waste into usable energy. While it is currently cheaper for the forestry industry to use these wastes than to dump them, the feasibility of using all of the remaining wastes is uncertain.

STRATEGY: Utilize Hydroelectricity.

Hydroelectric power has played an important role in U.S. electricity production since the 1880s. Over this period, hydropower has grown to 2,029 plants and 88,000 megawatts of capacity. These plants range from less than 1 megawatt to the engineering marvel of the 6,180-megawatt Grand Coulee dam in Washington. Hydropower provides more electricity than any other renewable source at low costs and without any carbon dioxide emissions.⁶⁹ In the United States, much of the potential for hydropower has already been developed or is unable to be development due to environmental regulations. Of the remaining 147,000 megawatts of potential hydropower resources, it is likely that only 37,000 megawatts will be available for actual development. Through upgrades and retrofitting, however, existing power units could

produce considerably more power. Of the 67,000 existing U.S. dams, less than 3 percent produce electricity. Originally built for flood control, many of these idle dams could be retrofitted to generate electricity. According to the Department of Energy, 10,000 megawatts of small-scale hydropower could be derived from this source.⁷⁰

STRATEGY: Develop a New Generation of Safe Nuclear Power. The United States should not foreclose the option of generating nuclear electricity. Currently, 111 nuclear power plants are licensed for operation in the United States. They produce almost 20 percent of the nation's electricity and, after coal, constitute the second largest source of electricity. Production of concrete used in the construction of nuclear power plants and the nuclear fuel assemblies produces carbon dioxide. The operation of nuclear power plants, however, produces virtually no carbon dioxide. According to industry sources, the 527 billion kilowatt-hours of electricity generated by nuclear plants in 1988 reduced American carbon dioxide emissions by about 128 million tons in that year compared with coal-fired generation.⁷¹

Despite the carbon-free nature of nuclear electricity, the future of nuclear power in the United States is in doubt at this time. No new nuclear generating units have been ordered in the United States since the Three Mile Island accident in 1979, and all those ordered since 1973 have been cancelled. Four nuclear units are currently under construction in the United States. Once those are completed, it is unlikely that there will be additions to nuclear generating capacity for at least ten years, because it takes that long to plan and build a new nuclear plant.

If nuclear power is to play a major role in America's energy future, the federal government must press for the resolution of certain critical issues. It will be necessary to ensure the safety of nuclear technologies, ensure the safe disposal of nuclear waste, and lower the cost of nuclear power; nuclear plants completed in recent years have cost an average of \$2,700 per installed kilowatt of capacity, not including \$800 to \$900 per kilowatt in real interest costs incurred during construction. This makes electricity generated by these nuclear units almost twice as expensive as new coal-fired units, on average.⁷² Priority should be given to the development and evaluation of advanced, passively safe reactor designs; waste management technologies; nuclear fusion research; and plant retrofit and life extension.

G O A L S

IMPLEMENT FORESTRY PROGRAMS TO REDUCE THE EFFECTS OF GLOBAL CLIMATE CHANGE

The ability of the forests to sequester carbon has raised interest in their use to reduce greenhouse gases. While the exact mechanisms of exchange are unknown, the land biota holds approximately 420 billion to 660 billion tons of carbon; 90 percent of this amount is held in the woody biomass of the world's forests, while the remaining share resides in crops and grasslands.⁷³ Forests are 20 to 100 times more efficient at storing carbon dioxide than croplands, depending on the location and plant regimes.⁷⁴

By destroying vast areas of carbon-rich tropical rain forests, humans have started to eliminate a huge natural sink for carbon. Before human disturbances, forests covered 47 percent of the earth's land area. Today, forests account for about 39 percent of the earth's surface.⁷⁵ When these forests are burned, they release the carbon they hold into the atmosphere. Currently, human alteration of forest ecosystems accounts for emissions of carbon dioxide equal to about 10 to 30 percent of total emissions from human sources.⁷⁶

At current rates of forest carbon uptake, it would require 1.65 billion acres of new plantation forests to absorb the 5.5 gigatons of annual worldwide carbon emissions, or roughly 73 percent of landmass in the United States.⁷⁷ A total offset of all carbon emissions is probably not a practical response to global warming, but it is clear that some role for forestry is needed as a part of any global climate strategy. The strategies include:

- encouraging forest offsets for new carbon dioxide emissions;
- improving forest management; and
- planting trees, especially in urban areas.

STRATEGY: Develop Forest Offsets for New Carbon Dioxide Emissions. Several studies have concluded that increased forest cover can be used to offset the increases in carbon emissions expected from future electric capacity expansions. One study projects that by 1996, 22,643 megawatts of coal-fired and 2,580 megawatts of oil-fired new electric generating capacity will come on-line in the United States. This additional capacity will add more than 166 million tons to the annual carbon dioxide emissions in the United States. Using relatively inefficient trees for carbon storage (silver maples, for example) would require more than 11 million acres of new plantings. Using a more efficient tree, such as eucalyptus, could reduce the required acres to under 7.5 million.⁷⁸

Increasing tree planting can be done through numerous existing mechanisms. The Conservation Reserve Program (CRP) of the U.S. Department of Agriculture uses economic incentives to encourage farmers to set aside highly erodible land for conservation purposes. Under current law, land owners enter into a ten-year contract that pays them about fifty dollars an acre plus half the costs of implementing an approved conservation program. The goal of the program is to set aside 40 million to 45 million acres, but by February 1989 only 30 million acres (between two-thirds and three-quarters of all eligible acres) were in the program. Of the total acreage set aside in 1988, only a small portion was planted with trees. CRP payments could be increased to encourage greater participation and to encourage planting of trees rather than some other land cover. If payments were doubled for acreage planted in trees, first-year costs for sequestering the carbon dioxide from all new power plants expected to be built by 1996—9.26 million acres of trees, using trees of average carbon dioxide uptake efficiency—would amount to \$1.62 billion, or about 7 percent of the total cost of the new power plants. These figures do not include any of the costs recouped from the forest harvest in future years.⁷⁹

Applied Energy Services (AES), an energy company in Virginia, launched a carbon offset project in 1989. The 15 million tons of carbon that will be emitted over the forty-year life span of a new 183 megawatt coal-fired station will be offset by 52 million trees planted in Guatemala. AES contributed \$2 million to

Figure 14 Carbon Dioxide Uptake by Species of Tree

	Metric Tons of Carbon Dioxide Removed Annually Per Acre
Silver Maple	15
Black Locust	18
American Sycamore	20
Eucalyptus	22.5

Source: Daniel J. Dudek, *Offsetting New CO₂ Emissions* (New York, N.Y.: Environmental Defense Fund, 1988), p. 10.

the project and received further funding through CARE, the Peace Corps, the U.S. Agency for International Development, and the Guatemalan Forestry Service.⁸⁰

STRATEGY: Improve Forest Management. Other possibilities for improving the forest absorption of carbon dioxide emissions involve state forestry programs, intensive forest management, and the creation of tree plantations. Modern forestry practices have increased the productivity of Douglas fir and loblolly pine—and hence increased carbon uptake by 26 to 100 percent. However, many experts warn that converting of our varied forests to plantation-style monoculture would have devastating ecological effects.⁸¹ The loss of genetic diversity would lessen the forests' resistance to pests and disease, which would increase both the need for pesticides and the strain placed on water resources. In the near term, intensely managed tree plantations are probably uneconomical compared with the crop set-aside approach. According to some studies, converting mature old growth forests, such as those in the Northwest, to tree plantations would lead to an increase in net carbon dioxide emissions. Although old growth forests do not absorb large amounts of carbon, they hold tremendous carbon stores in the woody biomass.⁸² The carbon in the trunks, branches, roots, leaves, and soils could take more than 250 years to replace. However, if extremes are avoided, management of existing forests can significantly improve productivity without disturbing the overall health of the forests. Accordingly, forestry strategies in response to global climate change should probably concentrate on marginal lands, reforestation, and a sensible management of existing forests rather than conversions of old growth forests to fast growing tree plantations.

STRATEGY: Plant Trees, Especially in Urban Areas. Trees are valuable in urban areas for numerous environmental and aesthetic reasons. In an urban setting, trees serve the dual role of absorbing carbon dioxide and controlling energy use. Trees can be used to shade buildings from the sun and reduce the demand for air conditioning. During the winter they both slow evaporative cooling and shelter buildings from wind. According to one study, three strategically placed trees per house can reduce energy needs by 10 to 50 percent.⁸³ Moreover, trees break up the urban "heat island," the warming effect caused by absorption of solar energy by city buildings and other structures. Because they reduce the need for energy and break up the urban heat island, an urban tree is about fifteen times more valuable in reducing carbon dioxide emissions than a tree in the wilderness.⁸⁴ Despite the obvious benefits to be gained from urban trees, their numbers have diminished drastically; on average, only one urban tree is planted for every four removed. Because of these circumstances, the President has recently proposed a program to plant a billion trees a year in rural and urban areas. As part of its centennial celebration, North Dakota has developed an initiative to plant 10 million trees annually, adding 100 million trees by the year 2000. The project is being voluntarily coordinated through several state agencies.

Another opportunity for tree planting exists through the highway system. In 1985, highways covered 29.5 million acres of land (1.3 percent of the contiguous United States). EPA estimates costs of \$777 million for tree plantings on 20 percent of highway corridors.⁸⁵ This option can be used to beautify the nation's roadways while sequestering a considerable amount of carbon. Planting trees on 20 percent of interstate, state, and local highways would offset roughly 20 percent of the carbon from new power plants.

PLAN AND ACT NOW TO ADAPT TO A CHANGING CLIMATE

Many scientists believe that some change in our climate is now inevitable due to past emissions of greenhouse gases, even if drastic changes are made to control future emissions. On the other hand, economic infrastructure has been developed on the assumption that the present climate will be stable over the long term. The task force considers it prudent to begin planning now for adaptation to a different climate. It is likely that considerable funds will be needed to adjust the nation's infrastructure to climatic change. This cost must be balanced against the crucial role infrastructure plays in the productivity of the national economy. Three steps are particularly important:

- ensure that coastal development is consistent with the possibility of sea level rise;
- consider changes that may be necessary in water programs in response to different hydrologic conditions; and
- take steps to prepare for agriculture under conditions very different from those most farmers have experienced.

Adapting to Sea Level Changes

One of the most probable results of global warming will be an increase in sea level. Global warming causes sea level to rise through thermal expansion of oceans, and by net melting of glaciers and ice sheets. Assuming a global temperature increase of 3 to 10 degrees Fahrenheit, the most recent predictions are that mean global sea level would rise between

"Because of the risks of global climate change, we must begin now to plan for adaptation and change. The impacts on our shorelines, water resources, and agricultural productivity could be profound. Above all else, we need flexibility."

-
- Governor Michael N. Castle
Delaware
-

"The risk that global climate change poses to our farms, our forests, our water resources, and our way of life demands that we seek a greater understanding of this issue and take prudent action."

-
- Governor Tommy G. Thompson
Wisconsin
-

one and two feet.⁸⁶ Because the oceans have a large thermal inertia, it could take fifty years or more for higher sea levels to follow increased temperatures. Rising sea levels could devastate coastal areas by exacerbating coastal flooding; accelerating the destruction of wetlands; intensifying coastal erosion; inundating lowlands; and increasing the salinity of rivers, bays, and aquifers. As a result of these changes, communities could lose their water supplies as they become too salty to drink. Infrastructure and natural resources could be damaged or destroyed by flooding, erosion, and saltwater intrusion.

STRATEGY: Strengthen Coastal Zone Management Programs. In order to adapt to the changing coastal environment, a concerted effort must be made to promote further research, planning, evaluation, and assessment about the effects of rising sea level. Institutions that manage the coastal zone should be strengthened so that they can effectively develop and implement policies that anticipate sea level rise and increased frequency and severity of meteorological events. New Jersey is conducting a comprehensive study of sea level rise and other coastal changes to better understand their effects on the New Jersey shore. Policies will be developed to respond to anticipated changes, in consultation with the public and affected governmental entities.

The impact of future climate change on the levels and ecosystem of the Great Lakes is even less well understood at this time. A significant increase in temperature and drought conditions could result in a substantial lowering of lake levels and an increase in ambient lake water temperatures. A directed effort to determine the economic and environmental impacts of such changes on this major freshwater resource is critical.

STRATEGY: Develop Appropriate Land-Use Plans. In planning for less developed areas, incorporating land-use controls and management strategies could substantially

reduce the impact of a rising sea level as well as protect the natural environment. Among other things, proper land-use planning can allow wetlands and other natural areas to migrate inland in response to rising sea level, reducing the loss of such natural areas. A substantial portion of the nation's coastal wetlands have already been lost as a result of human activities. According to EPA, a three-foot rise in sea level could destroy 25 to 80 percent of the remaining wetland resources.⁸⁷ Maine and Texas have recently implemented protective land-use policies requiring all structures located in coastal areas to move inland in response to migrating coastal ecosystems. Not only does this policy protect wetlands, but it also is flexible and cost-efficient in that if no rise in sea level occurs then no action need be taken. States also can use their flood insurance systems to encourage the development of land-use plans that account for the possibility of climate change.

STRATEGY: Develop Appropriate Protective Infrastructure. Erecting bulkheads and levees is one option for protecting low-lying communities and lands. However, such measures generally lead to beach erosion in other nearby coastal areas. Pumping sand onto beaches is another option for protecting beaches against erosion. Not only does this protect the beach, but it also prevents increased erosion induced by the installation of hard erosion control structures.

Since the timing and magnitude of sea level rise is not clear, anticipatory strategies need not be implemented immediately. While it may be appropriate in highly developed areas to delay protective measures until the threat is imminent, it may be more cost-effective to gradually incorporate protective structural measures into a community's infrastructure than to wait until the impact of sea level increase occurs.

"I'd like to emphasize that any rise in sea level causes serious problems in coastal zones. We have a critical window within the next ten to twenty years to plan for the inevitable impacts of sea level rise."

-
- Dr. Robert Nicholls
Visiting Scholar, Center for Global Change, University of Maryland
New Orleans Regional Hearing
-

In many areas, the best option for protecting drinking water supplies and agricultural land from saltwater contamination is to construct barrier dams in canals and estuaries to divert saltwater.

Adapting to Changes in Agriculture

Predictions are inconclusive on the effects of global climate change on agriculture. Possible changes include the migration of climate zones northward, changes in plant and animal pests and diseases, and changes in the demand and availability of water. According to the most extensive studies to date, American agricultural production may shift regionally but will still maintain sufficient supplies for domestic demand.⁸⁸ Although net output may not change (or may even increase marginally), the disruption of traditional farming patterns could cause significant problems for regional economies. Adaptive strategies developed in the near term can ease the possible transitions necessary and provide benefits to producers today.

STRATEGY: Strengthen Agricultural Research and Planning. Substantially increased research efforts are needed with regard to global climate change and agriculture. Priority should be given to identifying the most vulnerable regions and farming types given anticipated changes in climate; establishing the efficacy of various adaptation and mitigation measures; identifying response strategies for new diseases and pests; establishing more tolerant crop varieties; and modifying or improving traditional farming practices.

Land-use plans also can be altered to account for potential changes in agricultural suitability in the future. Long-term development plans should be made to reflect the possibility of a northward shift in climate regimes. Water use planning should incorporate the possibility of increased demand for irrigation (due to low rainfall in some areas and higher evaporation everywhere) and strained water supplies. More careful long-term planning also benefits water quality and quantity.

Under most climate change scenarios, the range and abundance of agricultural pests increases. The ability of surveillance and pest

control programs to detect and respond to the introduction of new pests should be assessed and strengthened. Land grant universities and extension services can play a critical role in these efforts.

Research into drought-resistant species of crops and livestock could ease the transition to a climate with higher temperatures and lower soil moisture. Results from this research could lessen the need for northward migration of the agricultural belt. Advances in biotechnology have the potential to make agricultural products more climate-resistant.

STRATEGY: Improve Conservation of Soil and Water. The relationship between excess soil erosion and diminished yields is well established. Excessive loss of top soil and inefficient use of water will exacerbate farm yield reductions that may be caused by increased heat waves and drought. Conversely, improved conservation will better protect our farms and give farmers more options. In Oregon, the Governor's Task Force on Global Warming has recognized that water availability is likely to be the most important factor in determining future crop patterns, and the state Water Resources Commission is developing a water conservation plan focusing on irrigation efficiencies and reducing waste.

Increased use of conservation tillage and crop rotation improves the sustainability of soils and may lessen the need for pesticides. These practices also improve the resilience of crops to extreme weather events (e.g., droughts, floods, and storms) that may occur with greater frequency due to climate change. The states' cooperative extension programs can be used to promote the adoption of these methods by farmers.

STRATEGY: Encourage Greater Diversity and Flexibility in Farming Systems. The resilience of agriculture to changes in climate can be increased substantially by encouraging greater diversity in farming systems, including the development of new crops and more mixed-crop systems. In addition, the agricultural infrastructure, such as irrigation systems, can be made more flexible to allow adjustment to a range of future conditions. Finally, efforts to maintain genetic diversity and propagate

heat-and drought-tolerant crop and livestock varieties will allow greater adjustment to future climate changes.

Adapting to Changes in Water Supply and Demand

A number of studies suggest that global climate change will increase the frequency and severity of drought, particularly in mid-continental areas such as the American Midwest. Moreover, higher temperatures can increase the evaporation of soil moisture, exacerbating the effect of drought. These conditions result in both increased demand for and reduced supply of water. For some regions, severe water shortages are anticipated. In other areas, water tables may rise, necessitating different policy responses.

STRATEGY: Improve the Efficiency and Flexibility of Water Use. Improving the efficiency of water use provides a cushion against drought. There are numerous ways to conserve water. More efficient irrigation systems can improve the efficiency of water use dramatically. Pricing water at its replacement cost would discourage waste. Water managers can examine the use of market mechanisms to transfer water rights.

If new reservoirs or dams are constructed, planners should evaluate the marginal cost of adding capacity that could be used to respond to changing conditions in the future. Although it may not make sense to undertake large investments now in anticipation of future needs, it may be much less expensive to add marginal capacity to water systems while the reservoir is being built rather than later.

It may also make sense to protect options for future water supply development through a number of means, such as protective easements or land-use restrictions protecting potential reservoir sites. Water resource managers should also explore issues surrounding the transfer of water during periods of drought or excess supply.

STRATEGY: Protect Water Quality. The quality of water directly affects its availability for certain uses. By assuring that all water bodies are clean, more water can be made available for use in times of shortage. Cleaner waters will also reduce the impact on aquatic ecosystems during low stream flow conditions. States manage programs to control point source and non-point source water pollution; these programs can be used to address potential climate-related water quality threats. Meeting state and federal water quality standards is essential.

PURSUE AN AGGRESSIVE RESEARCH PROGRAM TO REDUCE KEY UNCERTAINTIES ABOUT GLOBAL CLIMATE CHANGE

National and international efforts have already begun to address the uncertainties surrounding the science of global warming. Internationally, the United Nations and the World Meteorological Organization have organized the Intergovernmental Panel on Climate Change. This group will release a report on the state of the art in global climate science, predicted effects of climate change, and strategies for reducing global warming. Its work will then be reflected in the process for developing an international framework convention on the atmosphere.

In the United States, multidisciplinary research is being coordinated by the U.S. Global Change Research Program. The President's fiscal 1991 budget calls for more than \$1 billion to fund this program, a 57 percent increase over fiscal 1990. As a joint effort of seven agencies and departments within the executive branch, this research program will be directed to improving the scientific basis for national and international policy formulation.

As a worldwide leader in basic and applied scientific research, the United States must aggressively pursue a research program to

"Perhaps the greatest single need now is for substantially more research. Some of the most important discoveries—such as the depletion of atmospheric ozone—have come through basic research in chemistry, physics, and the earth sciences. There is also a strong need for research in engineering and applied sciences, so that we can develop new technologies and buy time. Humanity faces the need for a very profound transition, to a way of life and an economic system compatible with long-term protection of the planet. We can't understand the issues or make that change without significantly more research."

• Gordon J. MacDonald
Vice President, MITRE Corporation
United Nations Hearing

improve understanding of the planet's climate, including its effects on the environment and its socioeconomic impacts. The Governors strongly support efforts to improve the state of scientific knowledge surrounding the climate change issue at both the national and international levels.

"There's a cliché. 'Everyone talks about the weather but nobody does anything about it.' The time to act on global climate change is now, but our policies must be based on sound economic and scientific analysis. Only then will we derive true societal and environmental benefits."

• Governor Stan Stephens
Montana

CONCLUSION

During the last several decades, the world has become more deeply aware of the relationship between people and the environment. New insights have reaffirmed that we are a part of nature rather than master over it. The potential for a catastrophic change in the global climate reinforces the need to consider the long-term effects of human actions. The balance between the necessities of economy and environment must be struck rationally and with full consideration of all the risks involved. Continued human prosperity can occur only in a healthy and habitable environment.

Global warming is at once one of the most threatening and the most misunderstood challenges humanity has ever faced. There is irrefutable evidence that human activities are changing the composition of the atmosphere. Physical laws indicate that a buildup of greenhouse gases should lead to a warmer climate. But the conjecture involved in predicting the actual effects of increased greenhouse gas concentrations make policy choices particularly complicated. With the scientific knowledge currently available, the choice is between waiting for more proof or ensuring against the possibility of a future disaster. Waiting may either prevent an unnecessary waste of resources or vastly exacerbate the predicted effects. Taking steps now could significantly reduce climate change in the future and avert disaster, or squander valuable resources and effort. Avoiding the negative impact of either extreme is at the center of the dilemma faced by policymakers at all levels.

The task force reviewed the extensive literature produced in the last several years on climate change and consulted representatives from the scientific, government, business, and environmental communities. Each of these groups has devoted serious and extensive consideration to global climate issues. It remains for representatives in government at state, federal, and international levels to make the weighty decisions—decisions that will be felt for generations. Ideally, these choices would be based on irrefutable evidence. In reality, they must be based on existing data.

The most important finding for the task force is that some steps should be taken now that can reduce the risk of future climate alteration while yielding other benefits in the short term. Many of these activities are already being undertaken by states, both as precautions against global warming and for the good economic, environmental, and social sense they make. The task force believes that these measures, many of which are described in this report, will not give us cause to regret our commitment to them. They are the most sensible steps to take now to achieve our goals.

Climate studies have deservedly received increased research priority and funding from the federal government. Depending on the results of these studies and others from around the world, our response may have to be adjusted to account for new understanding. The measures outlined above will provide the necessary flexibility to adjust to these developments. Great strides have been made toward understanding the planet; it is imperative that human actions continue to progress commensurate with available knowledge.

GLOSSARY

biomass energy—In its most familiar form, wood is burned to heat buildings or provide cooking heat. Wood or almost any form of plant fiber can also be burned to run a generator and produce electricity. Plant fiber can also be chemically altered to produce methanol and ethanol to be used as automotive fuels.

British Thermal Unit (Btu)—Basic unit of energy consumption in English system. One Btu is roughly equivalent to the energy of one blue-tip kitchen match.

clean coal technology—A technology that removes a significant proportion of the pollution-forming impurities in coal. Some of these technologies raise the efficiency of coal-fired power plants, and thereby reduces carbon dioxide emissions by requiring less coal to produce the same amount of electricity.

cogeneration—A technology that makes use of the heat generated through industrial processes to produce electricity. Many production plants use steam for heat or to make their products. Cogeneration takes advantage of some the heat to make electricity.

exajoule (EJ)—A unit of energy equal to 10^{18} joules. The United States consumes about 84 EJ of energy annually.

geothermal energy—Energy that relies on the natural heat of the earth to produce electricity. There are several different forms of geothermal energy in various stages of development, ranging from hydrothermal—the most common form used today—to systems that rely on molten rocks in volcanic areas.

hydroelectric power—A hydroelectric system relies on falling water to turn a turbine, which generates electricity.

joule—Basic unit of energy consumption; it is the energy required to lift a 1-kilogram weight about 10 centimeters.

kilowatt (KW, 1,000 watts) megawatt (MW, 1 million watts) gigawatt (GW, 10^9 watts)—Units of measure for generating capacity.

kilowatt-hour—A unit of measure for the amount of electric energy produced. In a conventional steam-turbine plant, about 10.9 megajoules (10^6 joules) of primary energy are required to produce 1 kilowatt-hour of electricity. One barrel of crude oil equals approximately 1,700 kilowatt-hours of electricity consumed.

quad—An abbreviation for quadrillion Btu (British Thermal Units). The United States consumes about 80 quads of energy annually. One quad is a little more than one EJ.

solar thermal electric energy—A solar thermal system uses mirrors to direct the sun's rays onto a receiving surface. A heating liquid is pumped through the element, which in turn produces steam that drives a turbine to produce electricity.

solar photovoltaic electricity—Photovoltaics are semiconductors that convert sunlight directly into DC electricity.

watt—Units of power; 1 watt is equal to 1/746 of a horsepower.

wind power—Wind power converts the power contained in moving air into electricity using a windmill.

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