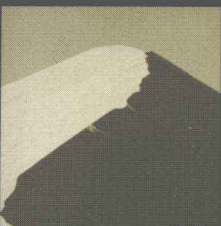


# SHAPING NATIONAL RESPONSES TO CLIMATE CHANGE



A POST-RIO GUIDE

**EDITED BY HENRY LEE**

Harvard Global Environmental Policy Project

# **SHAPING NATIONAL RESPONSES TO CLIMATE CHANGE**

**A POST-RIO GUIDE**

**EDITED BY HENRY LEE**

ISLAND PRESS

Washington, D.C. • Covelo, California

Copyright © 1995 by Island Press

All rights reserved under International and Pan-American Copyright Conventions. No part of this book may be reproduced in any form or by any means without permission in writing from the publisher: Island Press, 1718 Connecticut Avenue, N.W., Suite 300, Washington, DC 20009.

ISLAND PRESS is a trademark of The Center for Resource Economics.

Library of Congress Cataloging in Publication Data

Shaping national responses to climate change: a post-Rio guide/  
edited by Henry Lee.

p. cm.

Includes bibliographical references and index.

ISBN 1-55963-343-3. — ISBN 1-55963-344-1 (pbk.)

1. Environmental policy. 2. Climatic changes. 3. Greenhouse gases—Environmental aspects. 4. Greenhouse gases—Political aspects. 5. United Nations Framework Convention on Climate Change (1992) I. Lee, Henry.

GE170.S48 1995

363.73'87—dc20

94-39851

CIP

Printed on recycled, acid-free paper ♻️ ♻️

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

## ■ CONTRIBUTORS

ABRAM CHAYES is Felix Frankfurter Professor of Law Emeritus, Harvard Law School. Address: Harvard Law School, Cambridge, MA 02138.

ROBERT W. HAHN is Resident Scholar, American Enterprise Institute, 1150 17th Street, Washington, D.C. 20036.

DAVID HART is Assistant Professor of Public Policy, John F. Kennedy School of Government, Harvard University. Address: John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

DALE W. JORGENSON is Frederic Eaton Abbe Professor of Economics, Harvard University, and Director, Program on Technology and Economic Policy, John F. Kennedy School of Government, Harvard University. Address: John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

HENRY LEE is Director of the Environment and Natural Resources Program, Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University. He is also a lecturer at the John F. Kennedy School of Government. Address: John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

RONALD B. MITCHELL is Assistant Professor of Political Science, University of Oregon. Address: Department of Political Science, University of Oregon, Eugene, OR 97403.

VICKI NORBERG-BOHM is Assistant Professor of Environmental Policy and Planning, Massachusetts Institute of Technology. Address: Department of Urban Planning, Massachusetts Institute of Technology, Cambridge, MA 02139.

EDWARD A. PARSON is Assistant Professor of Public Policy, John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

JAMES K. SEBENIUS is Professor of Business Administration, Harvard Business School. Address: Harvard Business School, Cambridge, MA 02138.

ROBERT N. STAVINS is Associate Professor of Public Policy, John F. Kennedy School of Government, Harvard University. Address: John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

BRUCE N. STRAM is Vice President, Corporate Strategy and Planning, Enron Corporation. Address: Enron Corporation, P.O. Box 1188, Houston, TX 77251-1188.

RAYMOND VERNON is Clarence Dillon Professor of International Affairs Emeritus, John F. Kennedy School of Government, Harvard University. Address: John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

PETER J. WILCOXEN is Assistant Professor of Economics at the University of Texas at Austin. Address: Department of Economics, University of Texas, Austin, TX 78712.

RICHARD J. ZECKHAUSER is Frank Plumpton Ramsey Professor of Political Economy, John F. Kennedy School of Government, Harvard University. He is also Director, Harvard Faculty Project on Regulation. Address: John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138.

## ■ PREFACE

In June 1992, negotiators from more than 150 countries met in Rio de Janeiro and signed what is now known as the Framework Convention on Climate Change. By the time this volume is published, over 100 countries will have ratified the convention and the first meeting of the Conference of the Parties will have convened in Berlin.

By signing the Framework Convention, nations commit to work together to address a common problem. The task of negotiating, designing, developing, and implementing specific policies and programs to respond to that problem now begins—an undertaking that will extend well into the next decade and will demand a level of creativity and political acumen rarely matched in the annals of international environmental discussions.

Negotiators will be forced to grapple with issues at the core of nations' economies and social aspirations. Disparities in income, culture, national resources, and perceptions of fairness will make it very difficult to find common ground. For example, per capita energy consumption in countries of the Organization for Economic Cooperation and Development (OECD) is fifteen times higher than that in lower income economies. While energy growth in the former stabilized at 1 percent in the 1980s, that of low-income economies increased by 5.3 percent.<sup>1</sup> It will be almost impossible for negotiators to convince low-income countries to reduce their efforts to expand their economies and provide a higher standard of living for their people, yet a tripling or quadrupling of fossil fuel consumption in these countries will make it very difficult to reduce the growth in greenhouse gas emissions and the risk of global climate change.

With the signing of the Framework Convention, hundreds of experts and public officials in nearly one hundred countries will be engaged in a process to assess a broad menu of strategies to reduce the amount of greenhouse gases released into the atmosphere.<sup>2</sup> In the United States, the Climate Change Action Plan, announced by President Clinton in October 1993, contained forty-seven initiatives involving industry, transportation, housing, foreign policy, forestry, energy, environmental protection, and agriculture. This plan will be reviewed at least every two years. All other countries that ratify the Framework Convention will prepare and submit similar plans. These parallel processes—an international process through the Conference of the Parties and a domestic process through the development of national action plans—guarantee that design, development, and implementation of mitigation responses will be on the public policy agenda for many years.

The purpose of this book is to inform these processes. It lays out the factors that policymakers should consider in designing their responses. It explores paradigms and trade-offs, not merely single answers. Because the signing of the Framework Convention on Climate Change in June 1992 marked the beginning of an international negotiation process that will last for decades, the lessons in this book should be as relevant ten years from now as they are today. The early chapters focus on issues related to the negotiation of international environmental agreements—designing negotiation strategies, linking the politics of international negotiations with domestic policy development, and developing tactics that might be most effective in designing enforceable international initiatives.

The remaining chapters assess the effectiveness and efficiency of specific policies: carbon taxes, tradeable permits, and technology transfer initiatives. Many variations exist of each, and in four chapters it is difficult to include all of the relevant options. Instead, the authors identify the key factors that should be weighed in the design, development, and implementation of any policy that falls within the rubric of these three policy initiatives.

Many of the mitigation measures under active discussion involve the development and dissemination of technologies that either consume less energy or replace fossil fuels. Alternative vehicles, more efficient appliances, solar photovoltaic systems, wind power, and fuel cells are on many lists of promising future technologies. The authors of this volume agree that technology development and dissemination will play a critical, if not paramount, role in any mitigation strategy. Robert W. Hahn, Robert Stavins, Dale Jorgenson, Peter J. Wilcoxon, and Bruce Stram all argue that if governments judiciously use market incentives, such as carbon taxes or tradeable permits, they can create a market climate that will stimulate innovation leading to the development and dissemination of hundreds of new technologies. Therefore, this volume targets market incentives rather than particular emerging technologies.

Finally, this book is not Harvard University's response to the Clinton administration. The Clinton action plan ensures a dynamic process rather than a single plan. It will inevitably go through many iterations over the next decade. Policies and initiatives deemed politically untenable at one time may become acceptable at another. Our hope is that these chapters will provide frameworks—not single answers—for their design, development, and implementation of these.

## NOTES

1. *Far Eastern Economic Review*, 18 June 1992, 50.
2. For the Framework Convention on Climate Change to take effect, fifty countries must ratify it. At the conference in Rio de Janeiro in 1992, 161 countries signed the agreement.

# ■ ACKNOWLEDGMENTS

This volume represents the culmination of a four-year research project, the Harvard Global Environmental Policy Project, which involved thirty to forty scholars and experts. Many more people deserve to be acknowledged than I have space in which to do so. However, my coauthors and I would like to single out a few.

The Harvard Global Environmental Policy [Program] was originally designed and developed by Professor William Clark, director of Harvard University's Center for Science and International Affairs, and Florence Fisher, then assistant director of the Environment and Natural Resources Program. Without their help and guidance, this project would never have begun.

Many of the ideas contained in the chapters on negotiation emerged from discussions conducted under the auspices of the Harvard Negotiation Roundtable, chaired by Professor Howard Raiffa. Both he and the participants in the Roundtable played a critical role in creating the intellectual environment for new ideas. One of the most active participants was Professor Thomas Schelling. All of us who worked with Tom realize that our discussions were much richer as a result of his involvement. Others who participated in these discussions include Arthur Applebaum, William Moomaw, Richard Benedict, Richard Victor, and David Victor.

Any project of this type would not take place without the support of the community in which it is conducted. We owe thanks to past and present deans of the John F. Kennedy School of Government—Graham Allison, Robert Putnam, and Albert Carnesale—and to the former director of the Center for Science and International Affairs, Ashton Carter. I especially want to express my gratitude to William Hogan and Harvey Brooks, both of whom supported this effort since its inception and served as sounding boards for our ideas.

Much of the research that went into these chapters was supported by a grant from the U.S. Environmental Protection Agency. We are especially grateful to Richard Morgenstern, Dennis Tirpak, and Alex Cristofaro for their confidence in our work and for their patience.

Finally, we would like to thank the people who helped edit, review, and prepare this volume. Miriam Avins and Teresa Pelton Johnson did an amazing job in transforming our stilted writing. Jo-Ann Mahoney, Jesselynn Pelletier, and Karen Rothschild put in many long hours to prepare the manuscript, organize it, and deal with a myriad of details. Carter Wall and Bill White served as my research assistants and showed amazing resilience in the face of hundreds of requests for obscure facts, citations, and data. Last but certainly not least, I am grateful to my wife, Mary, and my family for their support in this venture.



# ■ CONTENTS

*Contributors* ix

*Preface* xi

*Acknowledgments* xiii

- 1 Introduction  
*Henry Lee* 1
  - 2 Overcoming Obstacles to a Successful Climate Convention  
*James K. Sebenius* 41
  - 3 Equal Measures or Fair Burdens: Negotiating  
Environmental Treaties in an Unequal World  
*Edward A. Parson and Richard J. Zeckhauser* 81
  - 4 Improving Compliance with the Climate Change Treaty  
*Ronald B. Mitchell and Abram Chayes* 115
  - 5 The Triad As Policymakers  
*Raymond Vernon* 147
  - 6 Trading in Greenhouse Permits: A Critical  
Examination of Design and Implementation Issues  
*Robert W. Hahn and Robert N. Stavins* 177
  - 7 A Carbon Tax Strategy for Global Climate Change  
*Bruce N. Stram* 219
  - 8 The Economic Effects of a Carbon Tax  
*Dale W. Jorgenson and Peter J. Wilcoxon* 237
  - 9 Technological Cooperation: Lessons from  
Development Experience  
*Vicki Norberg-Bohm and David Hart* 261
- Appendix* 289  
*Index* 293

# 1 Introduction

■ HENRY LEE

*John F. Kennedy School of Government  
Harvard University*

Modern communication, with its emphasis on ten-second sound bites, sensational headlines, and laser-sharp images, bombards today's society with a pictorial and verbal cacophony of sights and sounds—the Berlin Wall crumbling, Tiananmen Square exploding in revolution, the cries of children starving in African refugee camps. However, perhaps the most influential image of the past three decades is that of the planet Earth—a delicate blue orb, partially covered by wispy clouds. Yet as this image has been lodged in the public's psyche, so too has the awareness that the earth faces the possible threat of irreversible harm on an unprecedented scale. The ozone hole, the loss of biodiversity, and the population explosion are now all inextricably associated with that image. But the most difficult, complex, and, perhaps, uncertain of the problems threatening the planet is the possibility of significant and rapid climate change, commonly known as the greenhouse effect.

All of these environmental problems feed on one another. A growing population demands more energy, and more energy use increases greenhouse gas emissions, such as carbon dioxide and methane. More people need more arable land, which accelerates the pressure to clear-cut and burn forests, increasing the loss of biodiversity and the risk of climate change on a global scale. The fundamental issue is that humankind is altering, in ways that are not well understood, all of the systems and cycles that together make life on earth, as we know it, possible.<sup>1</sup> This book explores global climate change not only because it may prove to be one of the defining problems of the next century, but also because the processes and policies that will be effective in responding to this problem can be used to resolve other global environmental problems.

## OUR FOCUS

Much of the recent debate on global warming has focused on whether the world is moving toward a rapid and calamitous descent into a very different and warmer climate regime or whether these fears are the product of incomplete science, media sensationalism, and a risk-averse populace. We leave these scientific issues to those who are more qualified to assess them and instead address the strategic policy issues that are related to designing, negotiating, implementing, and enforcing national responses to the problem of global climate change. The purpose of this book is to draw attention to alternative ways of thinking about how to design and gain political support, both domestically and internationally, for strategies and policies that could effectively reduce greenhouse gases.

Our point of departure is the report of the scientific working group of the Intergovernmental Panel on Climate Change (IPCC), which represented the best judgment of the world's scientific community at the time this book was written.<sup>2</sup> The thrust of the report is that over the next hundred years, the global mean temperature is likely to increase at rates faster than the world has experienced in the past and that this will affect both climate and climate-dependent ecosystems in ways that are uncertain but, potentially, very harmful. Some reputable scientists disagree with these findings, and future research may prove them to be correct.<sup>3</sup> Enormous scientific uncertainty surrounds this issue, and this uncertainty is not likely to evaporate any time soon.

Therefore, governments have three alternative courses of action, which can be pursued individually or in combination. The first option is for governments to wait until the level of scientific uncertainty is reduced, when there is more confidence in the cost-effectiveness of certain responses. Given the magnitude of the scientific uncertainties, there are strong arguments in favor of such a course. Such a strategy would emphasize research and would postpone programmatic investments, at least in the near term.

The second option is to emphasize adaptation, that is, to invest in programs and technologies that might permit countries to effectively adapt to the impacts of climate change—if and when they emerge. Such investments would lower the future cost of the possible impacts on forestry, agriculture, transportation, and economic infrastructure. There are strong economic efficiency and political arguments in favor of this second option. If credible responses to the threat of climate change take the form of societal investments in global insurance, adaptation investments may be a logical and reasonable down payment.

The third option is to invest in mitigation initiatives—initiatives to reduce greenhouse gas emissions or to increase carbon dioxide sinks. Most industrialized nations have decided to give priority to mitigation responses. This choice may change at a later date, and the extent of the initial mitigation investments may seem modest. For the foreseeable future, however, developed countries will discuss, and in many instances pursue, mitigation alternatives. For this reason, the authors of this volume focus on this option and seek to inform the choices governments will make as they pursue mitigation strategies on both the domestic and international fronts. Our focus is on selecting the goals, strategies, and programs to pursue and the tactics for designing, developing, and implementing them.

We start from the premise that the U.S. government, by signing the United Nations (UN) Framework Convention on Climate Change (FCCC), has concluded that it is in its national interest to reduce world greenhouse gas emissions. Our question is not whether the United States should act, but rather how an enforceable strategy can be fashioned that will be acceptable both domestically and internationally. We step back from the immediate debate and present a strategic framework to assess and compare specific alternatives. Many technological and programmatic options to reduce the threat of climate change have been suggested, but without political consensus or a strategy for building and institutionalizing such a consensus, no option will achieve its potential. Whether a nation believes that solar energy, energy conservation, or aggressive tree planting is the right answer, its first step must be the design of an overall strategy to realize its international and domestic objectives. Without such a coherent strategy, mitigation efforts are the strategic equivalent of shooting stars—spectacularly bright, but short-lived, political phenomena in the global political firmament.

This book brings together a distinguished group of scholars to explore what steps and factors should be considered in the development of response strategies and what might be the consequences of nations' adopting those strategies. Many of the chapters are written from the perspective of the United States. To some, this focus may seem parochial. U.S. policy prescriptions are not necessarily more insightful or visionary than those of other countries; however, as the only remaining world superpower, the United States plays a unique role in the global community of nations. We do not suggest that the United States embrace more aggressive or stringent reduction goals, but we recognize that whatever positions and policies the United States supports will have a substantial influence on the positions and policies taken by other nations.

The first half of this book explores the factors that shape the prospects of negotiators obtaining a workable international agreement. James K. Sebenius applies the experiences from previous international environmental negotiations to draw important lessons for the U.S. negotiators who will be given the task of developing specific initiatives and protocols to implement the framework convention signed at the 1992 UN Conference on Environment and Development (UNCED). Edward A. Parson and Richard J. Zeckhauser assess the critical problem of trying to craft quantitative measures of national performance—emissions targets or equivalent measures—which will remain a central problem in future negotiations. Ronald B. Mitchell and Abram Chayes focus on compliance and enforcement issues. No matter what targets are selected or what programs are endorsed, no treaty, protocol, or agreement will succeed unless the parties comply with the provisions. Finally, Raymond Vernon turns his attention to the importance of the linkages between the process by which domestic policy responses are developed and those through which international negotiating strategies are formulated. Such linkages are created (or not) by each country's history, value system, and institutions, and these elements can result in very different behavior patterns.

The second half of the book explores broad policies and programs that the United States could adopt domestically in response to a negotiated agreement to reduce greenhouse gas emissions. Robert W. Hahn and Robert N. Stavins explore the use of market-based incentives, specifically, tradeable permits, and suggest criteria for deciding when to adopt such programs and how to design them. Bruce N. Stram assesses the political and strategic merits of a carbon tax and provides specific recommendations as to how such a tax might be structured and sold to a skeptical public. Next, Dale W. Jorgenson and Peter J. Wilcoxon tackle the critical question of how much it will cost—in terms of both money and the impact on the economy—if the United States decides to adopt specific targets for carbon dioxide reduction. Finally, Vicki Norberg-Bohm and David Hart look at the lessons to be learned from past U.S. efforts at transferring new technologies to developing countries, highlighting the importance of thinking not only about what technologies to transfer, but also about how to deploy them most effectively.

This introductory chapter summarizes the fundamental lessons contained in the eight chapters that follow. I begin by briefly describing several of the scientific, political, and economic dimensions that shape how policymakers must approach the problem. I then synthesize the principal recommendations on how the United States might be able to forge a

workable international agreement and explore specific policy paths that the United States should consider.

## THE DIMENSIONS OF THE PROBLEM

Human activities, especially over the past hundred years, have added substantially to the concentration of greenhouse gases—such as carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons (CFCs)—to the earth's atmosphere.<sup>4</sup> Since the industrial revolution, deforestation and the combustion of fossil fuels have led to a 26-percent increase in carbon dioxide in the atmosphere. Methane levels have doubled over this period.<sup>5</sup> If other environmental factors remain stable, and if the concentrations of greenhouse gases increase, the atmosphere's capacity to capture and hold heat will increase. This phenomenon should result in an increase in the earth's average temperature, which, in turn, could alter the level of precipitation, the rate of sea rise, and the number and severity of major storms. (See the appendix at the end of this volume for additional information and a summary of the principal findings of the scientific working group of the IPCC.)

Although this book does not examine the scientific debate, it is important to discuss a few aspects of the global climate change problem that will affect the magnitude and scope of governmental response. First, if the IPCC's scientific report is correct, it is unlikely that the world will be able to avoid some increase in average world temperature and perturbations in the form of changes in rainfall, storms, and other weather phenomena. Even if greenhouse gas emissions were radically reduced, substantial momentum has already been built into the system. Greenhouse gases have long atmospheric lifetimes. Carbon dioxide remains in the atmosphere for 50–200 years.<sup>6</sup> Nitrous oxide lasts for 150 years, and CFCs, 65–130 years. Only methane among the major man-made gases has a relatively short atmospheric lifetime, but even it lasts 10 years. The U.S. Environmental Protection Agency (EPA) calculated in a 1990 study that to stabilize atmospheric concentrations, a 75-percent reduction in greenhouse gas emissions would be required. In fact, the EPA estimated that carbon dioxide emissions would have to be reduced by 50 percent; nitrous oxides, by 80–85 percent; and methane, by 10–20 percent; CFCs would have to be phased out altogether.<sup>7</sup>

There is little likelihood that such emissions reductions will be realized. Yale University economist William Nordhaus noted in an article published in *Science* that a policy to stabilize greenhouse gas concentrations

(that is, one that would hold the actual concentrations of gases in the atmosphere constant) would require investments of \$30 trillion in discounted income (over the period 1985–2105) as compared with a no-controls policy.<sup>8</sup> The climate change treaty agreed to at the 1992 Earth Summit in Rio de Janeiro calls for nations to try to stabilize greenhouse gas emissions at 1990 levels. President Clinton committed the United States to this goal in April of 1993. The target may be laudable, but it will only minimally reduce the temperature increases projected by the IPCC, since concentrations, which are the governing factor, will continue to increase. Nordhaus estimated that the difference between a no-controls strategy and an emission-stabilization scenario may be less than three-tenths of one degree, albeit the difference increases over time and would be greater than 1 degree Celsius by the year 2105.<sup>9</sup>

The inference from these studies is that the levels of emissions reductions being discussed—even those suggested by the environmental community—will only slightly retard the increase in average world temperature, as well as the rate of those increases. Therefore, why commit billions of dollars to retard the growth in greenhouse gas emissions when the end result may be minimal?

There are two responses to this question. First, given all of the uncertainties, the experts may be underestimating the benefits from moderate reductions in greenhouse gases. Second, there is now evidence questioning the belief that changes in the world's climate will occur at rates sufficiently even and steady for the world to adapt with only moderate economic dislocations. Several studies of ice cores extracted from the Greenland ice sheet and Peru's Quelccaya ice cap, which date back 100,000–250,000 years, suggest that, historically, climate has shifted very rapidly.<sup>10</sup> That is, the earth's climate system resists change until pushed over a threshold, then it leaps into a new climate system. Dramatic change may come very suddenly. If so, adapting to change will prove to be much more difficult and the cost in human misery much higher. Further warming, in and of itself, is not the primary danger; rather it is perturbations in the world's weather system that might dramatically disturb the amount and location of rainfall and the intensity of storms.

Two scenarios capture the dilemma facing policymakers. In the first, the United States and other countries invest billions of dollars with little, if any, benefit. In the second, too little is invested, and the world's climates jump abruptly into a new equilibrium, with disastrous consequences. The high level of scientific uncertainty surrounding this issue makes it impossible for policymakers to avoid this dilemma. Professor

Harvey Brooks captured the essence of this policy choice when he wrote the following.

Scientific uncertainty, both in the measurement of the current state and in the inferring of future trends from current data, is a major impediment to operationalizing the concept of sustainable development in both managed and natural ecosystems. In some cases, the insurance premium that may have to be paid in order to fully hedge against current technical uncertainties may be so high as to be economically unrealistic. Whether or not this premium is worth paying depends on the projected cost of reversing the future consequences of current decisions, if the premium is not paid.<sup>11</sup>

To think about the problem, consider a simple graph with time on one axis and temperature, as a surrogate for climate change, on the other. Assume that there is a correlation between the rate and magnitude of climate change and the damage to the planet's environment. There are certain trajectories that governments would find unacceptably costly, either because average global temperature rises too rapidly or because the absolute magnitude of the change is too great. The challenge for policymakers is twofold: first, to ensure that the wrong trajectories do not occur and, second, to plan so that the correct trajectories are not achieved in an unacceptably costly and inefficient manner. These two challenges are of equal concern.

## DESIGNING A U.S. STRATEGY

In the chapters that follow, the authors discuss many important issues. Some, such as the differences in interest and values between the developed and the developing worlds, constrain what can be done; others, such as the need to create new international institutions and workable enforcement and monitoring mechanisms, will be essential ingredients in any effective climate change agreements or protocols. There are, however, several fundamental elements of the global climate change problem that will have to be factored into the design of any mitigation response.

1. The problem could be very large.
2. Because of scientific and economic uncertainties, the perceptions of the problem will be in constant flux.



3. Efforts to effectively reduce greenhouse gas emissions will carry large up-front costs.
4. The development and dissemination of new and efficient technologies will be especially important.
5. Energy prices, especially those for carbon-intensive fuels, will have to increase.

First, the design of U.S. domestic policy options to mitigate global warming will be a much more complex task than was the design of responses to past environmental problems. The cost of even stabilizing emissions is several orders of magnitude larger than is the cost of phasing out chemicals that destroy the ozone layer or of reducing the threat of acid rain. Furthermore, climate change is a global commons problem—no nation can solve it alone, nor can any nation insulate itself from the consequences of another's actions. For example, recent commitments by the Organization for Economic Cooperation and Development's (OECD) member countries to reduce emissions by 2000 will almost certainly be offset by the growth in emissions in large, rapidly growing developing countries.<sup>12</sup>

Vernon makes the point that domestic policy cannot get too far in front of, or lag too far behind, positions taken internationally without undercutting the credibility and bargaining position of U.S. negotiators. This linkage between international and domestic policies is often ignored or not fully appreciated. International policy is formulated by the executive branch, with only moderate involvement by special interests, whereas domestic policy is a product of a pluralistic, interactive process involving the executive branch, the Congress, state and local governments, and a spectrum of interest groups. Thus, ideological and specific economic concerns, such as the impact on regions or on certain industries, tend to surface with more emotion during the formation of domestic policy. If the United States is to craft an effective global strategy for greenhouse gas mitigation, the processes by which it formulates domestic and international policies must be closely linked.

Second, since the scientific understanding of global climate change will be constantly evolving, international and domestic policy responses must be flexible. Over the next two decades, countries will go through five or six cycles of debating, developing, and implementing responses to the problem of global warming. Each cycle will be triggered by new scientific information. Policymakers should be careful to recognize that new information will not always point in the same direction and that each policy development cycle will build on the one which preceded it. In some instances, new information may contradict or repudiate past efforts.