

THE POLICY GRIDLOCK ON GLOBAL WARMING

By Eugene B. Skolnikoff

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Climate change has become a staple of national and international politics. It is by far the most dramatic environmental issue yet to receive worldwide attention, as human activities pose unprecedented threats to the planet's environment. The threat has spawned widespread proposals for treaties, international institutions, and major new policies, many of draconian dimensions. Even British Prime Minister Margaret Thatcher, who so assiduously defends her country's sovereignty in the European Community, has called for binding international protocols to control greenhouse gas emissions, with supervision and monitoring by international organizations. Analysis of the threat has also led to assertions that the climate will not change in the dimensions claimed, or that the proposed cures would be more costly in lives and prosperity than the climate change itself.

This often frenetic activity has legitimate roots. Responsible forecasts have predicted that the growing concentration of certain gases in the atmosphere could lead to climate change with major effects on health and living standards. The economic and political affairs of nations could be substantially altered and international relationships significantly changed. The forecasts raise many profound questions--of equity, Third World development, conflict over food and land, and the appropriate limits of human intervention in the natural environment--now measured on a planetary scale.

The many proposals for urgent action, however, rarely reflect the limits of policy processes, or what would be necessary to lead to major new policies. The question is not whether to take action now, as it appeared to be in the April 1990 White House conference on global climate change. Rather, it is to recognize what is feasible and what will fail, given the state of knowledge and the unique characteristics of the subject. Some proposals are wildly unrealistic even for an era of aroused environmental consciousness, such as those calling for the establishment of a new supranational institution with enforcement powers to supervise mandatory reductions in greenhouse gas production. Even more modest proposals to encourage energy efficiency and conservation have proved difficult or impossible.

Significantly, discussion of the proposals often neglects the real costs of premature action: the resources denied to other crucial needs and the effects of what might prove to be costly policy errors. If pressure from the scientific community and environmental movements leads to costly measures that later prove to have been unwise or unnecessary, the public may lose the trust in scientific analyses essential to sustaining long-term environmental protection.

It is important to understand the sometimes unique difficulties surrounding this subject. Without that understanding, there can be little clarity about what is possible and on what

time scale, and what will ultimately determine the boundaries within which effective action can be taken.

The central problem is that outside the security sector, policy processes confronting issues with substantial uncertainty do not normally yield policy that has high economic or political costs. This is especially true when the uncertainty extends not only to the issues themselves, but also to the measures to avert them or deal with their consequences. The responses of different political systems will, of course, vary, but that initial judgment is valid for most.

The climate change issue illustrates--in fact exaggerates-- all the elements of this central problem. Indeed, no major action is likely to be taken until those uncertainties are substantially reduced, and probably not before evidence of warming and its effects are actually visible. Unfortunately, any increase in temperature will be irreversible by the time the danger becomes obvious enough to permit political action.

The only real prospect for a different policy outcome in the near future would be if public consensus and international negotiations overcame the stubborn nature of the policy processes of governments. Certainly the rising concern about the environment is much in evidence, as growing political power of the Greens in many countries makes clear. And the escalating number of international meetings and calls for action puts pressure on governments to formulate new policies. It is not inconceivable--though still improbable--that policies and agreements could result that cannot be expected on the basis of economic or policy analysis alone. The "framework" treaty expected to be negotiated by 1992 is likely to be an empty shell for many years. The barriers to action and agreement are high, and the public's commitment has not yet been seriously tested on international issues that are both so costly and so intangible.

Consensus and Uncertainties

The global warming phenomenon is by now well-known. The basic greenhouse effect itself is neither a new concept, nor in doubt. In fact, it is essential for life on Earth. Without the warming action of the atmospheric blanket, the surface would be approximately 35 degrees C (63 degrees F) cooler and unable to support life as we know it, or possibly any life at all. Earth's atmosphere is largely transparent to short-wave energy from the sun. Some of the energy is reflected back into space, but a portion is absorbed by the surface and clouds and reradiated as long-wave energy--that is, as heat. Several gases absorb energy at these wavelengths and, in turn, warm the atmosphere. The gases contributing most to the greenhouse effect include water vapor, carbon dioxide (CO₂), methane, and several others, the most important of which include the manmade chlorofluorocarbons (CFCs). Several of these greenhouse gases have been increasing rapidly as a result of human activities--on a scale sufficient perhaps to alter significantly the determinants of climate and weather. The concentration of CO₂, the gas that accounts for approximately half of the human-caused warming effect, has increased some 25 per cent in a century, largely as a result of the burning of fossil fuels and the destruction of

forests. Other greenhouse gases come from agriculture, mining, automobiles, and industry.

This part of the story is straightforward and generally not in dispute. Estimates of the effects, however, are less definite. They come from theoretical analysis, calculation using complex models of the atmosphere and oceans, and the interpretation of a limited but growing body of measurements. Important uncertainties are introduced, and controversies over the models and their interpretation necessarily arise. The more prominent projections by such authoritative scientific bodies as the National Academy of Sciences coalesce around the estimate that if greenhouse gases increase to the equivalent of a doubling of the atmospheric concentration of CO₂, average temperatures would rise by 1.5 degrees-4.5 degrees C (3 degrees-8 degrees F)--less at the equator but up to twice the average at the poles. This would lead to average surface temperatures higher than any recorded in human history. When a temperature rise would occur depends on the rate at which gases are emitted and on complex feedback effects of clouds and oceans that are not now adequately understood. In the absence of controls on emissions, and with no surges or large dips in economic growth, typical analyses predict it would take place around the middle of the twenty-first century.

The surface effects of such a temperature rise are not predictable in geographic detail; they would vary regionally and even locally. Many estimates, however, predict reduced availability of fresh water during summer growing seasons in inner areas of the continents, migration of agriculture toward the poles, increased desertification, and more weather extremes. Probably the most publicized prediction is a sea level rise by one-third to one-half a meter by the middle of next century. Low-lying areas would be particularly vulnerable to storm surges. If the forecasts are correct, all of this will happen more rapidly than has virtually any ecosystem change in the last 160,000 years, raising questions of such unanticipated and possibly serious nonlinear effects as shifts of major ocean currents.

Not only are these forecasts uncertain and controversial, they depend on future developments in the economy, in technology, and in policy, as well as on the results of research. And not all the effects will necessarily be damaging; some activities will be enhanced and some localities and nations may benefit by the changes, at least in relation to others.

The greenhouse effect and its possible physical and socioeconomic effects are frequently presented in cataclysmic terms; certainly the visions of catastrophe have stimulated a variety of proposals for the United States and other countries to reduce CO₂ and other greenhouse gas emissions to "stabilize" the atmosphere. The subject is rich in complexity and detail, but there are several characteristics that make it different from or larger than other environmental issues.

Special Characteristics

The first is that global warming epitomizes the idea that everything relates to everything else. The issue arises from the growth of human population and wealth. It is rooted in industrialization, technological change, dependence on energy, striving for economic growth, and the many other aspects of a human population that aspires to improve its quality of life. The buildup of greenhouse gases is a result of normal, not aberrant, human behavior and is a product of innumerable independent decisions by individuals, industries, and governments in daily life all over the globe.

Societies are increasingly familiar with the need to regulate and influence decision making dispersed among individuals and institutions; the control of greenhouse gases--or of their effects --is not different in kind from other policy issues in the management of risks and control of externalities of technology. In the climate debate, however, the nature of the interactions, the number of relevant actors, and the scale involved all mean that core economic and political interests within and among countries will be directly involved in measures to limit emissions, as well as in the effects of warming that do take place. Agriculture, energy, industry, water, ecology, population, Third World development, and specific political commitments--such as tax policy--are only the most obvious interests at stake.

The breadth of such interests greatly complicates bureaucratic politics within governments and among international organizations. Virtually all government ministries and international organizations have a stake in global warming, either in its mitigation or in its possible effects. Overlapping jurisdiction, differing agendas and priorities, varying knowledge and influence, and competition for budgets and power all conspire to complicate tradeoffs and make concerted policy difficult to achieve. Moreover, the interaction of so many interests and issues means that policies will probably have significant unexpected consequences, and that developments in subjects far afield, such as political change in Eastern Europe or China, will affect the climate issue.

A second major characteristic of the issue is the interaction of two vast and complex systems, the planet's ecosystem and the human socioeconomic system. Large systems usually have large inertia, making change slow and difficult. Natural changes in the ecosystem occur over periods normally measured in centuries, which has made a reasonably consistent and predictable climate a staple of the development of civilization. The evolution of the socioeconomic system, once also measured in centuries, is now clearly moving more rapidly, both in growth and in internal structural modification. Nevertheless, such major components of the overall system as energy technologies and the location of urban populations can still be changed only slowly.

The fact that climate change involves the interplay of large human and physical systems has several consequences. The most obvious are that the time horizon of policy intervention must be very long and that changes in either of the fundamental systems cannot be achieved quickly, even if there were an agreed will to do so. The momentum in the systems as a whole already guarantees some atmospheric change, however great that change turns out to be and whatever policies are put in place. But this momentum also means that delaying action will extend the effects further into the future and with greater

magnitude. Effective irreversibility becomes an inherent and unavoidable aspect of the problem.

This latter characteristic makes it particularly difficult to evaluate policies intended to reduce emissions. The present value of benefits that will be realized decades from now is small. Even if direct comparison of the future with the present were possible, the costs and benefits of ill-defined future consequences would be much more uncertain than the near-term costs and benefits of specific actions today. Thus, specific policies are likely to be assessed principally for their short-term impact and for their costs that would deny funding for other needs. The more theoretical and controversial long-term consequences are likely to receive short shrift. The less certain the future costs, the more likely the future will carry less weight in comparison to the present.

Ironically, the complexity of these large systems also suggests they could be vulnerable to dislocation in unexpected ways. Complex systems that are incompletely understood may have unsuspected nonlinear responses when subjected to unusual stress. Major war is an example of stress that can produce large discontinuities in the socioeconomic system. Although the ecosystem is resilient and self-correcting under a variety of disruptive events, it is now being taxed by human activities at a greater rate than ever before. The ecosystem's responses to that stress are uncertain, making confident prediction of stability hazardous. Surprises such as the Antarctic ozone hole cannot be ruled out on the basis of current knowledge.

A third characteristic of the issue is the importance of uncertainty. In the case of climate change, the uncertainties are particularly large, contentious, and slow to be reduced. The policy process needs information first about the phenomenon itself and then about its causes. Yet that information is of little policy interest without knowing the effects of global warming on precipitation, sea level, crops, ice cover, frequency and violence of storms, and other consequences. At the next level, the effects of the phenomenon on agriculture, coastal zones, economic development, energy demand, international status, population migration, prevalence of disease and pests, and urban areas become important. At this level policymakers need analyses of alternatives for moderating the rate and extent of warming and the possibilities for adapting to warming. At each successive level, the uncertainties are likely to be greater, as the variables and possible future effects become less well-defined.

Removing or reducing all these uncertainties is not essential; policy is often made without definitive "downstream" analysis. However, if policies are especially costly, affected interests are apt to use the absence of a definitive analysis of effects as an argument to defer or prevent action.

A fourth major characteristic of the climate issue is the global nature of its causes, effects, and the actions and policies required to modify it. No country can solve the problem on its own, and the actions of one can be negated if others fail to act. That does not mean unilateral action is irrelevant, only that it is not a solution.

Universal action clearly seems required. An appreciation of that fact may be valuable in promoting a global approach, but it can also deter national action if it proves difficult to achieve common policies, or if a nation tries to act as a free rider, benefiting from the actions of others without contributing. The complicated bargains over policy that must be struck within nations will be rendered more difficult by international negotiation over issues that are not likely to parallel those domestic bargains. Perhaps more significant in the long run is the absence of any institution in the international system with the authority to dictate or enforce trade-offs. For the time being, national attitudes are not likely to accept such a dramatic ceding of power to international institutions.

Further complicating the global nature of climate change are the profound differences between developing and industrialized countries in both causes and consequences. Today, the developing world (including China with its large coal reserves) accounts for about one-third of the emissions of greenhouse gases, but its contribution will grow rapidly as population and development increase. Developing countries are not likely to compromise their objective of economic growth in response to a problem created by rich countries. As developing nations are fond of pointing out, with justification, it is the industrialized countries that have benefited from using the global atmosphere as a sink for their carbon byproducts and that now propose limits on the use of that shared resource. Curbing greenhouse gases is not the highest priority of developing countries; and in any case, their response would require an immediate infusion of money, skilled labor, and technology.

To include the developing countries in an attempt to cap or reduce emissions would require global bargains between the North and the South including a large expansion of development assistance. A new global fund of "only" a few billion dollars would be on the wrong scale, no matter how useful such a fund might be in its own right. In addition, some countries may see themselves as winners if warming occurs, reasoning that they will benefit from longer, more productive growing conditions or from a more hospitable climate. Or they might calculate that the costs of warming would not be significant to them and would be lower than the costs they are being asked to bear to prevent it. Such nations may be lukewarm participants at best in negotiations toward common international action. Ironically, reducing uncertainty might show that some states would benefit, thereby dimming their interest in an international agreement.

The global character of the issue also has important implications for international cooperation, first for reaching agreements and later for the oversight and management of commonly agreed rules, resource transfer, research, monitoring, and dispute settlement. International organizations perform all these functions today within their areas of responsibility, and do so more effectively than is often believed. Nevertheless, national governments are not about to delegate significant authority over matters central to their political and economic interests to an external body. Negotiation and implementation of agreements will be carried out within the basic nation-state system. The contending national policy processes striving for agreement will ultimately determine what is done.

A fifth dominant characteristic of the global warming issue is its dependence on the theories, research, and calculations of scientists even to know there is a problem. Only

uncertain and conflicting data indicate a warming trend consistent with the predictions. There is no tangible evidence yet--nothing that can be seen or felt. Although the word of scientists alone is enough for some things to be judged dangerous--the thinning of the Earth's ozone shield and the unseen relationship between a chemical and cancer, among others--observable evidence of some kind is usually necessary to catalyze corrective action. For climate change, there is no demonstrable effect. Indeed, comprehensive data showing a sustained buildup of CO₂ in the global atmosphere began to be collected only in the 1950s.

The evidence of such a buildup is growing and becoming more precise, and imaginative paleoclimatic research is uncovering a relationship (not necessarily causal) between the atmosphere's greenhouse gas content and swings in the planet's average temperature. However, estimates of future temperatures and other effects rely on complex computer models of the Earth's atmosphere, designed and steadily improved by a relatively small group of scientists. These scientists would be the first to concede the imperfections of their models and the incompleteness of their data, especially with regard to the oceans and their interaction with the atmosphere. Potentially significant feedback effects (such as clouds or changes in absorption of CO₂ by the ocean) are not adequately accounted for, and computers are still incapable of performing computations on the needed scale. Many scientists would also admit to a considerable degree of incestuousness within the community: Common paradigms are reinforced through intensive interactions among a small group of researchers.

Nevertheless, a consensus among many researchers (though by no means all) holds that the consistency in the predictions of various models, along with corollary evidence, provides a reasonable basis for anticipating the indicated temperature rise. No scientist asserts that the effects will definitely occur in a particular time frame, but many leave no doubt that they accept the general consensus.

In essence, elements of the scientific community have reached a judgment based on limited evidence and imperfect models that has massive implications for the health of the ecosystem and for the fate of people and of nations. The image of an inverted pyramid comes to mind, of a steadily broadening body of implications that rests ultimately on the point of a relatively small band of dedicated scientists who recognize the uncertainties of their work.

The dependence of the public and policymakers on scientists for basic information on global warming has few parallels--weapons issues may be the closest example. The uncertainties, however, make it inevitable that respected scientists will be found on all sides of the issue; judgments will differ about the importance of the shortcomings in the data, the models, the interpretations, and the expectations of what future research will show. When it comes to difficult, costly, detailed economic and political choices, scientific experts will be testifying in opposition to one another.

The press plays an important role here, too. Much of the public concern about global warming is undoubtedly a result of the media focus on the more dramatic predictions,

since apocalypse makes for good copy. However, on detailed questions media coverage that strives to present all sides tends to portray differing scientific viewpoints as equal in merit, whatever the actual balance is among the scientists.

In fact, scientists face serious dilemmas in presenting their evidence, in characterizing uncertainty, in steering a course between objectivity and advocacy, and even in handling potential conflicts of interest as they seek research funding. Brutal candor about the imperfections of data and models may deter appropriate political action, just as subtle advocacy may lead to unjustified action. The importance of effective science policy mechanisms in governments thus becomes clear: They must be able to sort out conflicting views and relate knowledge and uncertainty to the demands of the policy process. Such mechanisms cannot resolve uncertainty or differing scientific judgments, but they can clarify policy choices and their implications.

Finally, the very planetary characteristic of the issue may come into play. Climate change is seen as a threat to the entire planet in a way only previously encountered in the destruction of the ozone layer. There is, or may be, a visceral public response to that kind of threat that goes beyond other environmental concerns. Is this response significant in the ecological consciousness being expressed on this issue? It is an open but possibly critical question.

These considerations lead to a conclusion that may be deeply troubling to some but is nevertheless compelling: Unless overwhelmed by a strong and enduring public consensus or by political leadership not yet in evidence, the political processes within and among nations are not likely to bring forth substantial policy action until the uncertainties surrounding climate change are greatly reduced, and probably not until evidence of warming is palpable. This conclusion holds, even though the Earth's climate may sustain irreversible changes if some of the forecasts are correct.

Among industrial countries, the United States may prove to be the most resistant to formulating comprehensive policy and to taking early action, especially in the absence of clear leadership. The divided American governmental structure--with conflicting bureaucratic and legislative goals and overlapping jurisdictions and agendas--makes agreement difficult even on less demanding issues. Virtually every federal agency has a legitimate interest in the climate issue; correspondingly, most congressional committees will be involved in the debate, each with different turf to defend or expand and each with a limited vision of the whole. Conflict between the overlapping jurisdiction of House and Senate authorizing committees and between the Congress and a fragmented executive branch further complicate the matter. All of this will militate against policy that would levy serious costs on powerful segments of society or that conflict with deeply held political commitments to such subjects as taxes or the appropriate scope of government. The central role assigned to the president's science adviser, Allan Bromley, to lead policy formulation in the executive branch on the climate issue is an encouraging step, though the obstacles to coherent policy are clearly formidable.

Significantly, the inherent uncertainties of the issue extend to the costs of adaptation to the warming. The costs of adaptation for some countries, especially the richer countries, may not be very large even when they are compared directly--without any discounting for the future--to the costs of prevention. Thus it becomes quite unlikely that actions with substantial short-term costs will be taken, at least until much more is known.

The growing strength of public support for environmental protection and the accompanying growth in mobilization and influence of national and international environmental movements will become more important. But it remains doubtful that these movements can move publics and national policy processes sufficiently in light of the uncertainties of the phenomenon itself and the more certain costs of action.

The successful conclusion of the Montreal Protocol in 1987 to cut production and use of CFCs might indicate otherwise. The agreement was an important precedent for international action before evidence of damage was in hand. Yet it also underscored the difficulties: The ability to reach agreement was aided by dramatic evidence of the unpredicted ozone hole over the Antarctic, while the immediate economic costs of regulation were relatively minor. Even so, agreement was difficult and resulted only in a commitment to cut CFCs by 50 per cent, though many industrialized countries subsequently called for a total phaseout of CFCs by the end of the century. The experience of the CFCs negotiation is relevant to the global warming issue, but it hardly compares in complexity and economic implications.

The presence of hard evidence is particularly important to the staying power of public attitudes. The North American heat and drought of 1988, heralded by a prominent scientist in congressional testimony as the arrival of the greenhouse effect, helped catapult the issue high on the environmental agenda, at least in the United States. Although subsequent analysis did not show a direct relationship between that summer's weather and global warming, the heat and drought nonetheless served to focus attention and opinion. Undoubtedly, several more summers of that kind--whether or not a causal tie to temperature rise exists--will continue to fuel the public pressure necessary to override obstacles in the policy process. On the other hand, a series of cooler-than-normal years might lessen both public interest and the ability to mobilize political action on the issue.

This confusion of appearance and reality can be avoided only through the ability to convincingly relate gradual climate changes or other environmental effects to changing average temperatures. One principle seems clear: The risk of capricious public opinion cannot be managed by dramatic pleas that are later shown to be wrong. The credibility of science and government is a powerful card, but one easily damaged.

Where Do We Go from Here?

This may seem a bleak description of the probable response to the threat, perhaps bleaker than it actually will be, given the many activities within nations, at the United Nations, and in international scientific circles. Certainly policy attention to the problem has

spawned a growth industry of conferences, seminars, analyses, studies, and policy research. It would be ungenerous to wonder whether this frenetic activity will ultimately be productive; even if it may be inefficient, greater understanding of the issue is essential for policy formation.

While scores of policy proposals have already been advanced, a few general prescriptions seem in order here. Perhaps the most important, though the most difficult to accept, is to recognize that the uncertainties surrounding climate change are genuine. A premature commitment to action can pose serious dangers of error and backlash and can incur costs that would affect a wide variety of interests. Not all these interests are narrow; indeed, one is the economic growth necessary to have resources adequate for later needs as they emerge. Measures that reduce emissions and contribute to other goals, such as improved energy efficiency, are numerous; but they must be justifiable on their own merits. If not, and if they increase costs, the achievement of other major social objectives will be unnecessarily harmed. Still, the risk of global change with serious consequences is sufficiently great that heroic measures are justified to understand the true situation better and to prepare policy responses that could prove necessary.

Several steps should follow. The first is the most compelling, even if it is the most obvious: Adequate funds must be made available for the research necessary to reduce uncertainty. It is difficult to imagine an issue for which that argument has more validity, no matter how banal the recommendation. The \$1 billion proposed in the United States for the president's fiscal year 1991 budget for research on global change is substantial, but it includes several expensive space projects. The remainder appears small in comparison to the scale and danger of the problem. Expanded U.S. funding might also encourage additional funding in other countries.

Much policy research is also necessary. In the future it will be critical to understand some of the interactions discussed here. These include careful assessments of the real costs of adaptation, of the tradeoffs among energy resources, of international negotiation processes, and of a host of issues associated with international organizations and Third World development. The fervor with which universities and a wide variety of other institutions, in the United States at least, have embraced the issue is a bit frightening, and in some cases self-serving. On the whole it is encouraging, however, because ideas and policy approaches will begin to be sorted out.

The appropriate international steps are more difficult to assess. Current discussions in the U.N. and other international forums are raising the issue's visibility among governments and publics. These negotiations are creating political momentum that will lead to some form of global negotiations. By September 1990 the Intergovernmental Panel on Climate Change set up by the U.N. is scheduled to offer its assessments of the scientific evidence and the socioeconomic impact, and to suggest response strategies. In addition, a negotiating body will be established to draft a climate-stabilization treaty for the 1992 U.N. Conference on Environment and Development. There is a good chance such a treaty will be attained at that conference.

However, in spite of the time and attention the international community is devoting to the subject, such a treaty and supplemental binding agreements to restrict emissions are not likely to have substantial reach, or to be accepted if they do, for all the reasons outlined above. The United States, the USSR, and Japan have made clear their skepticism about the adequacy of the knowledge base for taking strong measures. The need to develop policy for the international discussions will, however, be a useful spur for increasing understanding of the issues, for reducing the uncertainties, and for increasing the pressure on governments to focus attention and resources.

The international focus on global warming may also lead to two other important results. The first is that prospects may improve for measures, unilateral or international, that offer many benefits but do not find their primary justification in combating global warming. The complete cessation of CFC production or steps to increase energy efficiency and conservation are two broad examples of such measures. The second may be the development of contingency policies and a framework of international agreements if action proves necessary. Stringent policies to cut emissions may be politically impossible or even inappropriate today; but if they prove to be justified in the future, it would be of enormous value to have a clearer idea of the issues at stake, the policy alternatives, and a process for rapid response.

The role of the United States will continue to be central in the climate issue. As the biggest source of CO₂ and the nation with the largest scientific enterprise relevant to the subject, the United States will strongly influence the roles and attitudes of others. So far, the Bush administration has followed a low-key path, both domestically and internationally, and has given no impression of advancing the issue more than the minimum required. The question now is not what specific positions the administration takes on controlling greenhouse gases, but rather what determination it shows, including through funding, to bring the matter into focus and to take a leading international role in spurring collaborative research and the development of contingency policies.

The climate issue cries out for imaginative marshaling of political resources and for leadership from Washington, but not for questionable actions launched prematurely. The issue deserves a concerted commitment of domestic funds and personnel, imaginative international participation, and something more than the past penurious support for the U.N. The world is waiting for America to show that it understands this broader meaning of the role of power.

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By Eugene B. Skolnikoff

Eugene B. Skolnikoff, who worked in the office of the president's science adviser during the Eisenhower, Kennedy, and Carter administrations, is a professor of political science at the Massachusetts Institute of Technology.