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Environmental Decision Making and Multilateral Environmental Agreements

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Introduction: A New Generation of Environmental Issues

Humanity in the twenty-first century faces a new generation of environmental challenges. These threats differ significantly from past environmental problems that were primarily local accompaniments to the industrialization process. We are now learning that the industrial, agricultural, and energy policies that produced enormous economic growth during the last half-century are also beginning to have potentially serious environmental consequences for natural cycles and ecosystems upon which life depends.

These impacts are exacerbated by the continuing surge in human population numbers: despite declining birthrates in recent years, for most countries the greatest absolute increase in population will occur in the next half century. The resulting scale of human demands is reflected in an unprecedented exploitation of land and other natural resources, and in the outpouring of vast quantities of solid, liquid and gaseous wastes.

In the mid-1970s, the first truly global environmental threat to the planet – depletion of the stratospheric protective ozone layer – was theorized, derided, hotly debated, and ultimately proven true, later earning for its discoverers the Nobel Prize. In the years following, scientists across a broad range of disciplines began to sound alarms about other ominous environmental changes being brought about by human activities. These include: the greenhouse effect and climate change, the worldwide destruction of forests and habitat, the mass extinction of species and loss of biological diversity, the global diffusion of persistent organic pollutants, the spread of desertification and land erosion, the pollution of oceans and coastal waters, the destruction of coral reefs and serious depletion of fish populations, and the growing pressures on fresh water.

These varied problems nevertheless share a number of common characteristics. They are global in scope, crossing national boundaries and affecting most or all peoples. They develop very gradually, with a slow accumulation of almost imperceptible impacts -- for example, annual variations in global temperature are slight and are frequently affected by transient non-anthropogenic influences such as volcanic eruptions and solar radiance. Their probable impacts will occur far into the future, yet the potential damage to ecological systems may be extremely difficult to mitigate, perhaps even irreversible over generations, once they have become entrenched -- witness the Antarctic “ozone hole“ which, even with the phaseout of ozone depleting substances, will take about 75 years to overcome.

The common factor that presents the most difficulties to decision makers is that these complex issues are characterized by a considerable degree of scientific uncertainty concerning their causes, impacts, feedbacks, and the interrelationships among complex natural and social parameters. Often the dangers are theoretical and

remote, and the evidence may be incomplete or contradictory. It is extremely difficult to measure, much less predict, long-term trends. The concept of global reach is also not always obvious: for instance, that use of a perfume spray in Paris propelled by chlorofluorocarbons (CFCs) can lead to deaths from skin cancer half a world away and decades into the future.

The century ahead will thus increasingly be characterized by environmental problems that transcend the borders and responsibilities of sovereign states. The reality is that no nation, or group of nations, however strong they may be economically, politically, or militarily, can by themselves effectively counter these threats. Addressing these challenges will require an unprecedented degree of international cooperation, involving governments, intergovernmental bodies, the private sector, and, indeed, all of society.

The historic 1987 Montreal Protocol on Substances That Deplete the Ozone Layer heralded an upsurge of public sensitivity to *global* environmental threats and, in effect, ushered in a new era of environmental diplomacy. Foreign offices and finance ministries can no longer dismiss environmental concerns as irrelevant to traditional elements of national policy. Many governments have commissioned special ambassadors to coordinate and lead the increasingly complicated negotiations, which now require expertise not only in traditional ecological subjects, but also in economics, finance, technology, and arcane realms of science.

The past few years have, in fact, witnessed a virtual explosion of international negotiations to design multilateral environmental agreements (MEAs). These treaties and conferences were not one-time events, but rather, in most cases, they have launched an ongoing process of reporting and review of national policies and of scientific evidence. Institutional frameworks, supported by permanent secretariats and expert panels, have been established to assist continuing negotiations to appraise and refine national commitments in light of changing knowledge and conditions. Taken together, all of this can be regarded as a still-evolving system of international governance of the environment.

Against this background, I would like to explore six major factors that affect environmental decision making through the MEAs. Each one of these categories could be the subject of a dissertation, and other subjects might well be added to the list. Nevertheless, I offer the following preliminary taxonomy, with some accompanying observations, in the hope of stimulating further insights into synergies that might improve the effectiveness of environmental decision making:

- *interlinked problems*
- *scientific uncertainty*
- *negotiating process*
- *roles of president and secretariat*
- *technological imperatives*
- *time horizons*

Interlinked Problems

The new environmental challenges are often linked by common causal factors and by physical, chemical, and biological feedbacks. For example, climate change may generate far-reaching harmful impacts: rising sea levels could inundate low-lying

islands and coastal areas; changed rainfall patterns might have serious impacts on food production and hydroelectric power; warmer temperatures could spread tropical disease vectors northward; extreme weather events such as tropical storms, floods, and droughts could become more frequent and more intense; many species of plants and animals might not survive temperature changes.

Consider the linkages between the issues of climate change and forests. Carbon dioxide emitted from the burning of fossil fuels is the primary greenhouse gas. Its absorption by forests help to offset the emissions' impact on climate. When forests are destroyed, whether by humans or by natural forces, they release carbon dioxide and add to the greenhouse effect. And climate change itself could either add to or diminish forest growth, depending on such factors as location, rainfall, soils, etc.

Climate change and stratospheric ozone depletion are related through numerous subtle patterns of interaction. Ozone layer depletion affects global warming in contradictory ways. Since ozone itself is a greenhouse gas; its depletion tends to cool the stratosphere and offset global warming. Ozone depletion also permits ultraviolet radiation (UVB) to break down other greenhouse gases more rapidly. But UVB can also destroy natural carbon sinks such as plants and phytoplankton, thereby aggravating climate change. Further, some substitute chemicals specifically developed, and promoted, to protect the ozone layer, are powerful greenhouse gases. And some technologies for replacing ozone depleting substances are less energy efficient, thereby contributing to higher fuel use and climate change. In addition, other greenhouse gases can intensify the rate of ozone depletion. The net effect of all these interactions on climate change and the ozone layer is still subject to further research.

Biologists warn that alarming rates of extinction of plant and animal species are taking place due to the effects of air and water pollution, desertification, and clearing of vast areas of forests and other habitats to satisfy demand for wood products and provide land for settlement, mining, and farming; climate change would add to such impacts. More than one-fifth of the world's tropical forests, which contain the richest concentrations of species, have been lost since 1960. Pollution of coastal waters from urban and industrial wastes combine with overfishing to decimate fish populations; already almost three-fourths of oceanic fish stocks are classified as depleted, declining, or fully exploited. The worldwide spread of hazardous wastes and toxic chemicals -- especially persistent organic pollutants – also affects the health of many species. The effect of this manifold assault on the planet's gene pool, including potential pharmaceuticals, will be to increase the risks of human disease and the vulnerability of food crops to blights and changing climate.

Burning of forests and grasslands, compounded by inappropriate agricultural and irrigation practices, is also contributing to erosion and the spread of drylands, with annual losses of billions of tons of topsoil. Approximately one-fourth of the world's land area is currently degraded, and by 2025, the number of people adversely affected by desertification and drought is expected to double, to nearly two billion. Added to this, the cumulative pressures of municipal, industrial, and agricultural needs, together with pollution from these same sources, are making scarcity of fresh water into a major global problem. Currently 1.3 billion people lack clean water, and it is projected that by 2025 two-thirds of the world's population will live in water-stressed regions.

Varied problems such as sea-level rise, declines in agricultural productivity, destruction of forests, soil erosion, desertification, flooding, and scarcity of fresh water can lead to environmental migration involving mass movements of people.

The design and implementation of MEAs, whether their immediate focus is climate or ozone, forests or biological diversity, need to take account of the many-faceted interlinkages among environmental and social factors. Otherwise, we risk inadvertently adding to one problem while attempting to solve another. Or at best, we miss opportunities for synergistic activities and mutually reinforcing measures. Associated institutions, training, research, and investments should also reflect the inter-relationships among different core environmental problems.

Complex and Uncertain Science

Science and scientists are of paramount importance in the process of addressing the new environmental challenges. The complexity of global environmental problems has engendered research at the frontiers of modern science. And the research is a continually unfolding drama: the more scientists learn, the more new questions arise.

The Montreal Protocol offers a revealing example of the exciting and complicated nature of modern environmental science. The thin layer of ozone molecules scattered throughout the upper atmosphere is an essential precondition for all life on Earth, for it is our sole shield against dangerous wavelengths of ultraviolet radiation from outer space. Although lower level ozone – created by automobile and industrial emissions – also absorbs ultraviolet radiation, it is in itself dangerous to human health. Other low altitude airborne particulates may also mask the adverse effects of declining ozone in the stratosphere. Hence, the desirable objective of improving ambient air quality by removing sulfur dioxide and similar pollutants can actually increase the risks of skin cancer caused by a depleted stratospheric ozone layer.

Ozone amounts to considerably less than one part per million of the total atmosphere, and 90 percent of it is found above six miles in altitude, which is where it performs its life-preserving function. Twenty-five years ago, it was known that the intrinsically unstable ozone molecules were continually being created and destroyed by dimly understood natural forces involving solar radiation and chemical interactions with even more minute quantities of several trace gases. To complicate matters, stratospheric ozone concentrations fluctuate considerably on a daily, seasonal, and solar-cyclical basis, compounded by significant geographical and altitudinal variations.

Amidst all these fluxes, scientists faced a formidable challenge in predicting, and then detecting, the minuscule “signal” of a downturn in stratospheric ozone concentrations, not to mention linking such a development to anthropogenic chemicals, notably the very useful chlorofluorocarbons (CFCs). This necessitated the development of ever more sophisticated computer models to simulate the stratospheric interplay among radiative, chemical, and dynamic processes such as wind and temperature -- and projecting this for decades or centuries into the future. Intricate miniaturized measuring devices were created and fitted onto aircraft, satellites, and rockets in order to monitor remote gases in quantities as minute as parts per trillion.

To understand the implications of a fading ozone layer, scientists had to venture far beyond atmospheric chemistry: they had to examine our planet as a system of interrelated physical, chemical and biological processes on land, in water, and in the atmosphere – processes that are themselves influenced by economic, political, and social forces. Resolving the uncertainties and devising solutions became a massive international and interdisciplinary effort. Over the years, researching the dangers and solutions involved not just chemists and physicists, but also meteorologists, oceanographers, biologists, oncologists, economists, soil scientists, toxicologists, agronomists, pharmacologists, botanists, entomologists, electrical, chemical, transportation and materials engineers, and many other specialists.

If the ozone layer issue is now considerably better understood, other global environmental problems remain plagued with scientific uncertainties. For example, assessing the extent of biological diversity and species extinction is complicated by the fact that most animal and plant species have not yet even been identified. In the case of climate, scientists cannot predict what level of greenhouse gas concentration might precipitate calamitous impacts, nor can they measure such possible offsetting or delaying factors as cloud cover or carbon absorption by forests and soils. A major problem affecting the climate treaty negotiations has been the lack of indicators for the probability, severity, timing, or location of the various potential negative impacts.

In the face of incomplete scientific evidence, it becomes necessary to forge an international scientific consensus on the timing and extent of future dangers and on the feasibility of alternative mitigation strategies. The Scientific Assessment Panel on Stratospheric Ozone and the Intergovernmental Panel on Climate Change have involved thousands of scientists from around the world over a period of many years in a continual round of workshops, research seminars and peer-reviewed papers. Similar assessments have been organized on persistent organic pollutants, biological diversity, forests, the marine environment, and freshwater resource degradation.

However, an international scientific consensus is not by itself a sufficient precondition for government action in the face of uncertainties. Scientists must leave their laboratories and assume, alongside the diplomats, an unfamiliar share of responsibility for interpreting the policy implications of their findings. Sharing the political limelight with policy makers is an unaccustomed role that may occasionally be uncomfortable for a scientist. Yet, the fruitful interaction between scientists and diplomats proved to be an indispensable element in the success of the Montreal ozone protocol. Never before have so many scientists played such a prominent and continuing role on the international stage as in the new environmental diplomacy. For their part, political and economic decision makers need to fund the relevant research and to work together with scientists on realistic assessments of the risks and potential mitigation measures.

Negotiating in a Theater

Three major trends in the negotiation of MEAs have become prominent in recent years. First, the negotiations have become increasingly complicated as they confronted interrelationships among the environment, economic development, science, technology, and politics. Beset with traditional short-term economic and social priorities, governments found themselves in uncharted territory when they tried

to confront possible global environmental developments decades or even centuries in the future under conditions of considerable scientific uncertainty.

Second, many more governments have become involved in the process. It is easy to forget that the 1987 Montreal Protocol was originally signed by only 24 countries, the great majority of which were OECD nations. Recent negotiations in The Hague and Bonn of the Kyoto Protocol under the UN Framework Convention on Climate Change have involved some 180 governments.

Third, nongovernmental actors are finding significant roles in MEA negotiations, representing a major break with tradition. The only nongovernmental observers at the final negotiating session of the 1985 Vienna Convention on Protecting the Ozone Layer in March, 1985, had been three industrial associations – unbelievable as it may seem today, not a single environmental group was present at the signing of the first ozone treaty. In contrast, hundreds of nongovernmental organizations (NGOs) now participate routinely in MEA negotiations, representing the wide span of civil society: academe, agriculture, charities and aid groups, environmentalists, indigenous people, industry, labor, local communities, parliamentarians, religion, science, women, and youth.

The civil society has become a presence in virtually every nation, North and South. Such groups are now linked electronically and work together to coordinate positions and tactics before and during MEA negotiations, much in the same manner as governments. They undertake research, lobby parliaments, use the media to mobilize public opinion, and serve as watchdogs to monitor governmental compliance with treaties. Occasionally, NGO representatives are invited to serve on government delegations, where they have still more influence on the process.

The challenges for this new multilateral diplomacy are formidable. Even though voting rules are customary under United Nations and other intergovernmental proceedings, enormous efforts are expended to arrive at decisions by consensus, which naturally tends to prolong the negotiations. The complexity of the issues, together with the sheer number of actors, is also reflected in the structure and length of the negotiations. The Montreal Protocol originally involved only about 40 nations in four sessions lasting 5 to 9 days over a period of merely nine months. In contrast, the 1992 United Nations Conference on Environment and Development (UNCED) required no less than seven separate sessions over 2 ½ years, and the resultant Agenda 21 contains 40 chapters with over 800 pages. It is estimated that the final UNCED preparatory committee meeting alone generated 24 million pages (in the six UN languages); hundreds of documents were circulated by national delegations, the secretariat, and NGOs during this five-week session. A typical day saw 20 separate meetings dealing with over 70 different documents for decision.

Another complex feature of MEA negotiations is the growing role of smaller groupings of nations, united by regional, economic, or other special concerns. To the traditional UN regional groups of Africa, Asia, Eastern Europe, Latin America and the Caribbean, and Western European and Other, must be added such combinations as the Alliance of Small Island States (AOSIS), a group of over 40 small nations united by fear of rising sea level caused by climate change; the 15-member European Union; Former Soviet Union nations of Central Asia; the Group of 77 and China, representing over 130 developing countries; Nordic states; the Organization of Petroleum Exporting

Countries (OPEC); and such ad hoc, cross-regional alliances in the Kyoto Protocol negotiations as the “Environmental Integrity” and “Umbrella” groups.

Most countries may belong to, or have an interest in, more than one such informal grouping. This can put a strain on delegations, especially smaller ones, and may also necessitate pre-breakfast meetings to get all the “coordinating” done before the opening of negotiating sessions at 10 a.m. This problem is exacerbated as the number of working groups and informal contact groups multiplies. There have been complaints over this situation, particularly from many developing countries that simply cannot afford to field large expert delegations at lengthy sessions in expensive cities (notwithstanding some financial support provided for their attendance).

With all of this, environmental decision making through the MEAs has increasingly assumed the aspect of a theatrical spectacle, with thousands of actors from governments, NGOs, and the media. Some zealous advocacy organizations have organized noisy protests or demonstrations, sometimes even in the negotiating halls, in an attempt to garner publicity and influence the deliberations. Security concerns in recent Kyoto Protocol conferences in The Hague and Bonn necessitated strong police presence, which is not conducive to sensitive and creative negotiation of complex subjects.

In the glare of publicity, and beset by political pressures from opposing interest groups, it has become difficult for negotiators to engage in reasoned discourse, testing ideas and exploring options without the risk of making headlines. Rather, the temptation is often to focus on short-term political results, even though the problems under consideration are inherently complex and long-term in nature.

There is, thus, a growing tension between the legitimate concerns for transparency and democracy on the one hand, and the effectiveness of the decision making process on the other.

The Indispensable President and Secretariat

It is not often realized how much the president and the secretariat of a major MEA contribute to environmental decision making.

The chair of a global negotiation is usually a senior diplomat from one of the participating parties, known for his wisdom and experience and elected by the governments. Examples include Ambassador Tommy Koh of Singapore for UNCED, Ambassador Jean Ripert of France for the climate convention, Ambassador Winfried Lang of Austria for the ozone treaties, and, more recently, Minister Jan Pronk for the Kyoto Protocol.

Monsieur le President (or Madame la Presidente) performs a central function. But in addition, a negotiation’s success depends on other individual leaders, some elected as vice-chairs for political or other reasons, some appointed by the chair or secretary-general for their diplomatic and mediating skills, and some heads of delegation. Often the vice-president title is little more than ceremonial: UNCED had no less than 39 vice-chairs, elected after excruciating regional political maneuvering, most of whom played no significant role in the real negotiations. For the uninitiated observer,

it can be quite difficult to identify the true central actors in the complex global drama that is unfolding.

In presiding over a meeting, whether it be 3,000 delegates from 180 countries in a televised plenary, or 20 mid-level negotiators in a secret contact group, the aim of the chair is the same: to build a viable consensus with meaningful contents that takes account of widely varying national political, economic and environmental concerns. To accomplish this objective, there can be no substitute for a firm knowledge of the substance of the issues, with all their scientific subtleties and political nuances. Additionally, the chairman or -woman can profit from such personal characteristics as tact, patience, humor – and perhaps a sense for theater.

The chair must gain the confidence and respect of competing national delegations, while assuaging often-powerful NGOs representing a broad spectrum of differing perspectives. He or she must be fair but firm in the use of the chair's authority to foster a spirit of compromise and cooperation, while minimizing or deflecting rancorous confrontation. The chair will have a fine sense of when and how to overrule a recalcitrant delegation, observing a fine line between exercising forceful, confidence-inspiring leadership, and antagonizing sensitive egos. The indefinable aura of charisma is an important factor; it is not unknown for the chair to lose control of a meeting.

A chair will guide and persuade, cajole and push. He or she will sense how long to allow a debate to develop, or to drift, and when to curtail the discussion and move on. In a deadlock, the chair will know when to call a recess or to defer the decision to a later time or a higher body, e.g., to ministers. The chair will also sense when to appoint smaller groups or "friends of the chair" to work on new language, or when to offer compromise formulations on his own authority via a "chairman's text" when the nations are at impasse. The chair will apply pressure on pivotal delegations to yield or accept compromise, will ask delegations to reconsider, will broker the trading of concessions, will meet in private with key participants. Knowing the potential contributions of individual negotiators, the chair will sometimes call on someone out of turn in order to build a momentum toward resolution of a stalemate. The chair will look for and seize the moment when the mood changes and positions begin to coalesce toward a compromise.

The success of a large intergovernmental negotiation is also strongly dependent on the secretariat. The secretariat is essential for such tasks as developing or commissioning background documentation, convening meetings, providing translation, and similar logistical activities. During the heat of negotiation, delegations depend upon the secretariat to keep track of revisions and amendments of rapidly changing texts, often being negotiated in widely separated rooms. The secretariat must juggle meeting room schedules to accommodate smaller working groups, often at short notice in response to opportunities or crises. Texts must be collated, translated, and distributed via a system that often resembles a small-town post office.

It is important to recognize that a secretariat has the capacity to go well beyond the logistical functions, important as these are. Secretariat personnel provide continuity for negotiations that may continue over a period of years, during which there may be turnover among the government negotiators. They therefore represent a crucial

repository of experience and information. The secretariat can play a critical catalyzing role, developing pertinent data, sponsoring technical and scientific studies, illuminating issues -- and even influencing world public opinion. Experienced senior secretariat officials had a major impact on UNCED through their efforts in skillful drafting, mediating, and gaining the confidence of chairpersons and government negotiators.

Secretariats have also kept issues alive when many participating governments might have preferred the negotiations to languish. Such was the role of the UNEP secretariat on the ozone issue in 1981 and 1982, when the newly appointed U.S. Environment Protection Agency head under President Reagan declared ozone layer depletion to be a "non-problem" – a position fortunately reversed after she was fired.

A strong secretary-general can enhance the secretariat's influence, even taking personal positions, initiating proposals, and advancing concerns that might otherwise be overlooked by the governments. In effect, he can serve as a subtle advocate for stakeholders not formally represented at the negotiation. This can be a risky course, and to succeed, the secretary-general must be especially prominent and/or posses an independent stature or political base. UNCED Secretary-General Maurice Strong could play such an expanded role because of his close personal relationships with many heads of state and UN agencies and his unparalleled access to the media and to the nongovernmental community. UNEP Executive Director Mostafa Tolba drew upon his strong political credibility among developing nations, as well as his internationally recognized credentials as a scientist, to steer the ozone negotiations to Montreal in 1987 and in the critical amendments subsequently negotiated in London in 1990 and Copenhagen in 1992.

Technology for the Future

Critical for addressing the new environmental challenges are technological innovation and the related roles of the business sector and of market instruments. Research and development will be essential for creating and diffusing the commercially viable technologies that will be needed to reconcile future economic development with effective environmental protection. New technologies will affect virtually every aspect of life, from high-tech energy sources to revolutionary farming techniques.

The success of the Montreal Protocol offers abundant lessons on how financial resources and talent can be mobilized to meet technological challenges that at first seemed insurmountable. The treaty was technology forcing in the sense that, at the time of its signing, replacements were unavailable for nearly all uses of ozone depleting substances. By the mid-1980s, CFCs and related chemicals had found applications in thousands of products and processes that made them almost synonymous with modern standards of living: from air conditioning, insulation, and insect control, to pharmaceuticals, telecommunications, and spacecraft.

The protocol fostered a unique collaboration between governments and private companies, supplemented by international organizations and environmental groups, that launched a worldwide process of innovation. The results were astounding. Former competitors joined forces to cooperate in toxicity and safety testing of new substances, thereby economizing on development costs. Consortia of companies from the North aided their counterparts in the South with training and technology

transfer. User industries in the electronics and aerospace sectors did not wait for chemical companies to develop new solvents for the heretofore irreplaceable CFCs, but rather reexamined their own manufacturing processes and came up with a variety of fascinating solutions, from citrus extracts to solvent-free engineering. In sum, the Montreal Protocol brought about a veritable technological revolution that enabled most ozone-depleting substances to be eliminated in both North and South ahead of the timetables established by the treaty.

The experience of the Montreal Protocol underscored the necessity of providing adequate financing for all levels of science, from curiosity-driven basic research to applied engineering solutions. Although most ozone layer research funds came originally from governments, investments by the private sector proved crucial in developing substitutes for the ubiquitous CFC family of chemicals, in many cases where alternatives had been considered impossible.

Unfortunately, the international approach to the climate issue has followed another path. While the industrialized nations committed themselves in Kyoto to difficult targets, most of these same governments were dramatically reducing their investments in research on energy and technologies that would be essential to achieving long-term reductions in greenhouse gas emissions. Public sector energy research and development budgets in the nine leading OECD countries declined on average by more than 20 percent in real terms during the decade preceding the Kyoto Protocol.

Significant future reductions in greenhouse gas emissions, however, cannot occur without much more extensive commercial development of non-fossil fuel energy sources, as well as new technologies for carbon sequestration and innovative practices in land management. Further into the future, carbon-free energy technologies will be needed. Some are already in theoretical or experimental stages: superconductors, biofuels, microtechnology, hybrid fuel cells, solar hydrogen, and fusion energy. But “innovation as usual” will be insufficient: no serious approach to climate change can neglect the need for substantially more investment in research and development.

Examples of new environmental technologies needed to address other environmental issues of this century include the development of safe and economical alternatives to persistent organic pollutants; low-impact wood harvesting techniques; water conservation and purification; waste treatment and disposal; and agricultural and irrigation practices to increase productivity and stem the spread of drylands. All of this will depend on adequate, targeted funding and public-private cooperation.

An important factor for unleashing the creative energies of the private sector is the appropriate use of economic and market-based instruments. Among policies that will need to be adapted to the challenges of the next century are strategic research and development subsidies; cooperative government-industry agreements; tradable quotas and permits; taxation and pollution charges; government procurement policies, norms and standards; elimination of subsidies to environmentally destructive activities; eco-labeling and transparency; and carefully designed regulations that do not stifle entrepreneurial initiative.

Time Horizons

A basic factor influencing environmental decision making in MEAs is the degree to which policies and commitments are based on a short-term or a long-term time perspective. A difference in time perspective can lead to very different conclusions. This is a difficult issue: while the global environmental challenges are inherently long-term in nature, both governments and private industry exist and act within a relatively short time horizon.

Most of the causes of the new environmental threats are linked in some way to fundamental aspects of economic growth and development – e.g., use of fossil energy, industrialization, food production, clearing of forests, urbanization, consumer life-styles. Preventive measures will, therefore, often involve substantial structural changes and costs in the short term. Decision makers are thus placed in the uncomfortable position of having to weigh tangible short-term costs against uncertain long-term risks.

The negotiating governments respond to the whims of often superficially informed public opinion and/or powerful special interests. For its part, the private sector, which will be responsible for most of the research, investments, and economic dislocations associated with mitigating or adapting to environmental impacts, is focused on costs and profits as reflected in the judgments of the financial markets. In this situation, it is difficult to strike a balance between short-term exigencies and the long-term nature of the environmental problems being addressed.

A given country's time perspective in an environmental negotiation may be influenced by multiple factors. Its level of development, geography and climate, natural resource base, industrial structure, institutional capacity, population pressures, type of government and openness of its society, will all play a role. The sense of urgency associated with the state of scientific knowledge and evidence will contribute significantly to the negotiating and decision making process.

In the case of the ozone issue, new scientific evidence on dangers to the ozone layer continued to accumulate even after the Montreal Protocol was signed. In light of the undisputed fatal consequences of substantial ozone layer depletion, the scientific findings stimulated the parties to repeatedly amend and strengthen the treaty's commitments. In contrast, the climate change science, as noted earlier, is still uncertain in several crucial areas, notably the probable onset and severity of impacts. This factor affects the sense of urgency of most of the negotiating parties, and lends more weight to the nation's own particular short-term political and economic interests.

Thus, for example, most developing countries have resisted commitments to limit their rapidly rising emissions of carbon dioxide from energy and destruction of forests. Instead, they stress their more urgent priority of reducing poverty and increasing living standards – which will require greatly increasing supplies of energy. Except for the small island states, the developing nations tend to overlook their own vulnerability to possible long-term impacts of climate change. By focusing on currently cheap coal and oil, they also risk being locked into inefficient but long-lived capital investments in energy and infrastructure that will be obsolete as the industrialized nations move toward a carbon-free energy system.

One reason for the ozone protocol's effectiveness was that the targets set for reducing consumption of ozone depleting substances were appropriate to the time frame: they challenged industry without being unrealistic. Instead of expending time and energy in resisting the protocol, the private sector set to work and produced the wave of innovation described earlier. The effective transfer of this technology from North to South encouraged developing nations to accept commitments to reduce and even phase out their use of ozone depleting substances.

In contrast, the Kyoto Protocol emissions reduction targets represent a short-term approach to what is fundamentally a century-scale problem. While the protocol satisfied the immediate political needs of many of the negotiating parties, its complicated provisions engendered significant resistance from the private sector and may prove very difficult to implement. For several important countries, especially Australia, Canada, Japan, and the United States, achievement of the targets would entail significant short-term costs -- unless the targets were significantly diluted by offshore compliance under the "flexible mechanisms" of the protocol, including emissions trading and joint projects. The negative trends in energy technology research and development further contributed to the difficulties experienced by the climate protocol.

A longer time perspective in the climate negotiations would try to avoid the costs of forcing premature obsolescence of expensive capital infrastructure in energy producing and consuming sectors. To effectively address the climate change problem, realistic targets and complementary policy measures must be combined with a comprehensive strategy for energy technology research and development. Such a long-term strategy is essential to provide the technical capability for the much greater emissions reductions that will be necessary later in this century in order to stabilize atmospheric greenhouse gas concentrations at an acceptable level.

Conclusion: New Levels of Coordination

The global environmental negotiations probe the interrelationships between environmental and economic factors; they are heavily dependent on the findings of science and the responses of technology; and they are significantly influenced by important stakeholders from the civil society. The organization and process of these negotiations reflect the complexity of their subject matter, as well as the greater numbers of new actors, governmental and others, now crowding the diplomatic stage.

Because of the underlying scientific, economic, and societal inter-relationships, environmental decision making in the 21st century will require attaining new levels of coordination on several fronts:

Science must become increasingly multi- and interdisciplinary, as exemplified in the climate and ozone treaty assessment bodies. The International Geosphere-Biosphere Programme, and similar initiatives involving national academies of science and other private and public research institutions, should be strengthened and adequately funded. Scientists must, together with policy makers, analyze the interlinkages between commitments under one MEA and impacts on another.

Intra-governmental coordination should be simplified and improved. At one Kyoto Protocol negotiation last year, the U.S. alone had over 150 delegates, representing

12 different government bodies, including 3 separate White House offices and the Congress. Inter-ministerial councils, with clear lines of responsibility and authority, need to be devised to meet the challenges of the new century. State governments and local communities can make important contributions, and should therefore be included in the process.

International organizations and treaty secretariats can substantially improve their effectiveness and efficiency through greater coordination and elimination of duplication. UNEP Executive Director Töpfer is launching a promising initiative in Geneva aimed at "issues management" by UN agencies. MEA secretariats could benefit from centralized administrative services as well as focused substantive interaction.

Finally, *intergovernmental* consultations on policies, research, and technology should be greatly expanded and regularized, in bilateral, regional or smaller fora, outside of the pressures of the mega-conferences. This would help to make the MEA conferences themselves more creative and effective in decision making.

In conclusion, meeting global environmental challenges in the coming century will require new dimensions of diplomatic cooperation, new ways to stimulate technological innovation, and the inclusion of new participants at all levels in the decision-making processes. We must try in future to better link our treaty goals with the state of the science, and to provide adequate and predictable funding to develop the new technologies that are required to meet those goals.

International agreements must be forged with commitments that reflect long-term objectives, and that are realistic and easy to administer, equitable and cost-effective. Even the actual negotiation of a modern environmental treaty is not an end in itself. An innovative feature of the Montreal Protocol was that it was not a static solution, but rather a dynamic process. The entry into force of an MEA becomes merely the springboard for further activities and negotiations in response to changing scientific understanding as well as technological progress and economic developments.

Given the uncertainties in both risks and costs, we can only hope for enlightened political and industrial leaders who can look beyond the next election and the next quarterly profit-and-loss statement. During debates in the House of Lords in 1988 over the Montreal Protocol, Lord Kennet remarked that "politics is the art of taking good decisions on insufficient evidence." (Hansard 1988:1308) For modern environmental decision makers, this observation assumes the quality of a maxim.