PROTECTING THE OZONE LAYER:

Lessons, Models, and Prospects

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THE MONTREAL PROTOCOL: THE FIRST ADAPTIVE GLOBAL ENVIRONMENTAL REGIME?

Edward A. Parson

Does the Montreal Protocol represent a new model for the negotiation and operation of international regimes? Other papers have identified several innovative aspects of the Protocol, of which I will concentrate on one. I propose that one fundamental respect in which the Protocol is a new model for international environmental diplomacy is that it is the world's first *adaptive* global environmental regime. This adaptive character is related to the "dynamic and flexible" character of the Protocol that several other participants, including Dr. Tolba and Ambassador Benedick, have identified, but poses more specific conditions. An adaptive regime is one that, in pursuit of an unchanging goal, does two things. It supports identification, synthesis, and assimilation of changes in relevant knowledge; and it incorporates the results of changed knowledge into revisions of control measures, policies, and institutional arrangements. Put another way, in articulating its original goal, an adaptive regime incorporates the insight that what is needed to attain the goal cannot be fully known at the outset, but must be progressively adjusted over time.

What makes the Montreal Protocol adaptive lies partly in the text of the treaty and partly in practices that have developed since 1987. In the treaty, Article 6 specifies that at least every four years, the Parties must assess the control measures on the basis of available scientific, environmental, technical, and economic information, and that at least one year before each such assessment, the Parties must convene appropriate panels of experts in each of these fields to report to them. These requirements, and the delicate balance of responsibilities and communication between the Parties and their assessment panels that has developed, have been the principal engine driving the progressive strengthening of the Protocol since 1987.

The enactment of these measures represented commendable foresight and initiative of those who worked on the Protocol in 1986 and 1987, but I believe they also reflect some measure of historical accident and good luck.

Good luck was involved in two ways. First, it is important to note, as others have alluded in their contribution to this symposium, that the 1987 control measures—principally a commitment to cut production and consumption of chlorofluorocarbons (CFCs) by fifty percent—were negotiated at a time when, on the one hand, the urgency of doing something to protect the ozone layer was widely recognized but, on the other hand, the stringency of measures necessary to protect it was not known. The authoritative international scientific statement at the time was the 1986 report "Atmospheric Ozone", widely known as the "Blue Books", which was sponsored by several agencies including both the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) but principally initiated and funded by the National Aeronautics and Space Administration (NASA). This authoritative three-volume summary of the scientific knowledge of the time was more survey than policy assessment, but its projections of the consequences of various scenarios of CFC use were widely cited as the best policy-relevant knowledge of the time. These projections were widely summarized into two simple messages. On the one hand, roughly constant CFC emission levels would result in only small depletions in total global ozone, of the order of a few percent, and these losses would be even smaller if other anthropogenic emissions, such as carbone dioxide and methane, continued to increase. On the other hand, substantial continued growth in CFC emissions would bring large losses of global ozone, of the order of ten to twenty percent. This report was in its final stages of preparation when the British Antarctic Survey reported their observations of the Antarctic ozone hole from Halley Bay. In a brief paragraph added in final editing, the report merely noted these shocking observations, and said that their cause or significance could not yet be assessed. Although the scientific expedition that yielded the decisive observations attributing the hole to CFCs was underway even as the negotiators met in Montreal, the question of the cause of the hole was unresolved as the Protocol was signed.

Consequently, if I might presume to make a retrospective rationalization of how the 1987 negotiators came to the fifty percent reduction, it might be as follows. If CFCs are *not* the cause of the Antarctic ozone hole, then the appropriate control measures look something like a freeze to prevent growth above present levels, as had been adopted as negotiating positions by both the European governments and the American chemical industry, based on their respective interpretations of the Atmospheric Ozone report. But if CFCs *are* the cause of the Antarctic ozone hole, then the appropriate measures look like very stringent cuts, perhaps complete elimination of the chemicals, as had been proposed by the United States and the Toronto Group. Similarly crucial and unresolved questions existed on matters of the technical feasibility of reducing CFC use, as anyone who recalls the feeble technology exhibits in the foyer of the meeting center here in Montreal ten years ago will realize. Under these conditions, it does not appear far-fetched to describe the agreement of 1987 as an agreement to split the difference (between holding to present levels and total elimination), and to revisit the question in a few years with continued scientific and technical input. This agreement, forced by the provisional

character of the measures undertaken in 1987, was what left us with such an effective process of periodic review and assessment.

The second respect in which good historical luck was involved in shaping the current situation concerns the form of the assessment process. The most salient example of an international assessment process in the minds of the negotiators was the Blue Books, plus the subsequent contribution of leaders and participants in that process to informing the negotiations. This contribution was viewed as so valuable by all Parties that the negotiators agreed, apparently with minimal discussion, to replicate the process of the Blue Books in the assessment panels established under the Protocol. For the Atmospheric Science panel, this decision amounted to a straightforward application of a proven model to a very similar task, albeit with some required adjustments of mandate and participation. But in the other domains, particularly in technology and economics, the Blue Books model was generalized to a very different domain of questions, resulting in the establishment of an unprecedented body, the Technology and Economic Assessment Panel (TEAP). It is a powerful indication of the esteem in which the 1987 delegates held the Blue Books that they established a panel in its image to address questions of technology and economics, where the line between technical and political argument is much harder to draw defensibly, and that they did not try to assert direct control.

These decisions, through whatever combination of intelligence, foresight, and luck, have left us with an assessment process under the Protocol of unprecedented effectiveness.

Several features contribute to their striking success. First, all panels operate in the basic spirit of separating assessment from management, while still providing assessment outputs that are policy-relevant. While this is a Zen Koan, never fully realizable, the panels have been impressive in their ability to skate along the border and avoid significant political controversy over the substance of their reports or the process of their work. The success of TEAP in this regard, dealing with questions for which the separation of assessment from politics is much more difficult than for atmospheric science, is particularly impressive. Second, that panel members serve as individuals, in their scientific and technical capacities, *not* as representatives of a Party or other constituency, has contributed both to the high scientific and technical standards they have achieved and to their effective independence from the political differences of view that have at times divided the Parties. This independence has been further enhanced, particularly on the TEAP where it would be most difficult to achieve, through process rules requiring collective deliberations with arguments conducted only on technical or scientific bases, anonymity in reports, and the prohibition of bound votes.

Perhaps most important in sustaining the effectiveness of the panels has been the skill exhibited in defining the scope of questions they undertake. By and large, for the atmospheric science panels, the policy-relevant questions in which they summarize the results of their works for policy-makers have been "if-then" questions, in which the "if" denotes specific measures the Parties might decide to undertake, such as specified schedules for further restrictions of ozone-depleting

substances. The "then" expresses consequences of these hypothetical decisions in terms of an environmental measure that is sufficiently simple and stable (i.e., numerical estimates not to fluctuate much from year to year), and that is widely accepted to be important. The most often-used measure of environmental consequence so employed has been the projected future time-path of total stratospheric chlorine. The acceptance of this measure as sufficiently policy-relevant has enabled assessments to be agreed among scientists with enough consensus and authority that the charges of political influence that arise occasionally in the climate-change assessment process have not arisen in the ozone science assessment panel. Defining the questions to address is even more delicate for the Technology and Economics panel. They have emphasized judgments on the level of substitution or reduction that is technically and economically feasible in specific use sectors by specific dates, and where the terms of reference, definitions, and criteria—particularly when these are likely to be contentious—are specified in advance by the Parties based on informal consultation with panel members.

It is important to note that no assessment process, however effective, can or should eliminate disagreement or controversy over the appropriate policy course. The ozone panels have not done this, as current controversies over the treatment of hydrochlorofluorocarbons (HCFCs) and methyl bromide amply reveal. They have, though, removed certain bounded scientific and technical questions from the domain of political controversy to a separate forum where they can be resolved, or partly resolved, on scientific or technical grounds. Disagreement and controversy are not eliminated, but the scope of policy positions for which putative scientific or technical justification can be credibly advanced is narrowed. The remaining zone of disagreement is more purely political, and less confused by the confounding of differences of scientific or technical judgment with questions of political preferences or values. In addition, the TEAP has in some cases made a distinct and novel form of contribution to the regime. It has provided a vehicle to promulgate and evangelize relevant technical innovations direct to the affected Parties, speeding the dissemination of knowledge and of innovations rapidly among specific sectors worldwide. This first-order effect supporting innovation has a second-order effect on the political process, as firms that might have opposed the process through their domestic governments are turned into supporters by the realization that acceptable, or even desirable, alternatives exist to their present way of doing business.

For the general development of adaptive regimes for global environmental issues, I would propose that the first ten years' experience of the Montreal Protocol offers four simple lessons.

1. The Flywheel

If an environmental regime is pursuing real action on a serious problem—that is, if it seeks more than either symbolic action or the international ratification of what is already nearly universally agreed—then every participating government, however keen its commitment to the global environment, will experience times and situations when it becomes a less enthusiastic or even obstructive participant. While uneven

enthusiasm is to be expected of any participating nation, the experience of the United States in the ozone regime illustrates it particularly vividly. Last-minute reactions within the federal government threatened to derail U.S. support for the ozone regime three times: at the 1985 signing of the Vienna Convention, during final negotiations of the 1987 Protocol, and at a late stage in negotiations of the crucial 1990 amendments.

Given this inevitable inconstancy of all national participants, a continuing international process is essential. If the international process has a regular schedule that cannot be easily or arbitrarily delayed, and a high enough profile to embarrass Ministers, then it can develop enough inertia to oppose periodic lapses of will among major participating nations, and provide a vehicle for different governments to compete over time for international leadership. Some have called this aspect of the Protocol a *ratchet*, but I would argue that the *flywheel* is a more apt image. It is not the case, nor should it be, that an international regime can never reverse direction; sometimes advancing knowledge may indicate that earlier enacted measures were misconceived. But the process should build momentum that does not always depend on continued pushes from the same participants, that can smooth variations in individual inputs and resist short-term lapses of domestic political will. Institutions with stable mandates and funding, regular schedules of meetings and administrative requirements, and the engagement of multiple sectors and bodies in linked systems of deliberation and decision-making, all contribute to this smoothing function.

2. Seek And Ye Shall Find

This lesson poses a paradox of adaptive management. It is based on the observation that advance estimates of the cost and difficulty of making a technical change, imposing a regulation, changing a process, or reducing a substance or activity, are extremely unreliable. In part, this unreliability reflects the fact that when a present product, process, or technology is working and profitable, it is not worth looking hard for new ways of doing things unless under the threat of compulsion. In part, it reflects that advance cost estimates depend primarily on the expertise of those engaged in the present activity, whose interests may lead them to make very cautious or high estimates of the cost or difficulty of changing.

For these reasons, the cost and difficulty of meeting new environmental targets often turn out to be substantially smaller than were predicted in advance. Current research suggests that this is the case for many specific areas of the phase-out of ozone-depleting substances under the Protocol. But this beneficent result cannot be relied upon. Sometimes, when one starts looking at how to do something, one discovers that the problems are harder or more numerous than expected and costs turn out to be as high as, or higher than, projected. And sometimes, the world just looks different after making a change—new products or processes differ from the old ones in many ways, and it is difficult even to define retrospectively what the cost of meeting the environmental target was.

This unavoidable uncertainty means that environmental policy-makers must make regulatory decisions with very weak knowledge of how much they will cost. This uncertainty, which clearly prevailed in 1987, can introduce various paradoxes into the dynamics of interactions between policy-makers and firms affected by regulations. These are best illustrated by the attitude of a manufacturer of an important piece of CFC-using equipment. In anticipation of the CFC phase-outs, his firm had developed a major innovation that eliminated CFCs, improved performance, was cheaper to operate, and consequently was a hugely profitable market success. His assessment of this experience consisted of a lengthy period of enthusiastic boasting about the innovation and the profits and leadership position it brought to his firm, followed by the exhortation that on all accounts the Protocol negotiators should not put them in a position where they would have to do it again.

3. The First Ten Percent Is Easy, The Last Ten Percent Is Hard (or Different)

The process described above, of finding cheaper and better ways to innovate out of an environmental problem once you start looking, appears to generalize across single, or closely linked, technologies, processes, and firms. Changed thinking and practice, as well as specific innovations, can spread among firms or individuals who collaborate closely or who compete directly.

But solving environmental problems with diverse causes, such as ozone depletion or climate change, requires moving progressively to new chemicals, emissions, activities, industries, and technologies. Even when environmental policies are implemented through market-based measures that do allow decentralized shifting of effort among the activities under their scope, it is rare that the entire set of relevant activities are brought under treaty or regulation from the outset. Consequently, continued management of the problem normally requires progressively extending controls to new gases, processes, activities, or technologies. And each new area poses new technical, economic, and political problems. The new targets coming under the scope of an expanded regulation have not normally participated in the socialization that has brought changed thinking and practice to those firms and industries who are already in. Moreover, since prudent regulators tackle the easiest parts of a problem first, the technical and political problems posed by the new sectors will not just be as hard as the original sectors were, but harder. Methyl bromide is the case in point.

Indeed, it is plausible that the optimal strategy for any industry threatened by regulation that may be difficult or require changing practices, habits, and ways of thinking about its business, consists of two distinct stages. In the first stage, you dig in your heels and resist with all the force you can command until you decide that the regulation will inevitably be enacted, sooner or later. In the second stage, after your expectation has so changed, you reverse stance and compete to lead the pack in the new way of doing things. This reversal may even have the character of a conversion experience.

This process holds two lessons for those crafting environmental treaties and regulations. First, one should not expect that once one sub-domain of a problem has come under management, all subsequent difficulties will go away. Any incremental approach will bring new participants and new potential opponents at each step. Not having experienced the changes of view, or the conversions, of those assimilated at previous steps, the newcomers can be expected to fight just as hard as their predecessors did. Second, a regime moving into a new area should do it in a way that avoids unnecessarily inflaming potential opponents and that maximizes the benefits available from the lesson above, namely that one is likely to find better ways once one has started looking. One element of this approach involves setting relatively near-term interim targets whose probability of being achievable is high, whatever the ultimate goal is. These interim targets should be demanding enough to get people's attention, to re-direct development effort and to set in motion the forces that so often lower the cost of change. But they should be easy enough that they only rarely turn out to be unattainable and must be reversed. Still, if the regime really is managing adaptively, sometimes reversal will be necessary. The required paradox is to maintain a commitment sufficient to force real effort from the regulatory targets, while being able to back off on the infrequent occasions where it is necessary.

4. Do Not Demand Perfection

Finally, in a regime that is pursuing real policy change, with real difficulties and obstacles, there will be occasional lapses, including failures of compliance and targets that must be changed. An adaptive regime must be able to tolerate less than universal compliance without unraveling. A regime that remains functional only with perfect compliance will either break apart or come progressively to be re-defined so that compliance is meaningless. The requirement is to maintain commitment sufficient to force real effort, without being so rigid that a single instance of failure brings the regime down.

In conclusion, the Montreal Protocol will only truly be a model of a new way of negotiation and sustaining global environmental regimes if it is imitated. Thus far, regrettably, it appears that the Protocol is more honored with words than with deeds. While the Conventions on climate and biodiversity copy many aspects of the Protocol, in the aspects I have discussed here as being essential to its character as an adaptive regime, both are much weaker. Perhaps there is a paradox of innovation in regimes deeper than those I have discussed here, that may lead any effective innovation to have a limited viable life. Perhaps climate and biodiversity failed to adopt the most effective innovations of Montreal because Parties who wished to limit the effectiveness of the regimes observed how effective these innovations were for the Protocol. It would certainly be unfortunate if such motives have influenced the design of review and assessment processes for the climate and biodiversity conventions, and indeed unnecessary. The record of the Protocol shows that while the panels have been independent and influential, they have not usurped the political

authority of the Parties to decide as they choose. The Parties have at times declined to take steps that many argued were clearly, though of course implicitly, favored by the panel reports. Still, innovators may need to continue generating new ways to move regimes forward, against the procedurally powerful opposition of those who do not want it to happen.