UN Vision Project on Global Public Policy Networks

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THE PROTECTION OF THE OZONE LAYER

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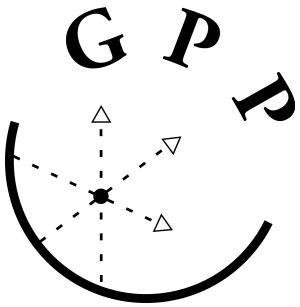
Case Study for the UN Vision Project on Global Public Policy Networks



I. INTRODUCTION

This case study analyses a surprising success story in the field of international environmental policy making, the threat to the ozone layer posed by industrial chemicals (mainly chlorofluorocarbons, CFCs) and the process how this threat has been averted. It looks at the regulations which have been put in place at the international level and examines how the process evolved over twenty years.

In 1974, scientists advanced the hypothesis that CFCs could damage the ozone layer. This so-called Molina-Rowland Hypothesis (MRH) called for a revision of the long-cherished belief in the harmlessness of CFCs, which were very popular both with producers and consumers of numerous domestic and industrial appliances (used as propellant in spray cans, coolant and insulation in refrigeration, cleaning agent in electronics manufacturing) since they seemed to be chemically inert, non-toxic and non-corrosive. According to the MRH, CFCs could deplete stratospheric ozone and hence lead to an increase in UV-B radiation, which in turn would have severe effects on biological systems (causing skin cancer in humans, crop damage, algae diminution) and on the global climate.

In the USA, this hypothesis was taken seriously early on. As a consequence, the Clean Air Act of 1977 introduced a CFC-ban in spray-cans. Several other countries followed suit, but not the other large producers of CFCs such as the Soviet Union, Japan or the EC. They pointed to the unknowns of the causal relationships. International negotiations—which started in 1977—first led to a non-binding treaty, the framework convention signed in 1985 in Vienna. In March 1977 the US took the initiative and hosted an international conference organized by UNEP. Delegates from 39 countries including a representative from the European Commission (Parson 1993). During this meeting, the 'World Plan of Action' for the protection of the ozone layer was adopted. This document recommended that the signing nations cooperate in scientific research. The delegates also recommended the creation of the *Coordinating Committee on the Ozone Layer* (CCOL) which was composed by experts from administration and NGOs which partook in the *World Plan of Action*. CCOL focused very much on the results of scientific research and met once a year during the period 1977 to 1985. It prepared the ground for political decision making and identified research need. The chemical industry actively participated.

The initial phase of the international negotiations led to the adoption of the Convention for the Protection of the Ozone Layer at a UNEP sponsored conference in Vienna in 1985. Delegates from forty-three states attended but only twenty signed the convention. The parties did, however, accept the general obligation to adopt 'appropriate

legislative or administrative measures … to control, limit, reduce, or prevent human activities under their jurisdiction or control should it be found that these activities have or are likely to have adverse effects resulting from modification or likely modification of the ozone layer.' (article 2.2.b Vienna Convention, VC). The convention also called for international cooperation in monitoring, research and scientific assessments and requested UNEP to continue work on a protocol on ozone depleting substances (ODS), i.e. binding controls (Soroos 1997; Tolba 1998).

During these negotiations, two camps advocated different approaches. On the one hand the USA (and few other countries) who proposed a worldwide ban on CFCs as aerosol propellants but opposed other CFC restrictions; and on the other hand the EC which favored a total production limit but opposed cuts from current production levels. Staunch enemies of regulation (such as France, the UK, Japan, and the European Council of Chemical Manufacturers' Federation) used scientific uncertainty as a pretext to avoid legally binding controls (the scientific assessments published by WMO did not reach a strong consensus before the 1988 report of the Ozone Trends Panel, see below).

After a protracted negotiation period, a compromise was reached in September 1987 (Montreal Protocol) which envisaged a 50% cut of five ODS by the year 1999. In the years that followed, the timetable has been further accelerated and the list of controlled substances extended, resulting in a complete phase-out of most ODS in the industrialized countries by 1996 (Benedick 1991; Brack 1996; UNEP 1995). More and more countries adhered to the MP and its subsequent amendments. These agreements comprise binding control measures to curb CFC emissions and are—without doubt—an instance of successful international governance. According to the United Nations Environment Program, in 1986 the total consumption of CFCs world-wide was about 1.1 million ton; by 1996 this had come down to about 160,000 tons. It has been calculated that without the Montreal Protocol global consumption of CFCs would have reached about 3 million tons in the year 2010 and 8 million tons in 2060, resulting in a 50% depletion of the ozone layer by 2035. The bulk of the 1986 total, or about one million tons, was consumed in industrialized countries, but by 1996 these countries consumed just 10,000 tons (for exemptions approved by the Parties). The developing countries have increased their consumption by about 30% over the last 10 years. Twenty of the 120 developing countries account for more than 90% of this group's consumption, and of these 20, key countries including Argentina, Chile, the Islamic Republic of Iran, Republic of Korea, Malaysia, the Philippines, the Syrian Arab Republic, Thailand, and Venezuela had already started to reduce CFC consumption as of 1996.

This success was unexpected at the time and still today poses problems in terms of theoretical explanation.

II. A NOTE ON TERMINOLOGY

In what follows, I shall distinguish between the concepts of Global Public Policy Network (GPPN) and international regime. While the MP is an international regime with formal rules and procedures, the policy network which brought it about was not (see Krasner's (1983: 2) definition of an international regime as 'implicit or explicit principles, norms, rules and decision-making procedures around which actors' expectations converge in a given area of international relations'). Conversely, the MP can hardly be described as a network. Its institutional makeup refers very much to traditional means of international cooperation, formal membership of states, ratification of treaties, formal rules and procedures, national enforcement of implementation etc. Therefore, I shall use the concept of GPPN only for the period up to the MP. The primary output of the GPPN was the regulatory framework of the MP.

The notion of a trisectoral network, including the state, for-profit and not-for-profit organizations, is very useful. However, as becomes clear from this case study, one has to acknowledge the particular role of one important group of actors (advocate scientists). This group could be subsumed under not-for-profit organizations. However, their place in the controversy is structurally different. They seem to be in a more influential position than NGOs. A further modification of the network concept pertains to its antagonistic character, i.e. for a long time period, *two opposing* networks were competing with each other in front of the world public. The media interest (which was waxing and waning) is also distinctive feature of this case. Broadsheets in some developed countries (mainly the US) covered the issue from the beginning of the controversy. As we know from political scientists, interests—when in articulated in public—have to be couched in a language which is generally acceptable:

Because policy is made out of language, arguments are used at every stage of the process. Every politician understands that ideas and arguments are needed not only to clarify his position with respect to an issue, but to bring other people around to his position. Even when a policy is best explained by the actions of groups seeking selfish goals, those who seek to justify the policy must appeal to the intellectual merits of the case. (Majone 1996).

In the public debate, arguments are compelled to present themselves in such a way that they are perceived as legitimate. This holds true also for environmental problems where decisions have to be taken under uncertainty. Here, the 'wait-and-see' approach and the precautionary principle are most pervasive.

All these factors point to a threefold specificity of this case: (a) advocate scientists play an important role; (b) the case is under constant public scrutiny; (c) there are two opposing networks appealing to different sets of norms and values.

III. ORIGIN AND PURPOSE OF THE GLOBAL PUBLIC POLICY NETWORK

III.1 Setting the agenda

Most critical in the agenda-setting phase was the sounding of the alarm by concerned scientists. This occurred at two stages, in 1974 with the publication of the so-called Molina-Rowland hypothesis (MRH) and in 1985 with the publication of the findings of the British Antarctic Survey (BAS). These alarm signals were taken up by the media, environmental groups and policy entrepreneurs. In 1974, it was mainly scientists like Rowland and Cicerone who spoke out in public and demanded a reduction of CFC production. It is probably fair to say that initially they did not try to consciously build a network. It was borne out of necessity, in order to maintain their position vis-à-vis other (seemingly more powerful) actors, like the chemical industry which denied the causal role of CFCs in ozone destruction. By the time the findings of the BAS were published, the two opposing networks had established themselves. While the pro-regulation network gained an early victory with the partial CFC ban of the Clean Air Act in 1977, their influence diminished thereafter. This had various reasons: for one, the estimates of future ozone reductions went down, second, the impression was that the massive reduction from the CFC spray can ban had solved the problem, and third, the Republican administration under President Reagan made it clear that it saw the regulations as an over-reaction to a minor problem. In fact, in 1984 long-term estimates of future ozone depletion went flat, they approached 0 per cent, some models even saw a possible ozone increase. The publication of the BAS data and the subsequent discussion in the scientific community led to a reversal of this situation. It can be regarded as a warning bell not only to the scientific community but also to business, politicians and the world community at large.

Initially, advocate scientists in both periods were little experienced in dealing with the public. After some time, they received support from Congress, government agencies, environmental groups and the National Academy of Sciences.

Early in 1975 the National Science Foundation and the Council on Environmental Quality formed the *Ad hoc Ad hoc Interagency Task Force on Inadvertent Modification of the Stratosphere* (IMOS) in which fourteen agencies cooperated. Its goal was getting an estimate on possible effects on the stratosphere and to develop a plan of action. IMOS published its results on June 12, 1975. The main message was: “There seems legitimate cause for serious concern.”

In the course of two years, a network of supporters of CFC regulation emerged from the bottom-up. There was never a question of excluding certain actors from participating in the network. Rather, those actors which disagreed with the proposed policy formed a different network which aimed at preventing or delaying CFC controls. Some advocates in the second period (i.e. after 1984) had the disadvantage that they were outsiders to the field. When they published their findings, the core group of scientists did not know who they were. It thus took some while before the results of the British team were seen as credible by the core group of scientists.

Advocate scientists had, apart from intrinsic scientific motivation, two main sources of motivation: career advancement and ethical/normative considerations. The former consisted in getting credits for the advancement of knowledge, the latter expressed their concern about harming the earth's atmosphere. The time horizon was rather long-term (typical calculations of ozone loss were in the dimension of 100 years). This mixture of motives made them take a long-term interest in the ozone layer. Opponents of regulation followed a short-term strategy of defending a chemical substance in the absence of proof which would demonstrate its damaging effects (the wait-and-see approach). Their ethical outlook was shared by people with no direct stake in these chemicals in that they were convinced that a preventive policy was wrong since it harmed free enterprise.

The most important resources in this competition were symbolic. It was all about credible estimates about the size of the problem and the necessity to act. Hence knowledge creation was the most important activity, albeit new knowledge was always contested. Credible scientific information was the main resource of power throughout the controversy.

III.2 Advocate scientists and the precautionary principle

In the 1970s, a small group of scientists succeeded in framing the situation in a way that made precautionary measures look very reasonable and in institutionalizing a set of legal norms which could be used by the pro-regulatory forces in the mid-eighties. The core of this pro-regulation network was made up of advocate scientists, staff of government agencies, international organizations, and environmental activists. Advocate scientists were small in number and not representative of the atmospheric science community. Their case was supported by powerful allies, such as the Natural Resources Defense Council, the National Academy of Sciences, the *New York Times*, EPA and NASA staff, consumers and, on the international level, by UNEP, WMO and a small number of countries who enacted partial CFC bans. This policy network alarmed the world public about the

consequences of unfettered CFC emissions for stratospheric ozone, urging politicians to implement a control of these substances. It also developed a kind of 'political strategy' for the protection of the ozone layer. In the early days it was the proposal to replace CFC in spray cans which led to a supportive reaction in the United States, on the part of both consumers and lawmakers. The Clean Air Act institutionalized this precautionary approach (Betsill and Pielke 1998). In the 1980s, advocate scientists warned policy makers about the danger arising from continued use of CFCs, they tried to determine the scientific basis for a comprehensive solution, speaking out publicly after the discovery of the ozone hole in 1985 in favor of a worldwide ban of CFCs. Last but not least, they suggested technical solutions to policy problems (see below).

III.3 Business

The core of the anti-regulation network was made up of CFC producers and skeptical scientists in the 1970s, part of the Reagan administration, the EC, Japan and the former Soviet Union in the early 1980s. Du Pont acted as the speaker for this network. It participated actively in the research into the problem. As other CFC producers, it adopted a twofold strategy. In public it, it denied the risk posed by CFCs but financed research which should produce knowledge about the very problem. Industry showed different degrees of involvement with scientific research in different countries. The closest links existed in the US, where Du Pont tried to keep abreast with the latest state of the art knowledge, even recruiting scientists to the company. In Germany, on the other hand, chemical companies did not build such links which would have provided a constant flow of information.

In the beginning of the 1980s, Du Pont succeeded in convincing the public that the dangers for the ozone layer were minimal. However, it was pushed back in the mid-1980s, as the advocates of regulation managed to attract world-wide support from UNEP, WMO, NASA and others. Until 1986, the opponents of regulations repeated their position that too little was known to justify regulations. More scientific research was deemed necessary to remedy this lack of understanding. They were right in stating that little was known about the atmosphere. This became clear when the Antarctic ozone hole was discovered since no theoretical model had predicted this phenomenon. It took more than two years until it could be explained scientifically. But is (relative) ignorance an excuse for inaction? This was the real question underlying all controversies over whether regulations were justified or not.

After the discovery of the Antarctic ozone hole, industry leader Du Pont realized that it would very likely become the target of further regulations, maybe even of lawsuits brought by private citizens suffering from skin cancer (Roan 1989: 193). Additionally, the company feared that a too obstinate position might ruin the company's reputation and lead to consumer boycotts, including other products. As environmental manager of Du Pont's Freon product division, Joe Steed, explained: 'We couldn't let the whole company get a bad name just because of those chemicals' (quoted in Litfin 1994: 126). Once Du Pont reckoned that further resistance to regulations would be counter-productive and once it switched over, the blocking coalition broke up and lost its most potent ally. However, it should be noted that Du Pont Did they not become actively involved with the advocacy network. The company rather adapted to a changing environment. After the announcement in September 1986 that it considered global CFC controls reasonable, it took until March 1998 before the company announced that it had decided to phase out these chemicals.

III.4 NGOs

The Natural Resources Defense Council (NRDC), an US environmental group, was probably the first to join the advocates of regulation in November 1974. On the institutional level there was confusion about jurisdiction for the issue. NRDC tried to bring clarify this by petitioning the Consumer and Product Safety Commission to regulate CFCs in aerosols. Throughout the controversy, NRDC followed a strategy employing legal and scientific resources, not so much mobilizing people.

In 1983, the NRDC had brought a lawsuit against the EPA. The timing for this was discussed between EPA and NRDC members. In an out-of-court settlement EPA agreed to make a decision by November 1987. Senator Chafee introduced a bill which „called for unilateral CFC cuts by the US, accompanied by trade restrictions against countries who do not reciprocate".

Shortly before the start of the final negotiations for the MP, the NRDC intervened again. The US position for the international negotiations as laid out in the Clean air Act of 1978, was confirmed in spring 1987. Shortly before that, the anti-regulation network, rallying within the Domestic Policy Council, had sparked off a new controversy within government. The Secretary of the Interior, Hodel, apparently favored a „personal protection plan" instead of international regulations. The NRDC exploited this rumor by making it public, which backfired on Hodel and his allies (Benedick, 1991: 60-62; Cagin and Dray 1993: 332-334). In an article with the catchy headline „Advice on Ozone May Be: Wear Hats and Stand in the Shade," the *Wall Street Journal* quoted Hodel as saying:

„People who don't stand out in the sun – it doesn't affect them." (*Wall Street Journal*, 29 May 1987). The attempt to redefine the situation as one of personal risk ended in ridicule once it was made public. EPA administrator Lee Thomas confirmed the US option of a 95% reduction, which was supported by the Secretary of State, Shultz. Shultz appointed Richard Benedick as State Department's Deputy Assistant Secretary for Environment, Health, and Natural Resource Issues and chief negotiator for the international talks. As this episode shows, the US adopted its leadership role willy-nilly. Beneath the government level, there was a policy network active which influenced the course of action of the US, but also of other countries. Apart from visible scientists such as Molina and Rowland, there were more quiet scientists acting as policy advisers (e.g. Bob Watson), people at NRDC (David Doniger), WRI (Alan Miller and Irving Mintzer), at the EPA (Steven Anderson, James Hofmann, Steve Seidel) and, of course, at UNEP. They also had contacts across the Atlantic to their European colleagues. This network spread vital pieces of information at a critical juncture of the international negotiation process around the globe.

Environmental organizations in Germany intervened late, partly because they thought it not easy to reach people with such a difficult-to-pronounce topic as chlorofluorcarbons, partly because they feared that putting the atmosphere on the agenda might give a boost to the nuclear industry (since at the mid-end of the 1980s, CFCs and CO_2 were perceived as coming in a 'double pack'). In Germany at least, the environmental groups had fought their longest and fiercest battles against nuclear power. They were thus anxious to provide any argument for their long-standing enemy. Greenpeace started a campaign against the use of CFCs in spraycans in July 1987, sending out an SOS to 1.8 million Germans: "Help to stop the pending catastrophe!" Of course, it also targeted all other aspects of CFC use.

After the Montreal Protocol, Greenpeace was pushing for stricter legislation, calling to close 'loopholes' and to reframe the issue of substitutes which had been largely defined by the chemical industry. In Germany, it proposed and promoted vehemently an alternative technology for home refrigeration which was not only CFC and HCFC-free, but also HFC free ("Foron", based on butane and propane technology). With this, it tried to prevent R134a to replace CFCs. Although R134a does not contain chlorine and therefore does not attack ozone, it has a Global Warming Potential. Greenpeace wanted to ensure that we did not replace an ozone killer with a substance posing a hazard to global climate. This campaign was successful. German industry initially scorned the prototype fridges Greenpeace had produced with the former East German firm Scharfenstein but soon came to take over the technology. Today, all big German producers of home refrigeration appliances use this technology instead of R134a which is widely used

elsewhere in the world. China for its part has adopted the “Greenfreeze” technology up to 50% (thanks to Benny Härlin and Wolfgang Lohbeck from Greenpeace).

III.5 Evidence, metaphors, images

The scientific evidence in 1987, when the Montreal Protocol was signed, did not include a proof of cause and effect between CFC and ozone destruction. It consisted mainly in the observation of an abnormal drop in ozone over springtime Antarctica which could not be explained until 1988. However, the pro-regulation network had two other pieces of information available to influence the negotiation process: high amounts of chlorine over Antarctica, suggesting a link to CFCs, and a probable negative trend in global ozone over the last decade or so (the first piece of information was provided by a large scale expedition to Antarctica during August-October 1987). It used this evidence in a setting of international negotiations, in which ‘linkages between the actors serve as channels of communication and for the exchange of information, expertise, trust and other policy resources’ (Kenis and Schneider 1991). But above all the duly dramatized ozone hole and its visual representation made an impact. Before the metaphor ‘ozone hole’ came up, experts and lay persons from the mid-1970s to the mid-1980s were concerned with a possible future ‘thinning of the ozone layer’. The difference between the two metaphors is evident. While the thinning metaphor evokes the picture of a tissue which is threadbare, the hole metaphor evokes the picture of a balloon which is punctured and blows up or loses its air; or an organism that got an infectious disease. This metaphor clearly was designed to capture the element of drama (Grundmann 1998). Before 1985, everyone expected an ozone loss of maybe 10 or 20% in one hundred years (Benedick 1991: 13).

III.6 Combining science and politics

Actors who are able to speak both the language of science and politics were critical in the process. There can be no doubt that the community of atmospheric scientists had such personalities (from first-class scientific institutions, like NASA and NOAA) who were extremely efficient in feeding crucial pieces of information into the policy process which galvanized policy makers into action.

At the beginning of the 1980s, NASA took over an important role in organizing the international scientific research for the World Meteorological Association (WMO) and UNEP. It put together the results of the various research groups from all over the world.

Admittedly, the main findings still came from US laboratories, but the people in charge at NASA made sure that a minimal consensus could eventually emerge between research groups in different countries. As one interviewee stated:

"By 1980, there were at least six or seven assessments of the state of knowledge. The EC wrote one in the late seventies, as did NASA, NAS, UNEP, WMO, and the British government. At that stage industry and other people were looking rather at the differences than at the commonalties of the different studies. So I tried to work with the international science community toward a single international assessment, so that there was not a German document, a British document, and an American document. We had some success in 1980 in writing a document, by 1985 we had a document that really was representative of the world view."

Key actors in the ozone story regard this standardization of scientific knowledge as the main reason for success of the MP. However, there seem to be reasons to be cautious with regard to this interpretation (see below).

In the second half of the 1980s, the network in favor of regulations was able to muster important allies, personalities from different institutions like NASA, WMO, UNEP, State Department, EPA and governmental agencies in other countries. These acted as speakers to the world public, stressing the need to take measures. The executive director of UNEP took sides in the process of negotiations and supported the most stringent control schemes, which is unusual for a high-ranking representative of a UN body. The media started giving much more attention to the issue than in previous years.

The US position for the international negotiations as laid out in the Clean air Act of 1978, was confirmed in spring 1987. It aimed at a near phase-out of CFCs. Shortly before that, the anti-regulation network, rallying within the Domestic Policy Council, had sparked off a new controversy within government. The Secretary of the Interior, Hodel, apparently favored a „personal protection plan' instead of international regulations. The NRDC exploited this rumor by making it public, which backfired on Hodel and his allies. In an article with the catchy headline „Advice on Ozone May Be: Wear Hats and Stand in the Shade,' the *Wall Street Journal* quoted Hodel as saying: „People who don't stand out in the sun – it doesn't affect them.' The attempt to redefine the situation as one of personal risk ended in ridicule once it was made public. EPA administrator Lee Thomas confirmed the US option of a 95% reduction, which was supported by the Secretary of State, Shultz. Shultz appointed Richard Benedick as State Department's Deputy Assistant Secretary for Environment, Health, and Natural Resource Issues and chief negotiator for the international talks. As this episode shows, the US adopted its leadership role willy-nilly. Beneath the government level, there was a policy network active which influenced the

course of action of the US, but also of other countries. Apart from visible scientists such as Molina and Rowland, there were more quiet scientists acting as policy advisers (e.g. Bob Watson), people at NRDC (David Doniger), at the World Resources Institute (Alan Miller and Irving Mintzer), at the EPA (Steven Anderson, James Hofmann, Steve Seidel) and, of course, at UNEP. They also had contacts across the Atlantic to their European colleagues. This network spread vital pieces of information at a critical juncture of the international negotiation process around the globe (Cagin and Dray 1993; Grundmann 1998).

Leading modellers gathered in April 1987 at a UNEP meeting in Würzburg (Germany) and discussed different methods and parameters of their models (UNEP 1987). This was the attempt of the pro-regulation network to challenge the arguments of the anti-regulation network who said that different models led to differing results and insisted that these would not justify regulation. So the scientists decided to run models as much as possible under the same conditions. In the end, the results were very similar in terms of long-term predictions (Tolba 1998). Several months after the MP, a scientific consensus emerged about two key issues, first that the ozone hole was caused by CFCs and second that there had been a global decline in ozone concentrations. The findings were published in the WMO-UNEP sponsored report of the Ozone Trends Panel (WMO 1988).

IV. The Montreal Protocol: Overcoming the deadlock

In the preparatory phase of the Montreal Protocol the participants found themselves in a deadlock: on the one side were countries willing to take action, on the other were countries against. Both based their positions on principled opinions, the precautionary and wait-and-see approach. It is only partly true that their norms and principles were masking their real interests. This applies certainly to some enemies of regulation (i.e. European CFC producers) who wanted to protect their share of the CFC world market, no matter what. But two examples from the USA teach a different lesson. On the one hand, parts of the US-administration were opposing world wide CFC controls while the main producer of CFCs became more receptive to the idea of regulating this kind of business. And the straightforward advocates of strict controls showed a concern about the long-term protection of the ozone layer—something from which they might not even profit. This indicates how norms and ideas can be real and autonomous (Elster 1989).

How could the deadlock-like situation between the two camps be overcome? By 1987, industry representatives had lost their status as unofficial spokespersons for their respective governments in many delegations, while representatives from environmental organizations gained influence (Benedick 1991)—a clear sign that well-organized interests were on the decline and that diffuse interests were gaining more weight. When the formal negotiating meeting began on December 1, 1986, there were four environmental NGOs attending as well as representatives from industry and business. During the second round in February 1987 there were more NGOs attending and again more during the April meetings. NGOs and the media were demanding action. Tolba, with reference to the scientific results from the Würzburg meeting, emphasized that ‘no longer can those who oppose action to regulate CFC releases hide behind scientific dissent.’ (Tolba 1998: 70).

This change reflects the growth of the policy network which was in favor of strict regulations. Cooperation emerged after the obstinacy of the opponents of regulation was broken and the pro-regulation network was ready to grant exceptions to them. A breakdown of the negotiations was the least preferred outcome for the pro-regulation network, but not for the European, Soviet, and Japanese industry and its supporters. They would have profited from the continuation of the status quo. The required unanimity conferred an advantage on them through the ‘default condition’ of the negotiation system (Scharpf 1988). Their negotiation strategy was stubbornness: they tried to hold out as long as possible (Maxwell and Weiner 1993: 31; cf. also Elster 1989: 80). For the pro-regulation network, on the other hand, it was rational to gain as much concessions from them as possible. Not surprisingly, the result was a protracted negotiation period. The fact

that it could be finished after merely 18 months is due to a dramatic gain in credibility of the pro-regulation network. Three key events helped tipping the balance.

First, the discovery of the ozone hole and its symbolic representation changed the perception of the problem completely. As Rowland put it, 'The big loss of ozone over Antarctica has changed this from being a computer hypothesis plausible for the future to a current reality and cause for concern' (*New York Times*, 7 December 1986, p. E9). Although it was officially not a topic in Montreal, it did in fact have an influence on the negotiations. This is a debated issue in the literature and cannot be settled within the limits of this article. I have two reasons for my thesis. The first relies on my interview material, the second on a critical examination of the official position which denies this influence. Suffice it to say that most of the interviewees whom I asked about this agreed that the ozone hole was absolutely instrumental in getting the Montreal agreement. Disagreement came from those who were actively involved in hammering out the details of the protocol. Their strategy in Montreal was to achieve an agreement which was based on the precautionary principle, *not* on the actual damage over the South Pole. This was a very sensible strategy. Had they based their strategy on the ozone hole, the whole treaty would have been worthless in case that CFCs were not involved. During the negotiation in Montreal, the information of high chlorine over Antarctica was there—but no mechanism which could explain such huge ozone destruction. The spokespersons of the 'official' position therefore had a good strategy in leaving the ozone hole aside (although they probably used the alarm signal of the ozone hole as an additional argument to explain that it is far better to err on the side of caution). The problem is that they cannot step back from their official position. This could destroy their credibility after the event.

Second, Du Pont's role as focal actor deserves special attention. As already mentioned, the company had exposed itself most clearly in defense of CFCs and acted as a world wide speaker for the anti-regulation network. Once it came to see regulations as inevitable, this had a direct impact on other actors of the anti-regulation network, leading to a bandwagon effect.

Third, the European Community came closer to the advocates of strict regulation. This change of heart was due to a turn in the German position (Jachtenfuchs 1990). The *New York Times* reported: 'The American official did not identify the countries that are at odds on the issue, but the West German delegation made it clear that its position was close to that of the United States, and that Britain stood at the other extreme … Heinrich W. Kraus, a German delegate, said that Bonn had pressed at periodic meetings of European environment ministers for a joint stance closer to the United States' and that it would continue to do so.' ('U.S. Blames Europe for Lack of Ozone Agreement', *New York Times*

(February 28 1987, p. 2). A study commission of the German Parliament was instrumental in getting the support of recalcitrant EC member states (or at least in neutralizing their influence). This report was only published after the Montreal Protocol (German Bundestag 1989). However, several politicy entrepreneurs from both the Social Democrats and the Christian Democrats started lobbying their parliamentary colleagues in major European countries from 1986 (Interviews by the author with Laurens Brinkhorst, 21 February 1995; Richard Benedick, 31 March 1995; Michael Müller, 18 June 1996; Heinrich-Wilhelm Kraus, 19 October 1994; Clemens Stroetmann, 15 March 1995). The turn of the German position was caused mainly by domestic policy events. In the 1986 national elections, the Green party enjoyed huge gains in votes and there were several ecological disasters on the river Rhine. The nuclear accident in Chernobyl happened in the same year and triggered the setting up of the Ministry for the Environment. Also in 1986, the ozone hole was publicized widely in the German mass media. This changed the attitude of the big parties towards ozone politics.

IV.1 Integrative Bargaining

All these factors lead to the hegemony of the pro-regulation position. Once the 'draggers' were isolated, representatives of several key countries were like-minded. They were agreed that some countries should be granted exceptions. Methods of technical problem-solving and bargaining were instrumental in bringing them on board in due time. As we shall see, these methods played an important role not only in Montreal, but also in the negotiations that followed in the years to come. But even more important was a third mode of conflict resolution which could be labeled integrative problem-solving or *integrative bargaining* (Walton and McKersie 1965; Young 1994). In contrast to distributive bargaining where negotiators know the shape of a welfare frontier and will therefore 'turn to calculations regarding strategic behaviors or committal tactics that may help them achieve their distributive goals', with integrative bargaining negotiators 'do not start with a common understanding of the contract curve or the locus of the negotiation set' and therefore have a strong incentive 'to engage in exploratory interactions to identify opportunities for devising mutually beneficial deals.' (Young 1994: 100-1). In other words, here negotiators are attempting a comprehensive solution of the problem. The tools which are used here are much broader than compromises or technical yardsticks which are applied equitably.

The MP really took off as a result of granting exceptions and adaptation clauses for draggers. It entailed favorable clauses for nearly all big competitors of the USA. The EC

was acknowledged as a regional economic integration organization (REIO), which meant that it was treated as a single unit which could sign an international treaty. The United States rejected this proposition for a long time. However, the EC was adamant about this: after the Single European Act in July 1987 it wanted to be recognized on the international level. The Soviet Union was allowed to complete two new CFC production plants which were already under way in its 5-year plan. Finally, the developing countries were granted a 10-year grace period in which they could continue to produce and consume (specified amounts) of CFCs (Benedick 1991). All these exceptions entailed competitive advantages for America's economic rivals. The fact that the USA not only accepted such a solution, but actively promoted it, can only be explained by the influence of the transnational policy network in favor of strict controls (and not by a 'realist' reading). Its cognitive orientation and normative commitment lead to a dedicated search for a comprehensive solution of the problem. The battle to protect the ozone layer was won by the pro-regulation network first and foremost on the domestic ground in the USA. Here, it was possible to break the resistance of the anti-regulatory forces inside the Reagan administration which in the spring of 1987 tried to derail the pro-regulation position developed by EPA and State Department for the international negotiations—at a point when industry had given up its hard defensive line.

IV.2Technical problem-solving

In negotiating the Montreal Protocol and its subsequent amendments, technical yardsticks (*Ozone Depletion Potential,* ODP and *Chlorine Loading Potential,* CLP) were crucial to arrive at common solutions. They allowed the costs of regulation to be distributed in a fair (i.e. generally accepted) manner. The ODP is a weighting system for different ODS in which CFC 11 was assigned the (arbitrary) value 1, as Benedick (1991: 78) summarized it:

> On the basis of this weighting system, the negotiators could craft a protocol provision that allowed substances to be treated for control purposes as a combined 'basket' rather than individually. This formulation gave countries an incentive to impose greater reductions on substances that were relatively more harmful to the ozone layer, as well as those whose uses were less essential to them.

This furnished a technical gauge for estimating the destructive potential of different substances and each country's contribution to the problem. By this token, several countries realized that they could achieve the required reduction quota by cutting back in an area which was not vital for its economy. Japan, for instance, initially opposed the Montreal Protocol since CFC 113 was one of the included substances (Benedick 1991:

79). It was heavily used in Japan's computer industry as a solvent. When Japanese representatives realized that Japan could arrive at the required reductions by cutting back in CFC 11 and CFC 12, an important step to agreement was made.

After the establishment of the international regime (Montreal Protocol, MP), several formal mechanisms for implementation, enforcement and monitoring were put into place. The MP attracted several new participants after its initial setup-phase. Once the bandwagon started rolling, this was largely a self-reinforcing process.

IV.3 Bargaining

The readiness of the pro-regulation network to grant exceptions to laggards and the identification of technical measures was instrumental in resolving remaining questions. These were typically contained within brackets of the draft treaty. Main areas of contention concerned the sharing of the costs of regulation. An important issue was the identification of a baseline from which reductions would be calculated. Again, differences between the Europe and the USA showed up. One side favored a formula based on production figures, the other a formula based on consumption figures. Both positions reflected economic interests. As mentioned before, the United States and other countries initially opposed treating the EC as a single unit. The problem was resolved in a way which gave the EC an advantage. However, the United States still refused to allow EC members to swap production quotas. Under such a rule a production decrease in one country could be compensated by an increase in another. The solution was a compromise. The EC was treated as a unit for purposes of consumption, but not for purposes of production (Cagin and Dray 1993: 335). Level-playing-field-arguments regarding CFC production became much less important in the years to follow. After all big CFC producers switched to alternative substances, the London amendments to the MP of 1990 (see below) extended the unitary treatment of the EC to production purposes as well (interview with Laurens Brinkhorst, 21 February 1995). A similar compromise was found in defining the final reduction goals. The final agreement reached in Montreal was a freeze at 1986 levels, starting in 1989, followed by a 20% reduction by 1994 and a further 30% reduction by 1999. The long-term goal of 50% amounted to a quasi-arithmetic mean between the initial opposing figures of the EC and the USA (20% vs. 90%).

Today, there is a vast participation of Southern countries in the MP. During the period of establishing the MP, these played a relative minor role. Since both the problem and the scientific research were originating in the Northern countries, they took no great interest in the issue. Some countries (like China and India) saw the MP as inequitable and

refused to sign it. Although their CFC production at the time was minimal, they were expected to consume 30 per cent of the world production by the year 2000. Both demanded adequate financial support and clearly defined access to alternative technologies before signing up (Wood 1993; also see below, the role of the Multilateral Fund).

To sum up: the real stumbling blocks were removed once the pro-regulation camp made large concessions to countries unable or unwilling to bind themselves to stringent controls. However, this could only happen in a reflexive process which went back and forth between normal bargaining, integrative bargaining and technical problem-solving. Negotiators had to explore which regulations might be feasible and how the burden of the costs would be distributed. Such compromises were contained within 'brackets' of draft treaties. Informal consultations were essential to reduce the number of these brackets and the number of draggers. As agreements between key actors emerged, more and more contentious issues were resolved and more and more draggers isolated. Once such a dynamics set in, even the most adamant parties found it difficult to resist a compromise.

IV.4 The London amendments, 1990

British prime minister Thatcher convened an international ozone conference in London in March 1989 at which more than 120 governments participated, more than double than in Montreal. To many this appeared to be a preemption of the first meeting of the parties in Helsinki (scheduled one month after the London conference), but it turned out to be helpful. More than 90 environmental organizations were present as well as the international media, all demanding stern action. The following meeting in Helsinki produced a non-binding document calling for a phase-out of CFCs 'as soon as possible but not later than the year 2000' (Soroos 1997: 165).

In June 1990, the second conference of the parties was attended by 55 parties and 44 nonparties in London. Thirty-four industrial groups and fourteen environmental groups were present. Shortly after the signature of the Montreal Protocol, it had become clear that there were huge ozone losses due to ODS which had not been predicted by any scientific model. This changed the perceived task of regulatory action. It was no longer a question of preventing future damage, but to establish controls in order to achieve the recovery of the ozone layer as soon as possible. Taking up suggestions by EPA staff, two NASA scientists advanced the indicator 'Chlorine Loading Potential' (CLP) (Prather and Watson 1990, cf. Litfin 1994: 100). It is based on the idea of critical loads: ozone destruction sets in only after certain concentrations of ODS have accumulated in the atmosphere. In contrast to

ODP, CLP is a technical yardstick involving a historical dimension. Pre-industrial chlorine levels were estimated to be 0,6 parts per billion (ppb). Methyl chloride was identified as the major source. However, this natural source of chlorine today only accounts for a fifth of all anthropogenic sources (Graedel and Crutzen 1993). The Antarctic ozone hole began to develop in the late 1970s, when mean global chlorine concentrations rose to 1,5-2 ppb (today they reach nearly 4 ppb).

A logical benchmark for evaluating future control strategies was the return of atmospheric chlorine concentrations to no higher than 2 parts per billion - roughly the chlorine loading at which Antarctic springtime ozone levels had begun to drop sharply in the late 1970s. (Benedick 1991: 130).

Only one scenario led to a reduction of chlorine levels below 2ppb in the middle of the next century. In this scenario, all CFCs were phased out at the turn of the century, with no substitutes (HCFC 22), no carbon tetrachloride and no methylchloroform being manufactured. This formed the basis for the London agreement, albeit HCFCs were not controlled. Delegates also agreed to establish a special fund, albeit on an interim basis (Multilateral Fund, MLF) to help developing countries to comply with the MP. $240 million were allocated for the period 1990-93.

IV.5 The Copenhagen amendments, 1992

The fourth meeting of the parties was attended by representatives from 87 countries in November 1992 in Copenhagen. They agreed to advance the date for phasing out the five substances already under control of the MP, to include other substances and to clarify the status of the MLF. For the first time, hydrochlorofluorocarbons (HCFCS) were included on the list of regulated substances (they also destroy ozone albeit to a lesser degree than CFCs). Northern countries committed themselves to phase out their consumption by the year 2030. Some wanted stricter timetables since alternatives existed for all uses (e.g. hydrocarbons for refrigeration). With regard to methyl bromide, some developing countries and Israel were opposing restrictions because it was critical to their economic development. It is used mainly in the fumigation of soils. Interestingly, they referred to scientific uncertainties about the impact on the ozone layer to justify their opposition. The only agreement that could be reached was that developed countries would freeze production at 1991 levels by 1996 (Tolba 1998).

The issue of the MLF was taken up again. Developed countries agreed to increase the level of funding and to make the Fund permanent. Developing countries rejected all

attempts to shift the task to the Global Environment Facility (GEF) since this was seen by the South as being dominated by the rich countries. The level of funding was increased to between $350 and $500 million for the period 1994-96.

All non developing countries have to contribute to the fund. Initially, some argued that the contributions to the fund should be based on actual CFC consumption. However, this would undermine the flow from donor countries as they were phasing out CFCs. Therefore, the United Nations scale of assessment was chosen, adjusted to account for those Article 5 countries which contribute to the UN but not to the fund (Biermann 1997).

Interestingly, the agreements which were reached in Copenhagen, were influenced by scientific findings which indicated that ozone loss was much larger than had been predicted, especially over the Northern hemisphere. However, it must be said that this information was not well founded at the time (which several atmospheric scientists later admitted). Senator Al Gore coined the phrase of an 'Ozone hole over Kennebunkport', where President Bush with his family spent their holidays. On *Time* magazine's front page one could read: 'Vanishing Ozone: The Danger Moves Closer to Home'. However, the prediction about dramatic ozone losses in the North were not confirmed. In April, NASA reported that the depletion was only 10 percent. This is not to say that ozone depletion has not worsened over time. The important point is that scientific information is fed into the policy process at crucial moments in the negotiation process. Clearly, dramatic news enhances the probability of getting tighter controls. However, this tactic may backfire if the message turns out to be exaggerated.

IV.6 The Vienna amendments, 1995

Representatives from 149 countries met in Vienna in December 1995 for the 7th meeting of the parties to the MP. Two basic issues were dealt with: the broadening of the scope of the MP, again tackling substances like HCFCs and methyl bromide, and the problem of non-compliance (see below, section V.2.). In Vienna, the phase-out date was brought forward to 2020 (with the exception of a small amount of production for servicing purposes which may continue until 2030, cf. Soroos 1997, Krueger/Rowlands 1996).

Methyl bromide is another substance which had been regulated in 1992. While an assessment report suggested that for developed countries it was technically and economically feasible to eliminate 90% of methyl bromide, some OECD countries with a large agricultural sector (esp. in Southern Europe and some states in the US) opposed it. The compromise reached in Vienna was a complete phase-out by 2010.

Also the Vienna negotiations were influenced by dramatic or should we say dramatized scientific information: this time it is the size and duration of the Antarctic ozone hole which was said to be the largest ever. On September 13th, 1995 WMO reported that ozone depletion was the fastest since the beginning of the 1980s. On November 8th, this statement is revised. WMO communicates that the ozone hole has not grown further. However, on December 1st, two days before the start of negotiations in Vienna, the German minister of environmental affairs urges the developing countries not to make use of their allotted 'grace period' since the forecasts about an increasing ozone hole had proven right (*Frankfurter Allgemeine Zeitung*, 2 December 1995: 5).

V. STRUCTURE OF AND PROCESSES OF THE MP

The MP established a formal structure with the annual conference of the parties as highest decision making body, and several other bodies (MLF, UNEP secretariat, technical, scientific and socio-economic working groups, implementation committee). Parties are countries. Parties to the Vienna Convention meet every three years (Article 6 of the VC). Parties to the Montreal Protocol (basically the same Parties), meet every year at 'Meeting of the Parties' (Article 11 of the MP), and several months prior to them in preparatory meetings called 'Open-Ended Working Group Meetings'. The meetings are organized by the Secretariat. The Secretariat has close working relationships with the following organizations and bodies:

a. UNEP/UNON, which provides the Secretariat with administrative support.

b. The Secretariat of the Multilateral Fund, which handles the evaluation and administration of projects to phase out ODS. The MLF relies on the implementing agencies UNDP, UNIDO, World Bank and UNEP-TIE to implement these projects.

c. The Scientific Assessment Panel

d. The Technical and Economic Assessment Panel (TEAP) and its 7 Technical Options Committees (TOC).

e. The Environmental Effects Assessment Panel

These assessment panels provide the Parties and the Secretariat with the necessary scientific, technological, economic and environmental input. The meetings are transparent; all Parties can participate. The United Nations and its specialized agencies, as well as any state not party to the treaties and any body or agency qualified in fields relating to the protection of the ozone layer which has informed the Secretariat of its wish to be represented at the meetings, are invited (see Article 6(5) of the VC and Article 11(5) of the MP). The Reports of the Meetings, as well as all documents prepared for the meetings, are posted on the Ozone Secretariat's Home Page (unep.org/ozone).

The Secretariat has an Executive Secretary, a Deputy ES and three professionals. It has 6 General Service staff. Of the five professionals, three have a government background, one an academic background and one an NGO, UN background. Meetings are open to any organization interested or experienced in the ozone field as observers, unless more than a third of the Parties objects. Observers can (and do) speak with the permission of the chair. Reports of the meetings (and also the Secretariat documentation) are available to public on request and through a website. The many connected

organizations including NGOs correspond frequently and participate in all important meetings on registration.

The Implementation Committee is an exception to this. Here there is no NGO participation. States which are not members of the Committee cannot attend but are invited to present their case if they are non-compliant with the control measures of the Protocol. The main task of the Implementation Committee is to collect self-reported data of members to the MP, to identify non-compliance and the reasons for it, and to make appropriate recommendations to the meeting of the parties.

The Secretariat relies very much on its Home Page to disseminate the documents it prepares prior to the meetings, and the reports of the meetings themselves. Also, the documents and reports are published in the six official UN languages, and the Secretariat relies on Email to send them from the venue of the meetings to Geneva, Nairobi, or Montreal for translation. Scientific, technological, economic and Environmental assessment of the Ozone Layer is carried out by appropriate Assessment Panels, consisting of experts from all over the world. Their reports presented to the member of the protocol are drafted at special meetings, and reviewed and finalized through e-mail (the author is grateful to UNEP staff who provided this information).

According to information from UNEP, it could do without the Home Page and e-mail, as they did until 2-3 years ago, but it would be much more complicated, time consuming and expensive. Apparently, there are some problems with using the Home Page and e-mail. UNEP tries to improve its IT system. One staff in the Secretariat is an information officer.

V.1 The Multilateral Fund

How do the actors finance their participation? If we distinguish between the phases before and after the establishment of the MP, it seems clear that the finances in the first phase came from various sources: UNEP contributed with the infrastructure of its secretariat, several countries and IOs (UNEP, OECD) hosted ozone conferences, universities and government funding agencies paid for scientific experiments and projects. After the establishment of the MP, the perhaps single most important funding mechanism was the Multilateral Fund (MLF) to aid poorer countries to achieve a transition to CFC free technologies.

Two years after the London amendments the fourth conference of the parties (COP) in Copenhagen addressed three questions: the MLF, the control of additional

substances and the compliance mechanism. On basis of the MLF which had been established in London (1990), more countries signed up to the MP. Especially important was the access of countries like India and China. Thirty-nine country specific aid programs were agreed upon to help developing countries. They had been granted a ten year grace period in which they could continue to use ODS in order to meet their basic domestic needs (Article 5). Initially, developing countries were classified according to principle of self-definition. They included the Group of 77 plus Albania, China, Mongolia and Namibia (Biermann 1997). According to Article 5 of the MP, these countries are allowed to produce and consume less than 300 grams ODS per capita and year. The MP clearly acknowledged that these 'Article 5 countries' need help in phasing out ODS. However, at the time of the MP no mechanism was provided. The details of the Fund's structure and size were hotly debated between developed and developing countries. The latter demanded a clear commitment from the former to bear all incremental cost incurred by Article 5 countries in the future phase out of ODS. Furthermore, they wanted to make sure that this fund would be separate from already existing aid budgets. And finally, they wanted a voting structure which should be democratic and equitable, and hence not favor the major contributing members (i.e. without the one-dollar-one-vote procedure known from the World Bank). Developed countries feared to set a precedent which would lead to unlimited environmental aid, also in other environmental issues. They also wanted to control the use of financial transfers, e.g. through the World Bank. In London a compromise was reached. The MLF was established as an independent body managed by an Executive Committee which reports to the MOPs. It consists of 14 parties, equally split between Article 5 parties and non-Article 5 parties. A Montreal-based secretariat assists the Executive Committee and four implementing agencies carry out the actual work in developing countries: UNEP, UNDP, World Bank and UNIDO (see Falkner 1998: 172, and Wood 1993, for further details).

The MLF provides additional financial resources which are not taken from existing international aid budgets; the representation and voting structure within the MLF aim at an equitable distribution of powers between rich and poor countries (granting a veto right to donor countries). The aim of the MLF is to help transferring environmentally friendly technology to the South, and the record of decision making indicates that Northern and Southern states have been able to proceed by consensual decision making. However, there seem have to been some difficulties in the Fund's initial period. 'Confusion over policy and organizational matters in the first year and slow distribution of funds during the first three-year period added to the general impression that the Fund was just another ineffective international body, serving bureaucratic rather than environmental ends' (Falkner 1998).

Adding to the difficulties, some donor countries at first did not comply with their payment duties. Russia suffered from insolvency, and France had reservations about the Fund's structure. While the MOP acknowledged the internal economic difficulties of the countries of the former Soviet Union, they also saw the danger of unilateral non-compliance. On the one hand, this could lead to a downward spiral, on the other hand non-compliance would lead to deficit in the Fund and consequently to a failure of the aid programs, lastly resulting in an involuntary failure of Article 5 countries to fulfill their commitments. This problem was solved by relieving the East European countries from paying their duties in hard currency. Instead, they had to give equivalent help in kind (substitute technology, training and servicing).

In January 1993, the Fund was put on a permanent basis with a budget of $510m for the period 1994-1996 and during the 1996 MOP, a new budget of $540m was approved for the period 1997-99. The allocations were determined by size of country, $5m went to a small, $20 to a medium sized country, and $40m to large countries, such as China or India. These financial incentives led China to join the MP in 1991 with India following soon after (Tolba 1998: 81-2). The Fund should complete its task by 2010 when the article 5 countries will be required to have phased out ODS production.

As of 1997, a total of about 46,000 ODP tons had been phased out in Article 5 countries with the support of the Fund and an additional 34,000 tons were expected to follow by the end of 1998 (UNEP/OzL.Pro.10/9), but developing countries have simultaneously doubled their production of CFCs since 1986 to over 100,000 ODP tons in 1996.

There is some discussion about the performance and effectiveness of the Fund. Biermann (1997) holds that the MLF has done remarkably well since nearly all incremental costs have been paid and the Fund is run in a cooperative way. Falkner admits that despite initial problems, the Fund was institutionally successful. But he does not think that this is the main reason for ODP reductions since the phase out my have been achieved by other factors. The first of these is the power of transnational corporations which operate in Article 5 countries. The conversion in the electronics sector provides a case in point. Here, ODS were used as cleaning agents and have been replaced by non-chemical solvents. The Fund did not play any role in this. Conversely, export-oriented developing countries are constrained to conform to market demands and thus switch to alternative substances. 'It is thus primarily the phase-out of domestic ODS use in developing countries, especially those with a significant internal market (e.g. China), where the Fund can make a significant contribution to the global phase-out.' (Falkner 1998: 174).

In summary, maybe a more balanced judgment is in order. The achievements of the Fund may be less than hoped for; there are indications that the Fund represents a symbolic victory for the Southern countries which primarily has helped to win global support for the MP. The structure of the MLF indicates furthermore that developed countries have given up their prerogatives of securing themselves an institutionally ingrained advantage. However, in terms of reduction of actual ODS emissions, it may well be that the Fund is less important than other mechanisms.

V.2 The MLF and GEF

Among other countries, initially France and the UK were not satisfied with the provision of the MLF operating independent from other North-South institutions. They wanted to transfer the Fund to GEF which had been established in 1990 by the World Bank, UNEP and UNDP in order to provide concessional funding for investment projects and technical assistance for environmental protection in four broad areas: global warming, ecological diversity, international waters, and the ozone layer.

While also the GEF finances projects to phase out ODS, there are important differences to the MLF. The level of contributions for the MLF is determined by the UN scale of assessment, for the GEF it was not defined at the time. Then, a minimum of 4 million Special Drawing Rights from developing countries was required in order to give them a voice in the GEF (meanwhile this has changed and no contributions are necessary, thanks to Charlotte Streck for this information). In the MLF they are represented without contributing to the Fund (Wood 1993). Whereas the MLF supports only developing countries operating under Article 5 of the MP, the GEF assists those countries that do not qualify under Article 5, either because they are classified as industrialized countries or because their per capita ODS consumption exceeds 0.3 kg., but have major difficulties in complying with the phase out scheme. In practice, mainly countries with economies in transitions (CEIT), i.e. former socialist countries in Eastern Europe are supported by GEF. To date, total allocations of $130m were made to help phase out more than 35m tons ODS in 15 countries by the year 2000 (UNEP/OzL.Pro.10/9).

V.3 Lack of Compliance

This was an important item on the agenda during the Vienna meeting in 1995. Some countries were conceding that they were not able to reach their commitments under the

MP and its amendments. This referred both to contributions these countries had to make to the MLF, but also to the phase-out of ODS. It also became clear that there was illegal international trade in CFCs which was hindering the effectiveness of the adopted control measures. Russia and some other Eastern European countries (Belarus, Bulgaria, Poland and the Ukraine) in particular were not able to eliminate a range of CFCs. At the Vienna meeting, this problem was attacked in the following way. While it was accepted that these countries might have to produce more ODS than allowed, they should be frank in their reporting and also refrain from exporting any of their ongoing production. This should prevent the black market in CFCs from growing. This seems to be another instance of integrative bargaining. A purely interest-based negotiation style would have led to a tit-for-tat strategy in with the countries in compliance would punish non-compliant countries, thus setting a downward spiral in motion. In the meantime, Russia seems to be making good progress to coming into compliance with the MP (10^{th} meeting of the parties, Cairo November 1998, see http://www.unep.org/ozone/reports2.htm#ReportsMOP).

There is also a problem with data reporting on ODS. Many parties do not report on time (e.g. in 1998, only 88 of the 164 parties that should have reported data for 1997 had done so), seven parties had never reported any data and nine parties had not reported any data for the last three years. However, there seems to be reason for overall optimism: production and consumption of major ODS have decreased considerably (although production of HCFCs has increased). China, after six years of rising consumption, had decreased consumption of CFCs from 1995 to 1996 by over 20% (UNEP/OzL.Pro.10/9).

V.4 Trust and Learning

Looking back at the whole process, it is obvious that there was much initial mistrust. Before the MP, there was a build up of mutual trust mainly within the pro-regulation camp, which did not easily extend across to the other coalition. Even in 1986, industry was still recalcitrant and did not trust scientists like Rowland (and vice versa). There is little known about the relationships within the network opposing regulations. Largely, actors seem to have trusted each other. With the announcement of Du Pont in 1986, not to oppose regulations any more, this trust relationship was broken for a short period of time since Du Pont did not discuss their move with their allies and competitors but announced it unilaterally in a ‘Dear Customer’ letter, fueling (unfounded) speculations about Du Pont’s alleged technological advantage.

In the run up to the MP, two important workshops were organized by UNEP and held in May and September of 1986. During these workshops, informal consultation was

instrumental in building bridges between the different camps. Especially during the second meeting held in Leesburg, the participants began to know one another and the atmosphere became more relaxed (Tolba 1998; Benedick 1991). Also during the formal negotiations, the chairpersons discussed sensitive issues informally within a group called 'Friends of the Chairman'. This group consisted of heads of delegations form all major stakeholders. They worked on an unofficial text away from the plenary sessions. The informal approach was even used in the final round in Montreal when Lang and Tolba made their opening statement and then adjourned the meeting. By this token, ministers and heads of delegations would be prevented from committing themselves to positions they would later find hard to abandon (Tolba 1998).

After the MP, both the industry and environmental NGOs and all connected UN and intergovernmental organizations participate in the institutional framework. They all agree that industry cooperation is necessary to implement the protocol. Differences between them arise about the pace of implementation and on the viability of the available technologies. International organizations like UNEP try to mediate between industry and environmental NGOs. Both claim that what they say is the best for the ozone layer. Business representatives tend to look down slightly on the environmentalists as lacking in knowledge. Business in turn is perceived as knowledgeable but interested only in their own welfare. A similar tension exists between international organizations and governments. IOs are respected as providing a platform for all but the governments tend to think that only they know the correct recipe for the solution. (Thanks to UNEP staff for providing this inside information).

It is noteworthy that the chemical industry slowly adapted to the perception that it might be better to be safe than sorry. Partly before, but certainly during the implementation of the MP, the chemical industry started trusting the other members in the network much more (and vice versa). At least this is what happened in the US, as an industry representative reported:

EPA and the CFC alliance have created trust over the last few years. Industry has recognized that we are better off if we cooperate and try to get it right the first time, to review EPA's drafts and discuss it. So we have gone from severe confrontation in the 1980s to cooperation in the 1990s. (Interview with the author, 15 November 1994).

Germany may provide a contrasting example. Here, industry had to be forced into cooperation. Implementing the MP, the German government in 1991 made a law banning CFCs and halons. This was one of the rare moments where an adversarial policy style could be observed in this country. Only one year later did industry come round and made a

public commitment to stop production and consumption of CFCs by 1994 (Bundesregierung 1994).

Apart from a small number of nay-sayers (the so-called 'backlash', cf. Maduro and Schauerhammer 1992), there is no doubt about the legitimation of the network's role. I guess that actors do not see the need to change very much. The remaining problems have to do with implementation on the national level and hence compliance to the rules of the international regime.

Governments are not legally bound until they ratify the Protocol and its amendments. Unfortunately, while most governments have ratified the Protocol, ratification of the amendments and their stronger control measures lag behind. As of October 8, 1999, the Ozone Agreements had been ratified by countries as follows (http://www.unep.org/ozone/ratif.htm):

- Vienna Convention - 172 Parties;
- Montreal Protocol - 171 Parties;
- London Amendment - 136 Parties;
- Copenhagen Amendment - 100 Parties;

V.5 Institutional contexts

Two important questions have to be asked here: First: to what extent does the environment (i. e. actors and power structures external to the network) determine the workings and ultimate success of the network? And second: how is the network 'nested' within existing institutional environment?

There was no structural determination of policy outcomes. However, institutional opportunity structures in which GPPNs operate, were decisive to achieve the positive outcome. This could be illustrated with respect to the different institutional frameworks in different countries. To take the examples of two big CFC producing countries, Germany and the US, it can be said that at the beginning of the controversy in 1974, both were different in the following aspects:

- In contrast to Germany, there were active research groups in the US who did work on stratospheric ozone;

- Within these research groups, there were a few scientists who acted as representatives of diffuse interests (i.e. aired concern about CFCs and its effects on the ozone layer);
- There were environmental pressure groups active in the field;
- There was a broad media interest and partisanship of important newspapers in favor of regulation;
- There was an adversarial policy style in the US—the chemical industry was under attack.

Germany and the US were similar in that

- Both countries had a 'progressive' government (Carter / Schmidt);
- The chemical industry opposed regulations but financed research into the issue.

According to the *most similar systems* logic (Przeworski/Teune 1970), the differences in politics, science and media seem to explain the different regulatory intensity. The US enacted a tough ban of CFC use in spray cans while in Germany there was a 'soft' voluntary agreement between government and the chemical industry. This is even more plausible if we look at the 1980s when Germany adopts the 'American Way': the policy style gets adversarial, the meanwhile established research groups also have advocates among their number, the media takes up the issue and takes sides. This explains under which structural conditions softer or tougher regulations are likely. However, it does not explain if there was one factor which was more decisive than the others, or if these factors influenced each other over time. In fact, one can show that these factors were interacting with each other and across national borders, creating self-reinforcing processes (cf. Grundmann 1999 for a full account).

The boundaries of the GPPN can best be described as open and fluent. There were no fixed membership criteria or selection processes, rather it was a self-selecting process. Some actors are playing a leading role in that they act as representatives or speakers in public.

V.6 A fourfold puzzle

The ozone regulations are the foremost success story in the field of global environmental policy, yet this success has to be regarded as a surprise. Four characteristics of the case seem to make its success unlikely. First, the successful representation of diffuse interests

vis-à-vis an industry which has to face costs (Wilson 1980). Second, in contradistinction to regulations within the nation- state where the 'shadow of hierarchy' sets more favorable conditions for cooperation, regulations in the international arena are bound to take place in the 'shadow of anarchy' (Oye 1986). As neo-institutionalist approaches have pointed out, under certain conditions cooperation is also likely in the international arena. The main mechanism is iterated prisoners' dilemmas (Axelrod 1984; Keohane 1984) which lead to or are institutionalized in international regimes. Both possibilities have to be excluded as an explanation for the case under consideration. This case did not follow the logic of a prisoners' dilemma. At the beginning of the international negotiations in the 1980s, main parties to a prospective treaty found themselves in a deadlock (compared to prisoners' dilemmas, deadlocks are much more resistant to solution since each side prefers to defect instead of cooperating. The logic of deadlocks has rarely been investigated in the literature on international relations, see Downs et al. 1986, Axelrod and Keohane 1986). This situation was transformed when the pro-regulation camp no longer contented itself with the status quo (which did not provide regulations). However, the camp which opposed regulations continued to do so even as others were going to take action (i.e. cooperate). Nor can the existence of an international regime be invoked to explain the solution of this collective action problem, since the regime was the result of a prior successful international cooperation (i.e. the Montreal Protocol).

A third puzzle pertains to the character of the good which is at stake. The ozone layer is a common pool resource, not a public good. This distinction may be subtle, yet it has important consequences. A public good can (in principle) be provided by a single actor without the free-riding of others adversely affecting it. In contrast, unilateral action cannot produce or protect a common pool resource, but can harm or destroy it. As a consequence, all potential polluters of the atmosphere must be part of an international agreement to protect the ozone layer.

Even more surprising is the successful cooperation if one considers fourthly that political decisions had to be taken under uncertainty. This is to say that although expert knowledge is moving to center stage, it cannot give a clear and unambiguous judgement since we typically have (at least) two opposing expert views on the matter.

All four reasons seem to pose considerable difficulties for international cooperation. Therefore, its success seems quite remarkable. Most explanations refer to economic and cognitive factors. The first argues that the influence of industry was all decisive to the outcome. Specifically, the US chemical firm Du Pont is said to have developed a technological advantage over its competitors in developing alternative substances. This, it is argued, put the firm in a position to actually favor international

regulations of CFCs. The cognitive approach has scientific consensus as the explaining variable. According to this view, expert communities reached a common understanding of causal relationships which could swiftly be transformed into political regulations. However, closer examination reveals that no evidence can be found for the claim that Du Pont had a technological advantage over its competitors. Neither was a scientific understanding of ozone depletion available at the time of the signing of the Montreal Protocol.

VI. OUTLOOK

Let me briefly recap the specificity of this case. The problem was identified by scientists who took on an advocate role in public. Opponents from industry doubted their data and theories. Instead, they claimed that there was no or only a minor problem which did not deserve widespread attention nor should it be subject to regulations. While the advocates of regulation were defending long-term diffuse interests in a global commons, the enemies of regulation were defending short-term economic interests. However, diffuse interests are patently difficult to articulate. Usually, they are too dependent upon political swings of mood (Downs 1972). The chances that they are taken serious is greatly enhanced where actors with a stake in the issue speak out. Advocate scientists are in a special position to do so. The upshot is that the lessons learned in this case may be applicable to cases

- where there is a public controversy over a problem affecting a global common good;
- which depends highly on scientific information;
- where there is controversy over this very scientific information (i.e. decisions have to taken under uncertainty);
- where diffuse interests have to be represented;
- where policy networks emerge that expand beyond national borders.

Both sides will be scrutinized by the public in a long lasting controversy. Over time, one side emerges which appears to be more trustworthy than the other. In the absence of scientific proof, the publicly visible track record of speakers on both sides is what counts most. By this token, sudden changes in the credibility of the opposing camps (i.e. triggered by a major crisis) can lead to the defeat of the opponents of regulation. The network then is able to implement international regulations which are enforceable on the national level (hard law) or serve as a normative-ethical yardstick (soft law). In the former case, the functions of the GPPN are taken over by an international regime (with the GPPN lingering in the background), in the latter, it is likely to continue actively and visibly.

VII. OUTCOME AND PROSPECTS OF THE NETWORK

International regulations for the protection of the ozone layer seem to be quite successful. They are even deemed to be a blueprint for other global environmental problems like climate change. One of the architects of the Montreal Protocol, former UNEP director Mostafa Tolba, is one of the most prominent persons who espouse such 'policy learning' when he says: 'The mechanisms we design for the protocol will – very likely – become the blueprint for the institutional apparatus designed to control greenhouse gases and adaptation to climate change' (quoted Benedick, 1991: 7). Therefore, the MP served as a role model and trigger for the climate change dispute.

VII.1 Ozone and Climate: Differences and Commonalities

By institutionalizing international scientific assessments, the architects of the Intergovernmental Panel on Climate Change (IPCC) drew an essential lesson from the case of the ozone hole. They tried to reach a consensus view on the scientific aspects of global climate changes, thus forming an epistemic community (Haas 1992). The IPCC was founded in November 1988, sailing in the waves of enthusiasm created by the successful MP, by two UN bodies, UNEP and WMO. Its role is to review and assess the published scientific literature on climate change, its costs, impacts, and possible policy responses. It also plays a role in assessing scientific and technical issues for the UN Framework Convention on Climate Change (Shackley 1997). Therefore, the IPCC is modeled precisely after the WMO-UNEP assessment reports in the ozone case. In both cases, a standardization of scientific knowledge is seen as instrumental to get the right policy decisions. This follows a linear or 'technocratic' policy model according to which first a scientific consensus has to be reached which then is transformed into political decisions.

It has been rightly remarked that insofar scientists adhere to this view, they must be regarded as rather naïve (Shackley and Skodvin 1995). Others have argued that the IPCC has primarily served the self-interest of the participating scientists in that they attracted huge funding resources and therefore stayed away from advocating specific policies (Boehmer-Christiansen 1995). To this, it has been replied that the avoidance of policy advocacy in IPCC reports is rooted in a desire to make the scientific information as effective as possible: 'For scientific information to be believed by the majority of participants in policy debates, it must be even-handed and not favour particular political or economic interests' (Moss 1995). Both

views seem to accept the linear model of a science input which is transformed into a policy outcome. Without doubt, the IPCC has succeeded in establishing a shared understanding of climate change that is accepted by many participants involved in building the climate change convention. But how instrumental was it in getting the United Nations Framework Convention on Climate Change (FCCC)? And is it strong enough?

From the consensus assessments of IPCC, rough goals could be derived; though not, however, solutions of the conflict between countries and groups of countries. But perhaps this is expecting too much from the scientists, given that they have resisted making detailed recommendations to the politicians. It is noteworthy that the FCCC has taken over another element of the role model MP: it ensures that tougher control measures are possible if new scientific evidence becomes available. Yet, at the same time, it may be that more precise prognoses of future climatic developments go unmade for political reasons; because, for example, Global Circulation Models with higher resolutions would allow the development of regional scenarios which might identify winners and losers due to climate change, thus posing additional difficulties for the international negotiations.

The case of ozone layer protection was different in that there was, before the consensus assessment reports, strictly speaking, no epistemic community. From the beginning, a few scientific advocates dared to combine their scientific judgments with political recommendations or demands. Rowland was not afraid to demand first a ban on CFCs in spray cans and then, after the discovery of the ozone hole, a general ban. Moreover, it was he who coined the metaphor of the ozone hole. His credibility and that of other advocates grew as time passed, particularly after the onset of dramatic events (the ozone hole). In the 1970s and the beginning of the 1980s, Rowland was considered an extremist by many colleagues. In the case of climate change this development was precluded by the deliberate creation of an epistemic community. Back in the 1980s, Stephen Schneider and James Hansen distinguished themselves as advocates of a policy of prevention. At public hearings, they did not hesitate to describe current extreme climatic events as expressions of anthropogenic climate change; for which they were much criticised (cf. Nance 1991, chapter 10). With the IPCC, this activity subsided. Climatologists thereby gained an exciting, relatively well-funded research field, but at a price: they could not move beyond the boundaries of the official consensus. This gave skeptics and outsiders the opportunity to deconstruct the available findings, which they did in public, primarily in the mass media. So in the end, all attempts at reaching a consensus view notwithstanding, debate and controversy could not be avoided. What is more, fierce enemies of regulation seem to dominate in the

public debate where they are not attacked by equally adamant advocates of regulation but by a consensus view which expresses the least common denominator.

The case of climate change reveals the limits of the technocratic policy model, since reaching a common scientific judgment does not necessarily mean that the problem can be defined and solved in concert. Problem definition is a much broader concept than scientific description of a problem; the former contains essential elements of a pragmatic, practical, and political dimension which the latter, as a rule, forgoes. As we know from other examples, scientific (un)certainty has no direct bearing on policy outcomes. Ozone is an example where political action was taken under uncertainty. And in very many cases no political action follows from conclusive scientific knowledge or consensus expert opinion because economic and political factors are much more influential. Policy makers make use of expert recommendations as they see fit. Are scientists deceiving themselves?

The first major breakthrough in the climate change negotiations was made in Kyoto, where the average goal of about 5% reduction was agreed to—a target that the US Senate may yet reject. Kyoto nonetheless set the stage for compromises to be reached between two different regulation philosophies: negotiable quotas (put forward by the US) vs. targets and timetables (put forward by the EU). However, the unilaterally established goals (e.g., the ambitious goals set by the EU) were not met so far, and it seems clear that it is by now no longer a matter of prevention, but rather only of ameliorating, and of coming to terms with, the consequences of global climate change (*adaptation*). Kyoto thus represents only a starting point which does not even come close to the range of reductions which would have to be put in place if climate change were to be prevented. According to IPCC scientists, CO2 emissions would have to be cut by more than 60% in order to stabilize climate on present-day levels (Houghton 1990; Wuebbles/Rosenberg 1998).

For a long time, the climate change negotiations were deadlocked. The deadlock has only slowly given way to a willingness to propose a comprehensive solution to the problem. At Kyoto at last, steps towards a comprehensive solution have emerged. This can be seen in the establishment of technical yardsticks that are applied in a flexible manner, and in the granting of exceptions which run counter to the short-term economic interests of those offering them.

A popular explanation for the difference between the two cases cites the greater complexity of the problem of climate change, or how ‘simple’ it was to solve the problem of the ozone layer. In retrospect it may seem so, in accordance with a functionalist logic which

declares solved problems to be easily-solved problems. Upon closer examination, we can see that the case was anything but simple. For almost twenty years, producers of CFCs throughout the world resisted regulation, in part by means of the same arguments which are still heard in the case of climate: there were, they claimed, no cost-effective alternative technologies. These were found when the producers were forced to forgo the use of CFCs. The anti-regulation position was still so strong in 1987 that six months before the signing of the Montreal Protocol, Lang, then chair of the international ozone negotiations, claimed that no more than 10 to 20 percent CFC reduction was feasible in the next decade (*New York Times*, 28 February 1987).

There is some truth to the complexity thesis with regard to the structure of business in both fields. While Du Pont was the market leader, and its change of direction set off a chain reaction, this has not occurred in the climate case and it is doubtful if it can. Here, there is no dominant producer from whom all others take their cue. However, there are signs that the oil industry is giving up its obstructive role. In May 1997, during a lecture at Stanford University, John Browne of BP America announced that the company was in favor of gradual reductions in CO2 emissions: ‘The time to consider the policy dimensions of climate change is not when the link between greenhouse gases and climate change is conclusively proven, but when the possibility cannot be discounted and is taken seriously by the society of which we are part. We in BP have reached that point’. BP's declaration could in any case be seen as a sign that oil producers no longer see their future exclusively in terms of oil and trigger a bandwagon effect.

But the real important difference between the two cases is as follows. The ozone controversy was decided once a clear alarm signal had appeared and was used by a strong, publicly visible policy network in order to advocate strict controls. In the climate controversy, however, it remains unclear whether various extreme climatic events are at all connected with the long-term global climate changes. A few climatologists make this claim, but this does not constitute the consensus of the IPCC. In a way, the early institutionalisation of the epistemic community in the form of the IPCC suppressed any open controversy. In order to preserve a consensus (of which too much was expected politically), the scientific controversy was silenced. This gave outsiders the chance to make their name in media, albeit being condemned as essentially unscientific by the mainstream epistemic community. If all conflicting opinions would have been openly aired, then extreme events could probably have served much better as justification for taking dramatic measures, because the representatives of a precautionary policy would have gained immensely in credibility.

The construction of the IPCC as an international epistemic community committed to a scientific consensus and serving a political end has proven, on this view, to be somewhat counterproductive. The pressure to come to a consensus involving no clear political measures robbed the controversy of an essential dynamic. The symbolic reinterpretation of dramatic events, and the mobilization by such means of third parties for the purpose of climate protection, have not been possible in the climate debate. This is a speculative lesson which follows from the above analysis. It rests on a counterfactual and therefore cannot be proven. If plausible, it would put into question the main lesson drawn by the architects of the IPCC.

VII.2 Main lessons learned

- Global environmental issues cannot be solved unilaterally. However, damage to a common pool resource can be done unilaterally. Therefore, control measures have to be binding on all main parties to an international treaty.
- Rather than being addressed by inter-state negotiations, global environmental issues are most likely identified by scientists who, apart from NGOs, also publicize them and make suggestions for solution.
- Transnational policy networks form as a result of growing concern about these issues with international organizations playing an important role.
- Advocate scientists, acting as speakers for the environment, have a special potential to mobilize public support for strict regulations.
- On the national as well as on the international level, there is an antagonistic constellation between proponents and opponents of regulations.
- Public credibility is the most valuable asset.
- Shifts of balance between the two competing networks may lead to a permanent advantage of one side.
- During international negotiations, informal consultations are instrumental in getting compromise between opposing parties.
- Flexible instruments help bringing draggers on board.

- Dramatic information, based on science, and rightly timed, is instrumental in advancing the cause of stricter controls.

If one asks who ‘lost’ and who ‘won’ and taking a long time period (ca. 1974-1985), the answer would be that certainly the chemical industry lost its battle to save CFCs. It also seems that they could have made more profits if CFC had not been regulated. This is so because other branches offering replacements were kicking into existing markets which formerly had been dominated by CFCs. If one looks at the international level, at the negotiations in Montreal and after, it is very difficult to identify losers and winners since the solutions entailed complex compromises on many issues. While the South may have won an important symbolic victory with the MLF, it is not clear that this Fund will be the main instrument in replacing ODS in developing countries. Conversely, it is not clear that the North has to pay disproportionate sums in order to get the agreement going. Above all, the success of the MP leads to a more positive interpretation of the story by the participants. Actors seem to agree that all have profited form the regulations since the counterfactual scenario of unfettered ozone destruction would have had dire consequences for all of us.

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CHRONOLOGY

1974	Molina-Rowland-Hypothesis
1975	US government task force (IMOS) sees „considerable cause for concern'
1976	First report of the US National Academy of Sciences (NAS) estimates 6-7.5% ozone depletion
1977	US Clean Air Act: aerosol ban, First intergovernmental meeting in Washington
1979	2nd NAS report: 16.5% estimate of ozone depletion
1980	EC: 30% reduction in aerosols, production capacity cap
1982	3rd NAS report: 5-9% estimate of ozone depletion
1984	4th NAS report: 2-4% estimate of ozone depletion
1985	Vienna Convention for the Protection of the Ozone Layer
	British Antarctic Survey: Ozone dramatically low over Antarctica
1986	'Ozone hole' accepted as real:
	(1) Activation of most atmospheric scientists
	(2) Germany in favor of Regulations
	(3) Du Pont not against Regulations
1987	Montreal Protocol on Substances that deplete the Ozone Layer: US, Japan, Soviet Union and EC agree on CFC controls: immediate freeze and 50% cutback by 1999 of 5 ozone depleting substances
1988	Scientists working in WMO-UNEP framework ('Ozone Trend Panel'):
	(1) Ozone Hole caused by CFCs
	(2) Global ozone depletion detected
	Du Pont declares CFC phase-out, Hoechst opposes it
1990	London Amendments:
	Great Britain and EC in favor of tighter Regulations
	Developing countries in favor, depending on monetary aid
1991	German CFC halon ban
	US Clean Air Act amended
1992	Copenhagen Amendments: Multilateral Fund established
1995	Vienna Amendments: More countries, substances included; quicker phase out

FIG: PREFERENCE CHANGE OF GOVERNMENT (G) AND INDUSTRY (I) IN THREE COUNTRIES, 1976-1988.

	1976		1980		1986		1987		1988	
	G	I	G	I	G	I	G	I	G	I
USA	•	o	o	o	o/ •	o/ •	•	•	•	•
Germany	o	o	o	o	o/ •	o	•	o	•	•
UK	o	o	o	o	o	o	o	o	•	•

• = pro-regulation of CFCs
o = anti-regulation of CFCs.