Volume 6, Fall Issue, 1992

TECHNOLOGY TRANSFER AND ITS ROLE IN INTERNATIONAL ENVIRONMENTAL LAW: A STRUCTURAL DILEMMA

*Colin M. Alberts**

INTRODUCTION

On the international stage, the movement of environmental issues to the forefront should come as little surprise. As the paradigm of East versus West becomes overshadowed by North versus South, there is an increasing perception that the efforts of Third World nations for sustained economic growth threaten both to exacerbate the ecological damage already being wrought by developed nations' activities and to conflict with the desire for ecological protection that has emerged as a major political issue in developed countries in the past fifteen years. There is a growing realization that the distinction between national and international environmental problems is, at best, artificial.[1] Coupled with the new awareness of the global import of environmental problems in the minds of many is the old faith in technology as the primary means to address these problems. At its core, this faith has as a creed that the ultimate problem of resource depletion in this finite world is not imminent. It can be forestalled by technological advances, as the one limitless resource on the planet is human intellect.[2]

When the United Nations Conference on the Human Environment was held in 1972,[3] many attending delegates from developing nations were openly suspicious of the proceedings which led to the creation of the United Nations Environment Programme ("UNEP").[4] In their view, the

---

* B.A., 1988, Boston University; J.D., 1991, University of Michigan. The author specializes in international technology issues.

1. Nitrogen oxide emissions are a prime example of this, as they must be regulated on a *local* level (e.g., urban "bubbles") because of ground-level ozone formation, on a *regional* level (e.g., the United States and Canada) because of acid rain, and on a *global* level because ground-level ozone is recognized as a heat-trapping "greenhouse" gas. *See, e.g.*, PETER H. SAND, LESSONS LEARNED IN GLOBAL ENVIRONMENTAL GOVERNANCE (1990).

2. In terms of environmental policy, this school of thought came about in direct response to a highly controversial book, DONELLA H. MEADOWS ET AL., THE LIMITS TO GROWTH (1972), which circulated in the millions. *See* Carl Kaysen, *The Computer That Printed Out W*o*l*f**, 50 FOREIGN AFF. 660 (1972). For a penetrating analysis of the effect of technological optimism on environmental policy planning, see James E. Krier & Clayton P. Gillette, *The Un-Easy Case for Technological Optimism*, 84 MICH L. REV. 405 (1985).

3. Conference on the Human Environment, June 5-16, 1972, 11 I.L.M. 1416.

4. G.A. Res. 2997, U.N. GAOR, 27th Sess., Supp. No. 30, at 43, U.N. Doc. A/8730

First World's new preoccupation with ecology was yet another ruse by which the Third World's aspirations to economic growth and development were to be stymied while the developed nations of North America and Western Europe maintained a disproportionate share of the world's industrial wealth.[5] In the years since the Conference, attitudes have changed gradually. Most nations, irrespective of their economic level, have come to recognize that the goal of sustainable development for environmental protection is the ideal for any just world economic order.[6] Many doubts persist, however, as developing nations are under enormous internal pressure to give environmental concerns secondary priority. Most developing countries have long since recognized that they have serious domestic environmental problems, but feel compelled to give attention and action to urgent, unmet economic and social needs first.

Translating sustainable international development from a lofty precept[7] to a practical reality requires that the First World meet the challenge of aiding developing countries (as well as the transforming countries of Eastern Europe) to address grave environmental threats and to spur "greener" economic growth. One of the epistemic assumptions maintained by the global community is a basic faith and confidence in the ability of science and engineering to fix problems. If the emerging post-cold war world order is to be characterized by a universal recognition of "liberal capitalism," as some have predicted,[8] then there is no reason to believe that this faith will dwindle. In the future, therefore, one of the most important issues in international environmental law, when considering the means to sustainable growth, will be technology transfer.

Technology transfer covers a wide range of activities, both commercial

---

(1973).

5. UNITED NATIONS ENVIRONMENT PROGRAMME, REVIEW OF THE AREAS OF ENVIRONMENT AND DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT, UNEP Report No. 3 (1978).

6. See, for example, THE EXPERTS GROUP ON ENVIRONMENTAL LAW OF THE WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AND SUSTAINABLE DEVELOPMENT: LEGAL PRINCIPLES AND RECOMMENDATIONS (1987), representing a diverse mix of 22 nations. Indeed, all of the major U.N. General Assembly resolutions related to demands for a New International Economic Order include references to the transfer of technology. *See, e.g., Declaration on the Establishment of a New International Economic Order*, G.A. Res. 3201, U.N. GAOR, 6th Sess., Supp. No. 1, para. 4(n)(p), U.N. Doc. S/9559.

7. Sustainable development, according to the Brundtland Commission of the U.N. Conference on the Human Environment, "meets the needs of the present without compromising the ability of future generations to meet their own needs." WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE 8 (1987).

8. *See, e.g.*, FRANCIS FUYUKAMA, THE END OF HISTORY AND THE LAST MAN (1991).

and political, involving the international flow of scientific research, studies, training, processes, techniques, hardware, and equipment. On the international environmental level, technology transfer can range from the complex to the simple, from graduate fellowships and research and development to local schooling for pollution-control equipment workers, provision of energy-efficient equipment, and reforestation techniques. On a broader level, even family planning techniques may be considered part of this realm.[9]

What makes technology transfer more of an emerging feature of future international environmental law is the First World's discovery that international environmental technology transfer has a "selfish" application in addition to its obvious altruistic application of cleaning up the environment. By appealing to Third World self-interest, developed countries use technology transfer as an incentive to encourage developing nations to join in the enhancement of international regimes designed to deal with grave global environmental issues. Access to technology is beginning to be looked at by First World governments as an important inducement to build international constituencies for powerful global environmental conventions.

This Article first examines the history of technology transfer's role in international environmental regimes and the lessons to be learned therefrom. It then explores the most important arena in which these issues are currently being addressed, namely the efforts to control release of greenhouse gases and ozone layer depletion, with specific criticisms and prospects for the future. The Article concludes that the use of technology transfer by industrialized nations as an inducement to bring developing nations into strong environmental regimes should only be undertaken upon the fulfillment of three conditions: first, all nations involved must share fundamental assumptions regarding the nature of specific environmental problems; second, the norms to which the countries are prepared to conform must be stated with precision; and third, there must be a concrete mechanism for the enforcement of these norms.

---

9. INTERNATIONAL ENVIRONMENTAL TECHNOLOGY TRANSFER ADVISORY BOARD, FINAL REPORT TO THE ADMINISTRATOR OF THE U.S. EPA 12 (1990).

I. HISTORICAL EVOLUTION

This Section examines three failed efforts to establish effective international technology transfer regimes: the nuclear non-proliferation regime, the 1982 Convention of the Law of the Sea, and the early UNEP-sponsored regional environmental regimes.

A. Case One: The NPT Regime

The first prominent use of technology transfer as an incentive for developing nations to participate in a major international regime was associated with the enactment of the 1968 Nuclear Non-Proliferation Treaty ("NPT").[10] The technical assistance program of the International Atomic Energy Agency ("IAEA") was the institutional response to the demand of developing countries for nuclear power generation technology in exchange for adherence to an international regime advancing the goal of developed nations to stop the spread of nuclear weapons. It was also symbolic of the larger quest of developing countries for advanced infrastructure technologies. The experience of this program serves to illustrate one facet of the dilemma which seems to plague technology transfer as an incentive: namely, that a detailed and concrete mechanism for transfer becomes paralyzed when the substantive assumptions underlying the agreement are no longer universally accepted.

In the years immediately following the Second World War, there was a great deal of optimism about nuclear energy and its potential as a catalyst for beneficial change in the Third World. Cheap and clean power was envisioned as promoting the electrification of remote rural areas and increasing agricultural efficiency and industrialization by powering water desalination, fertilizer processing, and electrical generation. In addition to opening up huge tracts of the Third World for rapid development, nuclear energy was seen as an opportunity to organize indigenous scientific and technological infrastructures in these countries. Nuclear programs would require training in skills ranging from hard theoretical sciences to precision welding. These skills would not only prove useful in transfers to other industrial projects, but also become self-sustaining and self-supporting in these countries. Moreover, the creation

10. Treaty on the Non-Proliferation of Nuclear Weapons, *opened for signature* July 1, 1968, 21 U.S.T. 483, 729 U.N.T.S. 161.

of technological elites in developing nations was envisioned, and it was hoped that these elites would have the effect of steering respective national polities into responsible and careful use of the awesome technologies which had been put in their hands.[11] Such was the mindset of several planners in the late 1940s and early 1950s,[12] and while it might seem hopelessly quixotic to present-day observers, it should be noted that some modern planners may have similarly grandiose ideas concerning the potential of environmental technology transfer.

Rather than await the creation of an international regime, the United States decided instead to act alone in an effort to accelerate the realization of its goals. Previously, the Atomic Energy Act of 1946[13] prescribed nuclear energy technology transfer only within the constraints of a predicted international agreement on non-proliferation. The new Act of 1954[14] gave a green light for the United States to enter bilateral agreements with developing nations, and President Eisenhower's "Atoms for Peace" program was born. Before its termination in 1962, the program extended more than thirteen million dollars in grants and waived lease charges to dozens of nations. But countries receiving assistance, instead of achieving self-sufficiency, came to rely on a continual flow of equipment and expertise.[15]

The failure of bilateral assistance programs such as Atoms for Peace led to the increased emphasis on nuclear technology transfer through the multilateral channel of the IAEA technical assistance program. The IAEA is authorized by statute to assist research and development of peaceful applications of nuclear energy through programs for training, exchange of scientists and technicians, sharing of information, and provision of technology, materials, and equipment among its member states.[16] It is also permitted to assist in the financing or arrangement of suitable financing for these projects.[17] The IAEA, however, was engaged in another task, running concurrent with its technical assistance mandate: to control the proliferation of materials and technology

---

11. BENJAMIN SCHIFF, INTERNATIONAL NUCLEAR TECHNOLOGY TRANSFER: DILEMMAS OF DISSEMINATION AND CONTROL 163-66 (1984).
12. *Id.*
13. Atomic Energy Act of 1946, Pub. L. No. 79-585, 60 Stat. 755.
14. Atomic Energy Act of 1954, Pub. L. No. 83-703, 68 Stat. 919.
15. SCHIFF, *supra* note 11, at 167.
16. Statute of the International Atomic Energy Agency, Oct. 26, 1956, art. III, paras. A.1-2, 276 U.N.T.S. 6, art. XI, paras. A & C, 276 U.N.T.S. 22, 24.
17. *Id.* art. XI, para. B, 276 U.N.T.S. 22.

regarding nuclear weapons (the "safeguards" program). While the linkage and administration of these two tasks became explicit with the negotiation and signing of the NPT, it had already evolved as part of the international regime since the 1957 founding of the IAEA. It also substantially impaired the efficacy of the NPT regime.

Today, non-proliferation and technology transfer are still officially regarded as universal ideals by both North and South. But in practice, the NPT regime is in paralysis, mired by disagreement over fundamental norms and procedure. Although the legal regime for nuclear control has created a detailed and concrete set of rules to be implemented regarding technology transfer and safeguards for that technology, political consensus over many norms that are fundamental to the regime are in disarray.

The first difference of opinion between North and South is whether the main focus of the IAEA's operations and activities should be technology transfer or safeguards. Beyond this, there is fundamental disagreement over how the Agency's two basic programs should relate to each other. In general, developed nations contributing to the IAEA general fund regard technology transfer expenditures as "buying" safeguards compliance from developing nations. The developing countries view the safeguards and technology transfer programs as competing with each other for scarce Agency resources.[18] The first viewpoint is thus one of complementary bargain, in which technical assistance in exchange for control is the operational and normative basis of the NPT regime and IAEA activities. The second viewpoint sees the existence of a zero-sum game, with allocations for the two major programs optimally balanced according to the statute.

B. Case Two: The Law of the Sea

The opposite pitfall for an international environmental technology transfer regime, that of the lack of an administrative system, is best represented by the experience of the United Nations 1982 Convention on the Law of the Sea ("UNCLOS III").[19] This treaty is still not in force. In this case, disagreement over fundamental norms of the subject matter at the outset led to the enactment of a technology transfer regime the

---

18. SCHIFF, *supra* note 11, at 163-66.

19. United Nations Convention on the Law of the Sea, *opened for signature* Dec. 10, 1982, U.N. Doc. A/CONF. 62/122, *reprinted in* 21 I.L.M. 1261 (1982) [hereinafter UNCLOS].

hallmark of which is the referral of material solutions and decision-making away from both the Convention and the realm of law itself. When the normative disagreement subsided, the parties were left with no apparatus for effective technology transfer.

The types of marine technology that any putative transfer regime could cover are greatly varied. These include fishing technology (e.g., sea farming, new nets, new fish location techniques), shipbuilding technology (e.g., special purpose carriers, electronic navigation aids), coastal engineering technology (e.g., port and breakwater construction and submarine cable techniques), desalination technology, and technology to harness tidal power to obtain energy.[20]

The most important and controversial technologies for purposes of the UNCLOS transfer regime, however, are the techniques surrounding deep seabed mining. This process involves the extraction of critical resources, such as oil, gas, and scarce minerals, and is thus the field of marine technology transfer which most significantly implicates the rivalry between East and West.[21] Because developing countries prefer technical assistance in the form of technology transfer to be disseminated to them through the medium of international organizations rather than through bilateral programs,[22] transfer of marine technology, particularly seabed mining technology, was high on the Third World's agenda at the UNCLOS III conferences. For a variety of reasons, developing nations were greatly dissatisfied with the predominant system of commercial technology transfer carried out largely by transnational corporations ("TNCs"). Complaints focused on the practice of TNCs selling technology "packages" which have the effect of increasing the direct and indirect costs of technology and which may be more tailored to the needs of the TNCs than the requirements of the developing nations.[23]

With a preference for technology transfer by international agencies

---

20. *See, e.g., Description of Some Types of Marine Technology and Possible Methods for Their Transfer*, Report by the Secretary-General, U.N. Doc. A/CONF. 62/C.3/L.33 (1976); Douglas M. Johnston, *Law, Technology and the Sea*, 55 CAL. L. REV. 449 (1967).

21. *See* BOLESLAW A. BOCZEK, THE TRANSFER OF MARINE TECHNOLOGY TO DEVELOPING NATIONS IN INTERNATIONAL LAW (1982).

22. For an explanation of why this is so, see Kay, *International Transfer of Marine Technology: The Transfer Process and International Organization*, 2 OCEAN DEV. & INT'L L. 351, 374 (1974).

23. BOCZEK, *supra* note 21, at 10-12; *see also* UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT, HANDBOOK ON THE ACQUISITION OF TECHNOLOGY BY DEVELOPING COUNTRIES ch. VII, U.N. Doc. UNCTAD/TT/AS.5 (1978) [hereinafter UNCTAD Handbook]; UNCTAD Draft International Code of Conduct on the Transfer of Technology, ch. 5(2)(c), U.N. Doc. TD/CODE TOT/25, *reprinted in* 19 I.L.M. 773 (1980).

clearly on the mind of the developing countries during the 1970s, UNCLOS III was a natural forum in which these countries could attempt to assert their demands regarding the transfer of marine technology. At the same time, another development was acting to put technology transfer on the UNCLOS III agenda, namely, the effort to open up seabed development to a wider circle of nations.[24] It was at this point that disagreements over norms fundamental to the projected regime emerged. The question of seabed mining technology transfer hit sensitive nerves among both developing and developed nations. The Third World viewed the issue as a touchstone, representing both the willingness of industrialized countries to part with a truly critical set of techniques and the need for this most promising and important technology group in their hopes for development. The First World certainly concurred in viewing deep seabed mining technology as crucial, but viewed this from a strategic as well as an economic standpoint. The division between North and South was thus exacerbated by the continuing rivalry between East and West.[25]

Out of this deadlock over norms emerged the present UNCLOS technology transfer regime. From the outset of the Conference, nearly all parties recognized that the final Convention would not be able to establish detailed, complex rules for technology transfer, but instead would have to settle for vague guidelines leaving the task of creating specifics to other entities. Part XIV of the Convention deals with marine technology transfer. On four different occasions, it refers to future cooperation by "States, directly or through competent international organizations"[26] without specifying which organizations or what rules of decisionmaking are to be employed.[27] The only material obligation is for contracting states to "promote where feasible and appropriate" technology transfer, or to "endeavor to foster favorable economic and legal conditions for it."[28] It has been noted that these provisions are

---

24. The famous "Maltese proposal" by Ambassador Pardo was to place the seabed beyond national control and make it part of the "common heritage of mankind." U.N. Doc. A/L 6695, *reprinted in* PACEM IN MARIBUS 27 (1972). The address created a chain reaction of events which led to the creation by the General Assembly of the "Seabed Committee," which was charged with drawing up an agenda for UNCLOS III, specifically including the issue of technology transfer. G.A. Res. 2340, U.N. GAOR, 22nd Sess., Supp. No. 16, at 14 (1967); G.A. Res. 2467, U.N. GAOR, 23rd Sess., Supp. No. 18, at 15 (1968).

25. *See, e.g.*, Treves, *Le transfert de technologie et la Conférence sur le droit de la mer*, 104 J. DU DROIT INT'L 43 (1977); BOCZEK, *supra* note 21, at 22-26.

26. UNCLOS, *supra* note 19, arts. 266(1), 271, 272, 273.

27. *Id.*

28. *Id.* arts. 266(1)-(3), 270.

constructed so as to accomodate all States and to have as an implicit assumption that conflict is avoidable as long as parties recognize the mutual benefit of agreements. The fallacy in this reasoning is that conflicts of interest are unavoidable when dealing with the scarce resources of the oceans,[29] otherwise there would be no need for UNCLOS. In remaining silent as to rule specificity, the Convention, "[i]n its concern to safeguard all States' interests . . . begs the question of what to do when disagreements arise within the formal framework it sets up."[30]

This "strategy of referral" would seem to be contradicted by the guidelines set forth later in Part XIV, where in the area of seabed mining, States are called to cooperate not only with the catch-all "competent international organizations," but also with the International Seabed Authority regarding the transfer of technology.[31] The Authority is then given a set of specific tasks by which to accomplish the mandated transfer.[32] This is merely another example of referral, albeit a disguised one. The most controversial question in the technology transfer debates at UNCLOS III was the mention and possible role of the International Seabed Authority.[33] The developed countries had as their goal the concession to this Authority of as little power as possible, perhaps even to eliminate any mention of the Authority. They acted out of fear that such a concession of power would lead to a concrete system of material rules which would threaten their interests. When this failed, the developed nations tried to have mention of the Authority deleted and replaced by "competent international organizations." Although this was put forth as a mere drafting amendment, debate nevertheless ensued. As might be expected, a compromise was reached and both "the Authority" and "competent international organizations" were included in the text.[34]

This compromise, however, was more of a concession to the developed

---

29. MARTTI KOSKENNIEMI, FROM APOLOGY TO UTOPIA: THE STRUCTURE OF INTERNATIONAL LEGAL ARGUMENT 438-40 (1989). This analysis of the UNCLOS pertains not only to its provisions on technology transfer, but also to compensation for damages, and territorial space, among other areas. The tendency, identified in UNCLOS, to refer material solution away from the instrument, has been noted as a recurring feature of modern international law. *See* DAVID KENNEDY, INTERNATIONAL LEGAL STRUCTURES 201-45 (1987).

30. KOSKENNIEMI, *supra* note 29, at 439.

31. UNCLOS, *supra* note 19, art. 273.

32. *Id.* art. 274.

33. *See Report of the Chairman*, International Seabed Authority, 3d Comm., 5th Sess., U.N. Doc. A/CONF.62/L.18 (1978).

34. BOCZEK, *supra* note 21, at 29.

nations' wishes than it appears. The International Seabed Authority, far from being an edict of material technology transfer duties, is in fact a massive procedure for complex decisionmaking under which measures for technology transfer will be adopted at some point in the future.[35] Thus, the effect of referral back into the maelstrom of general law or into some unspecified future agreement is the same with mention of the International Seabed Authority as it is with the suspect "competent international organizations."

Nor was this the only way in which division over fundamental norms contributed to a marine technology transfer regime which scrupulously avoided material rulemaking. This is shown in the *travaux preparatoires* on what eventually became Article 274. Originally the Authority was to be assigned functions beyond the seabed area, with a "special fund" to finance all marine activities of developing nations, including marine scientific research.[36] This proposal incurred the strong opposition of the industrialized nations, particularly the United States. The Revised Single Negotiating Text omitted any mention of a "special fund" and substituted "financial arrangements provided for in the Convention."[37] Furthermore, the First World found it unacceptable that the Authority should have the power to ensure that in the course of substantive technology transfer all blueprints and patents be made available to Third World countries. Therefore, the Negotiating Text and the final Convention replaced the words "blueprints and patents" with the more acceptable and noncommittal "technical documentation" which was to be available to all nations, particularly developing nations requiring technical assistance.

In summary, the technology transfer provisions of UNCLOS represent the deep division between North and South. As originally drafted, the regime represented the developing countries' efforts to institutionalize in a binding convention their ideals in at least one vital area of technology transfer, marine technology. But the determined opposition of the developed world during the drafting and negotiation of the Convention made inevitable provisions which were so non-controversial as to be banal. The "provisions are not formulated in terms of strict legal obligations but merely dictate a certain standard of behavior to be

35. The apparatus of the Authority is found in UNCLOS, *supra* note 19, arts. 150-187.

36. U.N. Doc. A/CONF.62/C.3/L.12 (1975).

37. Revised Single Negotiating Text, art. 86, U.N. Doc. A/CONF.62/WP.8 (1976). This article 86 became, in pertinent part, UNCLOS, *supra* note 19, art. 274.

followed in promoting technology transfer."[38] Thus, the conflicts which presumably made the Convention necessary in the first place were not resolved, but postponed for future resolution.

Conflicts over fundamental norms of technology transfer, particularly with regard to deep seabed mining technology, continue to the present. Largely for this reason, the United States has stood by its decision not to sign the Convention, and UNCLOS has yet to enter into force. But if the circumstances underlying the conflict were to cease, it is not apparent that any immediate benefit would accrue. If, for example, the decline of the East-West rivalry and the rise of a universal liberal-capitalist order were to relax North-South tensions to the point where marine technology transfer was something both sides were eager to undertake, international planners would be stuck with a regime which sets forth no material rules or obligations and refers these solutions elsewhere and to another time. Normative conflict at the outset of a regime can thus have adverse effects even after the rules of the game have changed.

When this model is contrasted with the experience of technology transfer under the NPT regime, the potential difficulties for any proposed technology transfer regime in international environmental law can be appreciated. In the NPT experience, unanimity over fundamental norms at the commencement of the regime led to a complicated and concrete system of material solution. When disagreement over norms surfaced, the decisionmaking apparatus ground into paralysis. By way of contrast, the disagreement over basic norms in the UNCLOS regime came when that regime was being drafted, leading to an ineffectual instrument which employs a strategy of referral that will continue to plague planners even if the normative conflict is resolved.

The experience of international environmental law to date gives reason to fear that environmental technology transfer regimes, particularly as incentives to induce participation in global or regional environmental accords, may risk the danger of emulating one or the other or both of these syndromes (NPT and UNCLOS). The very nature of environmental concerns suggests this outcome. Either a particular environmental problem will be perceived by interests in the developed world as relatively unimportant vis-à-vis other more prominent concerns, or it will be perceived as hypercritical, possibly even as threatening the planet. If the former perception holds sway in the First World, then disagreements

38. BOCZEK, *supra* note 21, at 47.

over fundamental norms may not be so acute as to preclude the establishment of a complicated regime of technology transfer with provisions tending toward those of an obligatory nature. If the latter perception is more the case, then disagreements over fundamental norms (given the developing world's desire for economic growth) may be so contradictory as to lead to a toothless regime of technology transfer, as was the case with UNCLOS.

One additional factor, however, is that these perceptions regarding given environmental concerns are not static, as the experience of the past few years demonstrates. The attention given to a problem such as global warming seems to have subsided over the past three or four years, and with it, calls for an international accord on greenhouse gases. Parallel to this trend is the opposite sentiment surrounding ozone layer depletion, which has changed from viewing ozone layer depletion as a side issue to one of critical importance. As scientific evidence and opinion is sifted and evaluated, perceptions change repeatedly. If this is the case, international environmental technology transfer regimes run the risk of repeating the follies of the NPT and UNCLOS experiences *ad infinitum*.

C. Case Three: The Early [illegible]mental Regimes

The introduction of technology transfer as an incentive to participate in international environmental agreements began in the mid-1970s with one of the first of the regional seas protocols and conventions, the 1976 Barcelona Convention.[39] UNEP sponsored the Convention in an attempt to raise environmental standards through restriction of a regime to a smaller area. Article 11(3) of this convention states that the "[t]he Contracting Parties undertake to co-operate in the provision of technical and other possible assistance in fields relating to marine pollution, with priority to be given to the special needs of developing countries . . . ."[40] Although Article 13 ("Institutional Arrangements") assigns UNEP several administrative and secretariat functions arising under articles of the treaty, no responsibility is delegated for the creation or execution of a procedural framework for technology transfer. Article 11(3) thus becomes little more than a hollow promise, with material solution referred away from

39. Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution, Feb. 16, 1976, 15 I.L.M. 290.

40. *Id.*

the Convention. The problem was echoed, but not rectified, by Article 10 of the Athens Protocol[41] which was meant to supplement the Barcelona Accord.

The same pattern was repeated twice more in the following decade. In the 1983 Cartagena Convention,[42] Article 13(3) calls for the signatory parties to engage in technology transfer for the purpose of "sound environmental management" for the benefit of "smaller island developing countries."[43] But as with Barcelona and Athens, there is no enumeration of this provision as one of the material obligations to be administered by UNEP.[44] Article 13(3) does go beyond the general obligation by referring the business of technology transfer to "the competent international and regional organizations, in the provision . . . of technical and other assistance."[45] This is, however, but an insignificant improvement, as it still avoids the task of specifying a complicated decision-making apparatus necessary for such a regime to be effective.

Finally, the 1986 Noumea Convention[46] seems to create the most non-committal method of solution referral of all these regional regimes. As expected, the signatories "undertake to co-operate . . . in the provision to other Parties of technical and other assistance" with regard to pollution control and environmental management technologies, but again the methods for arranging material solution are referred to "competent global, regional and sub-regional organizations."[47] The vagueness of this referral is underscored by the fact that this Convention, unlike its counterparts for the Mediterranean and the Caribbean, does not assign its institutional arrangements to UNEP, but instead enables a specific convention organization created for this purpose to be responsible for carrying out enforcement of the Convention.[48] But the mechanisms for technology transfer are not among those tasks enumerated for this special organization to carry out.

The regional seas conventions have thus far appeared to fall into more

---

41. Athens Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources, May 17, 1980, 19 I.L.M. 869.

42. Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, Mar. 24, 1983, 22 I.L.M. 227.

43. *Id.* art 13(3).

44. *Id.* art. 15.

45. *Id.* art. 13(3).

46. Noumea Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, Nov. 25, 1986, 26 I.L.M. 38.

47. *Id.* art. 18.

48. *Id.* arts. 2, 21.

or less the same dilemma regarding technology transfer as UNCLOS. It is conceivable that the developing countries do not consider the threat posed by the pollution targeted by these accords to warrant bargaining for a more comprehensive set of obligations on the part of developed nations to render concrete technical assistance as the price of participation. Alternatively, the developed nations may not view marine pollution with as much trepidation as developing nations for them to be willing to part with critical technologies to procure an anti-pollution regime. If threat perceptions change on at least one side, there will not be a set of material rules readily available; such rules would have to be laboriously negotiated. The temporal and political costs of this would be heavy indeed if a regional pollution problem grew in public perception to be one of imminent disaster requiring speedy and diligent resolution. This danger would naturally be magnified when the scene shifts to a global environmental problem.[49]

II. THE MONTREAL PROTOCOL: MODEL FOR SUCCESS

Ozone layer depletion emerged as a political issue in the United States in the mid-1970s and in Western Europe a few years afterward.[50] The realization that ozone-layer protection was properly a matter for the global agenda rather than purely a domestic environmental concern took

---

49. For this reason, perhaps, participants in the new global environmental regimes of the past few years have sought to draft technology transfer schemes which avoid the experience of the regional seas conventions from 1976 to 1986. These have largely fallen into the same trap of non-specificity as the regional marine conventions. For example, the 1989 Basel Convention attempting to deal with transboundary waste problems contains technology transfer provisions, but in the final analysis they are as non-specific and immaterial as UNCLOS. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *opened for signature* Mar. 22, 1989, U.N. Doc. UNEP/IG.8-0/3, *reprinted in* 28 I.L.M. 661 [hereinafter Basel Convention]. On the other hand, the 1988 Sofia Protocol's provision on technology transfer was written to procure East-bloc participation in the face of Western technology export restrictions. Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes, Oct. 31, 1988, 28 I.L.M. 212 [hereinafter Sofia Protocol]; JOHN G. LAMMERS, SECOND REPORT OF THE COMMITTEE, INTERNATIONAL COMMITTEE ON LEGAL ASPECTS OF LONG-DISTANCE AIR POLLUTION, REPORT OF THE 63RD CONFERENCE HELD AT WARSAW, Aug. 21-27, 1988, at 218-81. It created an Executive Committee to make specific rules, but the progress has been slow. *See* Executive Body for the Convention on Long-Range Transboundary Air Pollution, 7th Sess., at 6-7, U.N. Doc. ECE/EB.AIR/20 (1989).

50. *See* SAND, *supra* note 1.

longer to emerge. But by 1985, an international conference convened in Vienna to discuss ozone protection on a global level. The agreement which emerged laid the foundation for an international regime to control ozone-depleting pollutants, particularly chlorofluorocarbons ("CFCs").[51] Unfortunately, the Vienna Convention proved to be just as ready to employ the "strategy of referral" with regard to technology transfer as previous international regimes. States that are parties to the Convention are called upon to "co-operate, consistent with their national laws . . . and practices, and taking into account in particular the needs of the developing countries, in promoting . . . the development and transfer of technology and knowledge."[52] Predictably, this vague encouragement of technology transfer is to be carried out "directly or through competent international bodies."[53] As unpromising as this provision appeared, the Convention did have the advantage of having as a crucial element the establishment of a working group to develop a protocol for control of CFCs,[54] halons,[55] and other ozone-depleting chemicals.[56] This future protocol was to continue to formulate a more concrete regime for technology transfer.[57]

The document which was produced, the Montreal Protocol,[58] proved not to be the last word on an ozone-layer regime, nor did it attempt to be. It is extraordinary in being among the first global accords which deal with a problem not fully understood by science at the time of adoption. The Protocol dealt with the question of technology transfer only obliquely[59]

---

51. Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, U.N. Doc. UNEP/IG.53/5, *reprinted in* 26 I.L.M. 1527 [hereinafter Vienna Convention]. *See generally* Patricia Szell, *The Vienna Convention for the Protection of the Ozone Layer*, 36 INT'L DIG. HEALTH LEGIS. 839 (1985); Peter H. Sand, *Protecting the Ozone Layer: The Vienna Convention is Adopted*, 27 ENVIRONMENT 5 (1985).

52. Vienna Convention, *supra* note 51, art. 4(2).

53. *Id.*

54. CFCs are the chemical substances regarded as most responsible for ozone depletion. They are used primarily as coolants in refrigeration systems and as propellants in aerosols. The chlorine in CFCs is what destroys the ozone. Dale S. Bryk, *The Montreal Protocol and Recent Developments to Protect the Ozone Layer*, 15 HARV. ENVTL. L. REV. 275, 277 (1991).

55. Halons contain bromine, which is ten times as destructive to ozone as CFCs chlorine, but are used far less in industrial societies. *Id.*

56. These include methyl chloroform and carbon tetrachloride, widely used in manufacturing. *Id.*

57. Vienna Convention, *supra* note 51, art. 6.

58. Protocol on Substances that Deplete the Ozone Layer, Sept. 16, 1987, 26 I.L.M. 1541.

59. *Id.* at 1556 (Encouraging continued research and development and alternative technologies, and agreeing to meet periodically to review requests for technological

but nevertheless was to have a huge future impact on the legal status of technology transfer because of the nature of the control regime it created. A concrete schedule for reduction for CFCs and halons was established. Production and consumption of those substances was frozen at 1986 levels, with production and use of CFCs targeted for a reduction of fifty percent by 1998.[60]

Recent scientific surveys of ozone depletion over Antarctica shattered any sense of complacency the Montreal Protocol may have created. The problem was far worse than previously thought, and the original control schedule of the Protocol was understood to be completely inadequate. This was confirmed at the first Meeting of the Parties at Helsinki in 1989, where it was agreed that a 100 percent reduction of CFCs by 2000 was necessary, as well as a complete phase out of halons and other ozone-depleting chemicals.[61] This decision was to have an enormous impact on the role technology transfer would play in the emerging ozone regime. The process of revision of the control measures which were decided on at Helsinki gave the developing nations an enormous amount of leverage to exact technological assistance from developed nations. It became apparent to First World delegates that, for the Protocol to be a success, accession by developing countries would be imperative.

This sense of urgency arose from the fact that the developing world is the arena in which most ozone-depleting chemical use will occur in the future. Currently, developing countries account for only sixteen percent of global CFC consumption, with China and India accounting for less than five percent of the world total.[62] But the desires for modernization (with a particular desire for increased production of appliances and consumer products that employ CFCs) coupled with huge populations and even a moderate future economic growth rate mean that Third World CFC use will grow dramatically. One study concluded that the manufacture and production of CFCs in India alone would increase tenfold if India was not brought into the control regime, and that India's and

---

information).

60. *Id.* at 1552. It should also be noted that developing nations were given the option of exceeding targets by a margin of 10 to 15 percent and in any case could extend their period for compliance to 2008. *Id.* at 1555.

61. *Report of the Parties to the Montreal Protocol on the Work of Their First Meeting*, U.N. Doc. UNEP/OzL.Pro.1/5 (1989); Helsinki Declaration on the Protection of the Ozone Layer, May 2, 1989, 28 I.L.M. 1335 [hereinafter Helsinki Declaration].

62. Cynthia P. Shea, *Protecting the Ozone Layer*, *in* STATE OF THE WORLD 1989 77, 81 (Linda Starke ed., 1989).

China's combined global share of CFC use will be in excess of thirty-three percent by 2008.[63] This would offset the complete phaseout of CFCs in the United States. In the long run, all of the efforts of the industrialized nations to arrest ozone depletion would be nullified. Thus, the chief goal of the delegates of the developed world was to find a way to induce India and China to sign the Montreal Protocol. A rigorous and specific set of technology transfer provisions was one of the clear and obvious means to accomplish this goal.

In addition to this substantive decision, which ensured that technology transfer would be a critical part of the Second Meeting of the Parties and the future of the regime, the Helsinki Meeting also procedurally decided to establish the framework of a Financial Mechanism to facilitate and enable a self-sustaining technology regime.[64]

The Second Meeting of the Parties to the Montreal Protocol ("the London Meeting"), held from the twenty-seventh to the twenty-ninth of June 1990, was the occasion for a unique breakthrough in the law of international environmental technology transfer. For the first time in global environmental law, and for the first time in international law generally since the early NPT experience, a global regime created a concrete, material system of technology transfer to developing nations and the means with which to accomplish it. This regime was created in order to secure universal participation in the regime.[65]

This result did not come easily. Delegates of the developed nations came to the London Meeting with a condescending attitude; they believed that representatives of the developing world would not have a necessary grasp of the technical issues involved in order to enter into a substantive debate.[66] Thus, the delegates of the developed nations thought that it was necessary to emerge from the meeting with an agreement for a 100 percent phaseout of CFCs regardless of any resolution on technical assistance.[67] But the developing world's delegates came with a conviction that although CFC abatement was necessary, the burden of any

---

63. FRIENDS OF THE EARTH, BRIEFING SHEET: DEVELOPING COUNTRIES AND THE MONTREAL PROTOCOL (1990).

64. Helsinki Declaration, *supra* note 61.

65. The one exception to this history of accords bereft of specificity seems to be parts of the Final Act of the Lome II Convention, Annex XVIII (Joint Declaration on Sea Fishing), Annex XIX (Joint Declaration on Shipping) & art. 93(6), Oct. 31, 1979, 19 I.L.M. 327, 341.

66. Bryk, *supra* note 54, at 283-84.

67. *Id.* at 285-86, 295-96.

compromise should not fall on the shoulders of countries that did not create the problem.[68]

The control regime that India and China agreed to join was the one that the industrialized world generally wanted. CFC production and use would be totally eliminated by the year 2000, with a fifty percent reduction in baseline 1986 levels by 1995 and an eighty-five percent reduction by 1997.[69] The ten to fifteen percent leeway in the requirements will continue to extend to developing nations as it did in the Montreal Protocol, with a ten-year extension in implementation.[70] Specific reduction schedules were also adopted for halons, carbon tetrachloride, other fully halogenated CFCs, and methyl chloroform, with the first three of these completely phased out by 2000, and methyl chloroform phased out by 2005.[71]

In exchange for accession to these adjustments, remarkable in their specificity and obligatory nature, it was necessary that the technology transfer regime, the price of the adjustments, be equally concrete. Much preparatory work had been done prior to the London Meeting to set the parameters and figures for the proposed technology transfer regime.[72] The Parties established a multilateral trust fund to assist the Third World in meeting the requirements of the adjusted Montreal Protocol by facilitating the transfer of technology.[73] The fund was set up to run on an interim basis for three years, with a funding level of $160,000,000 that could be raised by up to $80,000,000 over the three years, at which point the Funding Mechanism would become fully established.[74] Of the

---

68. The most blunt and effective delegate of the developing nations was undoubtedly Maneka Ghandi, India's Environment and Forests Minister (and also the widow of Sanjay Ghandi), who expressed her frustration at nations who used CFCs extensively in their own industrialization and now want to change the rules of the game. "If you think I can go . . . and say 'Chuck out your fridge because someone in America destroyed the ozone layer,' then I'm not going to be able to do that." Larry B. Stammer, *Chinese Delegates to Seek Beijing's Approval for Pact to Protect Ozone*, L.A. TIMES, June 29, 1990, at A8.

69. *Report of the Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer*, Annex I, at 22-23, U.N. Doc. UNEP/OzL.Pro.2/3 (1990) [hereinafter London Report].

70. *Id.* Annex II, at 31.

71. *Id.* Annex I, at 23; Annex II, at 27-29.

72. *See Open-ended Working Group of the Parties to the Montreal Protocol, Report of the Legal Drafting Group*, at 16-17, U.N. Doc. UNEP/OzL.Pro.WG.II(1)/5 (1989) (exploring the technology transfer question generally); *Report of the Second Session of the Third Meeting*, U.N. Doc. UNEP/OzL.Pro.WG.III(2)/2 (1990) (final proposal for submission).

73. London Report, *supra* note 69, Decision II/8, para. 40, at 12.

74. *Id.* Annex IV, Appendix IV, at 50-51.

money in the interim fund, $80,000,000 was appropriated for equal distribution to India and China, with the remainder for other developing nations.[75]

In addition to providing the means for technology transfer by way of the funding mechanism, specific rules for the transfer process itself were also established. An Executive Committee, with its secretariat in Montreal, was created to administer and monitor the actual content of the transfers, not just to supervise the disbursement of funds. Seven seats on the Executive Committee are held by developing nations (Brazil, Egypt, Ghana, Jordan, Malaysia, Mexico, and Venezuela) and seven seats are held by developed nations (Canada, Germany, Finland, Japan, the Netherlands, Russia, and the United States), with the only permanent seat being held by the United States.[76] Finland is the chair, and Mexico is the vice-chair. Decisions require a two-thirds majority, provided that that majority constitutes a majority of both groups of seven.[77] Most important, the actual technology will be transferred, not just substitute products to be subsidized by the Executive Board with the finished products sent to the Third World.[78] Much progress has been made in promulgating normative, detailed rules regarding the classification of "incremental" technology costs eligible for fund support and the mechanics of determining donor contribution obligations.[79]

As a result of these amendments, India and China agreed to join the Protocol, and the fund actually began its operations on a three-year trial basis with $160,000,000.[80] But despite the fine detail that the London Meeting seemed to impart to the mechanics of technology transfer with regard to the ozone layer, there remains much at issue, both within the accords at London and still more outside considerations. Questions remain below the surface of the Protocol. Despite the success of the

---

75. *Id.*

76. *Id.* Decision II/8, para. 40, at 12.

77. *Id.* Annex IV, Appendix II, at 45.

78. *Id.* Annex II, para. U, at 36.

79. For example, various options were discussed, including the traditional U.N. scale of assessment and a formula based on the donor's 1986 consumption of CFCs. Also, it was determined "that a donor's bilateral assistance could be counted up to 20 per cent, as part of its contributions to the multilateral fund." Rene Bowser, *A History of the Montreal Protocol's Ozone Fund*, Int'l Envtl. Rep. (BNA), Nov. 20, 1991, at 637. In the area of environmental technology transfer, this bilateral aid has become rather substantial on the part of some nations, particularly Japan. *See, e.g.*, Ai Nakajima, *Aid Offered to Clean Environment Abroad*, NIKKEI WKLY. (Tokyo), July 27, 1991, at 3 (detailing recent MITI initiatives in this area).

80. UNEP NEWS RELEASE 1991/7, Mar. 15, 1991.

Protocol in avoiding the pitfalls of the earlier regimes, there remain areas of potential future disagreement which render the Protocol less than perfect.

First, evidence exists that both India and China are still not completely satisfied with the specificity of the technology transfers that are to take place. "[T]he industrialized nations are required to try hard to accomplish technology transfers; however, the developing nations are required to meet the deadlines [of the Protocol] whether or not the technology transfer actually occurs,"[81] the Indian delegate stated.

Second, the document does not establish a hierarchy of preferred methods of technology transfer or give the Executive Committee rules to guide its decisions. An illustration of this problem arose at the London Meeting as the result of an exchange between the Indian delegate and representatives from DuPont, the world's largest manufacturer of CFCs. The Indian delegate suggested that India acquire the technological capability to manufacture the full range of substitute gases. DuPont pointed out that by commercial standards India was too small a market for DuPont to build a CFC-alternative gases factory. Furthermore, DuPont requires that it maintain strict control of its own technology. It would be more cost-efficient to develop the technology which applies the alternative gases, such as redesigned refrigerators and air conditioners. If India has to pay more to use the CFC-replacement gases, clearly that will be a claim on the new fund, but should the Executive Committee also be obligated to finance the transfer of those technologies which employ the substitute gases? If India still wishes to proceed with the substitute gases factory, to what extent should (or must) the Committee exercise economic judgment over a Third World desired development pattern?[82]

Third, beyond the question of the choices the Committee must make, there still looms the question of who will actually make the choices and appropriate the funds. Although the Multilateral Fund is to be officially administered by the Executive Committee, the Committee is to "discharge its tasks . . . and responsibilities with the co-operation and assistance of the [World Bank]."[83] The debate record indicates that there was a desire on the part of the developing countries to keep the administrative

---

81. Maneka Ghandi, Indian Environmental Minister, Press Conference Statement (June 28, 1990), *in* Bryk, *supra* note 54, at 288.

82. *The Ozone Layer: The Lady Turned*, ECONOMIST, July 7, 1990, at 43, 44 [hereinafter *Ozone Layer*].

83. London Report, *supra* note 69, Decision II/8, para. 40, at 13.

control over the fund limited solely to the Committee. But one of the industrialized nations' delegates objected to the specter of a new U.N. bureaucracy, and proposed the Committee employing UNEP to perform clearinghouse functions and to help in political promotion, the World Bank to finance the investments, and the United Nations Development Programme ("UNDP") to advise on feasibility and to provide other technical assistance. Another First World delegate saw the World Bank as playing the role of "consultant."[84] Clearly, the developed nations see the World Bank as having a part in the allocation of the fund; the Bank's history of conditionality and project scrutiny makes it an appealing element in the Funding Mechanism. For the same reason, though, the developing countries are suspicious of its role.[85]

The presence of the World Bank as a player in the Montreal Protocol is the result of compromise, but the lack of specificity and centralization in the administration of the fund–three different entities lead the effort, coordinated by a diverse Executive Committee–is cause for worry. It may become yet another example of a "strategy of referral" that leaves the question to further meetings of the parties.[86] That this structural model is seen as the preferred schema of the future is underscored by the similar tripartite administration of the much larger Global Environmental Facility ("GEF"), which is still in the conceptual stage but will have environmental technology transfer as a major instrumentality in carrying out its envisaged mission.

Despite these potential future stumbling blocks, it must be emphasized that the Montreal Protocol is worthy of being termed a success and represents a model for avoiding the grosser errors of past environmental technology transfer regimes. The gravest danger to an otherwise extraordinary regime of technology transfer is the threat of later division over fundamental norms, as happened to the NPT technical assistance regime. At present, the regime shows promise because North and South, despite quibbling over small details, both share the fundamental assumptions that made it possible. The understanding by both sides that CFCs must be entirely curtailed and that developing nations are entitled to material assistance to "leapfrog" the stage of industrialization requiring CFCs could prove to be a fragile one. Further scientific observations and

---

84. *Id.* para. 28, at 8-9.

85. *Ozone Layer*, *supra* note 82, at 43, 44.

86. The Third Meeting of the Parties was held June 19-21, 1991. London Report, *supra* note 69, Decision II/20, at 18.

announcements could bring changes in the perception of the ozone-depletion threat on the part of either developed or developing nations, a change which could bring the regime into a state of paralysis.

CONCLUSION

As shown, the use of technology transfer by industrialized nations as an inducement to bring Third World nations into a stronger global or regional environmental regime is susceptible to two different dilemmas. First, the regime can be too dependent on the shared set of assumptions which gave rise to it in the first place. When the assumptions change, and states find themselves in disagreement over fundamental norms, the technology transfer regime dissolves into paralysis. This was the experience with the technology transfer provisions enacted to encourage participation in the Nuclear Non-Proliferation regime. Second, the regime can be established at a time when there is not sufficient agreement over fundamental norms. The legal instruments then enacted are invariably barren of materiality and specific resolution of legal duties. As evinced by the technology transfer provisions of the Law of the Sea Convention, the legal agreements are either illusory obligations or delegations of decisionmaking powers to non-legal entities.

In contrast, the London Adjustments to the Montreal Protocol show that technology transfer regimes can be successful. Such regimes play an important role in the construction of an international environmental legal order. Any attempt to make the global environment a more harmonious place, however, can be successful only to the extent that the North and South achieve a shared understanding of fundamental norms.