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International Technology Transfer: Constructing and Financing an Environmental Program

I. INTRODUCTION

The world is entering a new era, defined in terms of interdependent people rather than independent states. The actions of one state may impact the populations of other states in ways previously unimagined.¹ Nowhere is this more evident than with global environmental issues.

No one nation bears sole responsibility for the environmental degradation confronting the world, nor can any one nation rectify the harm. However, a solution to the Earth's environmental woes may reside in the industrialized nations' ability to disseminate appropriate technologies to the developing countries.² Fortunately, scientific and technological developments are increasingly being dispersed throughout the international community.³ Developing countries' increasing access to industrial markets⁴ suggests that environmentally safe tech-

1. The English poet and cleric, John Donne, observed nearly four centuries ago, "No man is an island entire of itself; every man is a piece of the continent, a part of the main; if a clod be washed away by the sea, Europe is the less, as well as if a promontory were" JOHN DONNE, DEVOTIONS No. XVII (1623).

2. The Montreal Protocol, although limited to chlorofluorocarbon ("CFC") substitute technologies, recognizes the need for financial and technological assistance to developing nations. The Protocol calls upon developed nations "to take every step . . . to ensure . . . that the best available, environmentally safe substitutes and related technologies are expeditiously transferred to developing countries and that [such] transfers occur under fair and most favorable conditions." INT'L ENVTL. TECHNOLOGY TRANSFER ADVISORY BD., E.P.A., FINAL REPORT TO THE ADMINISTRATOR OF THE U.S. ENVTL. PROTECTION AGENCY 19 (1990) [hereinafter IETTAB]. See also Dale S. Bryk, *The Montreal Protocol and Recent Developments to Protect the Ozone Layer*, HARV. ENVTL. L. REV. 275, 296 (1991) (discussing an exchange between Maneka Gandhi of India and William Reilly, head of the United States Environmental Protection Agency); Roberta Dohse, Comment, *Global Air Pollution and the Greenhouse Effect: Can International Legal Structures Meet the Challenge?*, 13 HOUS. J. INT'L L. 179, 181 (1990); Pamela Wexler, *Protecting the Global Atmosphere: Beyond the Montreal Protocol*, 14 MD. J. INT'L L. & TRADE 1, 16 (1990); *Progress Must Be Made in Next Decade to Resolve Key Problems of 21st Century*, 13 Int'l Envtl. Rep. (BNA) No. 3, at 159-60 (Mar. 14, 1990). But see Chee Yoke Ling, *Technology Transfer Will Not Solve Environmental Crisis*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 32.

3. IETTAB, *supra* note 2, at 1.

4. George Heaton et al., *Transforming Technology: An Agenda for Environmentally Sustainable Growth in the 21st Century*, in WORLD RESOURCES INST. 9 (1991).

nologies can successfully be transferred.⁵

This Comment proposes the creation of an international environmental technology transfer program to disseminate environmentally sound technologies to developing countries.⁶ First, this Comment will discuss background issues relevant to establishing such an environmental program. It will analyze the forces that cause environmental degradation and suggest how technology transfer can be an effective solution. Second, this Comment will examine existing international environmental programs as predecessors to the proposed program. Next, this Comment will describe and analyze the proposed program. Finally, this Comment concludes that concerted international effort is required if improvements are to be made.

II. BACKGROUND

A. *The Problem Defined*

The environmental issues confronting the world are very complex and implicate the full intricacies of international relationships.⁷ For example, scientists estimate that developing nations will be the largest contributors to ozone depletion within the next fifty to one hundred years if their present rates of economic expansion continue.⁸ Massive, though thoughtfully allocated, infusions of funds for transferring technology represent one part of an international response.⁹

5. *But see* ALAN B. DURNING, POVERTY AND THE ENVIRONMENT: REVERSING THE DOWNWARD SPIRAL 35 (1989); Edward Kufour, *G77: The Trade & Finance Issues UNCED Must Address*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 33.

6. Technology transfer represents an important element of these larger environmental issues. *See infra* part II.C.2.

7. At the London Conference to the Montreal Protocol, William K. Reilly, chief of the United States Environmental Protection Agency ("EPA"), commenting on environmental diplomatic efforts said: "These are enormously complicated issues They have nuances that involve economic advantage for countries We're dealing here with very complex problems that involve the interrelations between economic development and environmental protection." Larry B. Stammer, *Ozone Accord Spurs Drive on Global Heating*, L.A. TIMES, July 2, 1990, at A1.

8. It is expected that developing nations will overtake the developed nations in CFC pollution. *Technology Will Prevent Developing Nations from Becoming Major Polluters, Report Says*, 13 Int'l Env'tl. Rep. (BNA) No. 6, at 232-33 (June 13, 1990). For example, China has a population of over one billion, but fewer than one in ten households has a refrigerator. *Id.* The capacity for increased CFC production obviously exists; China had constructed twelve CFC production plants as of 1989. *Id.* *See also* Larry B. Stammer, *Saving the Earth: Who Sacrifices?*, L.A. TIMES, Mar. 13, 1989, at A1.

9. World leaders and delegates to the United Nations Conference on Environment and Development, commonly known as the Earth Summit, in its final session, promulgated a number of principles. Principle 9 provides that "States should cooperate to strengthen endoge-

One complicating factor in mobilizing international cooperation is that nations do not begin at the same stage of economic and social development.¹⁰ Each nation is understandably preoccupied with its own conflicting agenda of national issues.¹¹ The late Shrimati Indira Gandhi, former Prime Minister of India, said of the conflict between Third World development and environmental issues:

We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of large numbers of people. Are not poverty and need the greatest polluters? How can we speak to those who live in villages and in slums about keeping the oceans, the rivers and the air clean when their own lives are contaminated at the source? The environment cannot be improved in conditions of poverty. Nor can poverty be eradicated without the use of science and technology.¹²

The economic and social issues that vie with environmental issues in developing nations are also politically volatile,¹³ resulting in political and social instability in many developing nations.¹⁴

nous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies." *Text of Earth Summit's Rio Declaration*, REUTER LIBRARY REPORT, June 14, 1992, available in LEXIS, Nexis Library, LBYRPT File.

See *Environment: China-India Role in Montreal Pact Heats Up CFC Debate*, INTER PRESS SERVICE, June 28, 1991, available in LEXIS, Nexis Library, INPRES File (explaining that outside financing is necessary to enable countries such as Brazil, India and China to switch their current production of CFCs to environmentally safer CFC-substitutes).

10. The General United Nations Assembly agreed, by consensus, that international economic relations are currently inequitable. The Assembly resolved to increase cooperation and more rational economic North-South economic relations. U.N. Doc. A/S-18/14 (1990).

11. Developing countries are concerned with, among other issues, building their own economies, alleviating poverty and providing essential medical care to their citizenry. John Ntambirweki, *The Developing Countries in the Evolution of an International Environmental Law*, 14 HASTINGS INT'L & COMP. L. REV. 905, 924 (1991); Chakravarthi Raghavan, *South Says Equity the Touchstone of Climate Proposals*, THIRD WORLD RESURGENCE, Sept. 1991, at 5; Martin Khor Kok Peng, *UNCED Must Reform North Economy, South Development & World Economic Order*, THIRD WORLD RESURGENCE, Oct.-Nov., 1991, at 10.

12. Maneka Gandhi, *Address by the Prime Minister of India, in EVOLVING ENVIRONMENTAL PERCEPTIONS: FROM STOCKHOLM TO NAIROBI* 97 (Mostafa Tolba ed., 1988).

13. Maneka Gandhi, India's former minister for environment and forests, told the United Nations General Assembly on December 18, 1989 that "CFC issues are irrelevant to most developing country politicians." *Transfer of Environmental Technology to Compete with Third World Problems*, 13 Int'l Env'tl. Rep. (BNA) No. 3, at 112-13 (Mar. 14, 1990) (statement of Jonathan Moore, United States Ambassador to the United Nations, paraphrasing Maneka Gandhi's address). Gandhi further intimated that, in India, reforestation is important, but it competes with roads and electricity. *Id.* See also IETTAB, *supra* note 2, at 11.

14. Such nations include Peru, Argentina, Nicaragua and El Salvador, among other Latin American countries.

Moreover, many developing nations blame the industrialized countries for most global ecological dilemmas.¹⁵ While recognizing the risk to all the Earth's inhabitants, they insist that the industrialized nations should bear the primary burden of addressing those problems.¹⁶

Developing countries are unwilling and unable to make unilateral sacrifices.¹⁷ They steadfastly refuse to forego economic development in order to repair an environment they believe was damaged by the industrialized nations.¹⁸ Furthermore, developing countries ardently contend that the industrialized nations have benefitted from building their economies upon environmentally destructive technologies, such as fossil fuels.¹⁹ By selecting a more ecologically prudent course of development, economically developing countries would not have access to those same inexpensive, albeit ecologically injurious, technologies.²⁰

15. IETTAB, *supra* note 2, at 11. See also Maneka Gandhi, *West Responsible For Third World's Environmental Crises*, THIRD WORLD RESURGENCE, Aug. 1991, at 2; Chakravarthi Raghavan, *Third World Takes Unified Position on Environment for Earth Summit*, THIRD WORLD RESURGENCE, Aug. 1991, at 12; Raghavan, *supra* note 11, at 5.

16. E.g., IETTAB, *supra* note 2, at 11; Christine M. Johnson, *India Wins Hard-Fought Pledge From Ozone Conference*, UPI, June 30, 1990, available in LEXIS, Nexis Library, UPI File.

17. The developing countries will not undertake hardships alone and forego development. Rather, the industrialized countries must assume their own responsibilities in altering current consumption patterns. Edward Kufour, *G77: We Won't Negotiate Away Our Sovereignty*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 17. See Chakravarthi Raghavan, *UNCED: South On Financing and Technology*, THIRD WORLD RESURGENCE, June 1991, at 18 (explaining that the industrial nations, as holders of the majority of wealth and technology, must accept greater responsibility in altering international and national environmental degradation).

18. One commentator notes that "Third World countries could make a plausible argument for the right to be compensated to the extent that they incur opportunity costs by foregoing development options to preserve environmental resources" Günther Handl, *Environmental Protection and Development in Third World Countries: Common Destiny—Common Responsibility*, 20 N.Y.U. J. INT'L L. & POL. 603, 608 (1988). See also Bryk, *supra* note 2, at 291; Wexler, *supra* note 2, at 14; Raghavan, *supra* note 11, at 5 (explaining that the industrialized countries' environmentally taxing production and consumption patterns of development are harming the environment); Raghavan, *supra* note 15, at 12 (stating that industrialized countries must bear the majority of responsibility for the destruction of the global environment); Jonathan C. Randal, *Third World Seeks Aid Before Joining Ozone Pact*, WASH. POST, Mar. 7, 1989, at A16 (explaining that many Third World leaders want financial and technological aid as well as access to substitutes for ozone-eroding chemicals).

19. E.g., Susan E. Holley, *Global Warming: Construction and Enforcement of an International Accord*, 10 STAN. ENVTL. L.J. 44, 58 (1991). See also Handl, *supra* note 18, at 608.

20. Holley, *supra* note 19, at 58. Developing nations have an additional incentive not to follow in the industrialized nations' developmental footsteps in the form of long-term economic benefits. *Id.* at 59. Since most developing nations have not already devoted significant capital to fossil fuel-based energy systems, they are uniquely positioned to reap economic and

In addition, leaders of industrialized countries advocate different lifestyles for industrialized and developing countries, further emphasizing the current inequity in their relationship.²¹ Simply put, the poor do emulate the rich. The citizens of poor nations desire the same material advantages and the attendant lifestyles that citizens of industrialized countries enjoy.²² Employing the environmental technologies necessary to halt environmental degradation is expensive,²³ and the developing countries do not possess the financial wherewithal to pay for them.²⁴

Industrialized nations, on the other hand, face their own set of conflicting interests when confronting global environmental issues.²⁵ They too must contend with politically sensitive domestic issues.²⁶ For this reason, many political leaders from industrialized nations focus predominately on proposals that maintain their ecologically expensive lifestyles.²⁷ However, they simultaneously extol the virtues

other development benefits in the international marketplace. *Id.* By constructing non-fossil fuel-based economies, the developing countries will avoid these outmoded and environmentally expensive energy systems. *Id.* However, fossil fuel must be made economically unattractive to all potential users before this advantage can materialize. *Id.*

21. Chakravarthi Raghavan, *New N-S Relations Needed for UNCED to Succeed*, THIRD WORLD RESURGENCE, June 1991, at 21.

22. *Id.*

23. Generally, developing nations will have to do without the benefit of cheap, albeit "dirty," technologies from which industrialized nations have already derived economic benefit. Raghavan, *supra* note 17, at 18. They will have to either invest in research and development to develop the technologies themselves or buy it outright from industrialized nations that already own them. *Id.* After they obtain the technologies, their industries must still be refitted for them, and developing nations are unwilling to incur this expense. *Id.*

24. The poor nations of the world have gotten poorer. DURNING, *supra* note 5, at 15. The gulf between the rich industrialized nations and the poor developing nations has grown since 1950. *Id.* This has prompted one author to conclude that "the term developing nation has become a travesty: many countries are no longer so much developing as disintegrating." *Id.* It is difficult to envision Zambia, Bolivia, Nigeria, and other Third World countries paying for advanced environmentally-safe technologies owned by transnational corporations. Such countries are unable to satisfy the rudimentary dietary, housing and medical requirements of their citizens. In many developing nations, the basics of sustenance simply do not exist, so political decision-making on how to disperse these resources is moot.

25. See IETTAB, *supra* note 2, at 11-12; Allan H. Meltzer, *Applying Market Principles to the Cause of Saving the Environment*, L.A. TIMES, July 19, 1992, at D2; *U.S. Cannot Afford Hasty Commitment to Cut CO₂ Emissions*, *Official Says*, 13 Int'l Env'tl. Rep. (BNA) No. 3, at 112 (Mar. 14, 1990).

26. Peng, *supra* note 11, at 11.

27. Chakravarthi Raghavan, *Social, Development and Political Issues Must Take Centre Stage*, Say NGOs, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 18. See also Raghavan, *supra* note 15, at 12 (stating that "[t]he developed countries bore the main responsibility for the degradation of the global environment"). Thirty-eight non-governmental organizations from twenty-five nations met in July 1991 to analyze the UNCED proceedings. *Id.* The final

and necessity of protecting the environment.²⁸

Creating an international financing mechanism is necessary to address the Earth's environmental dilemmas.²⁹ Therefore, the industrialized nations should make appropriate technologies available to the developing nations by providing not only access, but also the funds necessary to purchase these technologies.³⁰ Implementing such a financing mechanism will demonstrate the industrialized nations' commitment to addressing global environmental problems.³¹

Success in this venture requires full participation by both the in-

statement of the meeting echoed the concerns and demands of Third World countries, declaring that "[t]he root cause of the environment and development crisis are [sic] the unsustainable model of development and lifestyles/consumption patterns which dominate the world today." Raghavan, *supra*, at 18. See also Gandhi, *supra* note 15, at 2 (explaining that the former extended period of Western colonialism and, more recently, the imposition of Western economic and growth philosophies and technologies have caused the Third World's environmental crises); Raghavan, *supra* note 11, at 5 (explaining that wasteful consumption patterns in the West exert unbearable pressures on the environment).

28. The industrialized nations' proposals at the United Nations Conference on Environment and Development ("UNCED") Preparatory Committees have been criticized by many. Chakravarthi Raghavan, *Rich Must Change Lifestyle, Says Third World Expert*, THIRD WORLD RESURGENCE, June 1991, at 16. Gamani Corea, a leading economist specializing in the Third World, stated that the proposals to date carry a thinly veiled message. *Id.* Some proposals expect Third World countries to pursue an environmentally-safe course of development, yet one that is significantly different from the West's environmentally-expensive lifestyle. *Id.*

29. The World Commission on Environment and Development concluded that "... the proposals regarding revenue from the use of international commons and natural resources now warrant and should receive serious consideration by governments and the United Nations General Assembly." WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE (1987) [hereinafter OUR COMMON FUTURE].

The establishment of funding mechanisms for the implementation of international environmental obligations has been deemed a necessity by the international community. Dr. Mustafa Tolba has noted:

What is at issue is an investment in the future. Nations of the World may not have a common past, but they certainly have a common future in the betterment or well being of which they have a stake. A new order of priorities based on global partnership is needed. It must be an order in which everyone, from all parts of the globe, pay[s] their shares in a common pool of resources to combat environmental dangers.

MUSTAFA TOLBA, TRANSFER OF TECHNOLOGY AND THE FINANCING OF GLOBAL ENVIRONMENTAL PROBLEMS: THE ROLE OF USERS FEES 22-24, U.N. Doc. UNEP/OzL.Fin.1/2 (1990).

30. See *supra* note 2 and accompanying text.

31. Some question the industrialized nations' commitment and political will to adopt measures to effectuate these changes. See Peng, *supra* note 11, at 10. One representative from the South has stated: "We often hear Northern delegations [to the UNCED proceedings] and even NGOs saying that it is true that the production and consumption patterns have to change, but that it is politically impossible to actually do it because no politician who advocates lifestyle change or diverting from economic growth would survive election." *Id.* at 11.

dustrialized and developing nations.³² However, many developing nations are suspicious of the industrialized nations' motives.³³ They believe that the sudden attention given to environmental issues stems chiefly from a desire to frustrate economic development in non-industrial countries.³⁴ Similar allegations have been leveled against proposals to provide intellectual property rights in newly created or discovered life forms.³⁵ Many suspect the industrialized nations of attempting to create a global monopoly over plant and animal forms at the expense of the developing nations.³⁶

Thus, one of the most important roles the industrialized nations can play is providing the developing countries with appropriate and safe technologies along with the money to acquire them. This assistance must be provided without attaching cumbersome conditions and other unnecessary restrictions on the funds.³⁷ Creating such an environmental tool demonstrates the industrialized nations' awareness and sensitivity to the non-industrialized nations' special technology

32. See *Natural Endowments: Financing Resource Conservation for Development*, in WORLD RESOURCES INST. 1, 21-22 (1989) (explaining the justification and rationale for international cooperation and noting that the adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer was an important step in recognizing international interdependence) [hereinafter *Natural Endowments*].

33. Those same suspicions resulted in similar allegations at other international negotiations. For example, attempts to halt the worldwide proliferation of nuclear weapons by the United States and the Soviet Union drew criticism from less developed nations. Wexler, *supra* note 2, at 16 n.55. See generally *Developments in the Law: International Environmental Law*, 104 HARV. L. REV. 1484 (1991) [hereinafter *Developments in the Law*]; Dohse, *supra* note 2, at 204; Vandana Shiva, *Real Versus Pseudo Greens in the New Politics*, THIRD WORLD RESURGENCE, July 1991, at 2; Ross Laver, *Who Pays the Bill?*, MACLEAN'S, Sept. 17, 1990, at 76.

34. See *Developments in the Law*, *supra* note 33, at 1569.

35. The term "life form" is used generically to refer to the unique genetic material that comprises each of the many different plant and animal species inhabiting the Earth. While issues surrounding intellectual property rights are beyond the scope of this Comment, they provide a good illustration of the suspicion that exists in many developing countries. See Roberto Verzola, *Patents on Life Forms: A Threat to Third World*, THIRD WORLD RESURGENCE, June 1991, at 12; Vandana Shiva, *Private Property in Life Forms*, THIRD WORLD RESURGENCE, Sept. 1991, at 34.

36. Third World experts note that calls for intellectual property protection do not come from beneficiary industrialized nations, but rather from transnational corporations seeking monopolies over food production and other economic advantage. Shiva, *supra* note 35, at 34. For example, Ralph Hardy, of Dupont, has stated: "The competitive position of U.S. industry in biotechnology would be improved if there were international conventions that would provide greater uniformity with respect to patentability and property rights." *Id.*

37. At the Earth Summit in Brazil in June 1992, Maurice Strong, Secretary General for the UNCED, described the developing countries' critical need of funds for technical assistance to expedite integration of environmentally sensitive policies into their development goals as "the principal challenge we face." Maurice F. Strong, Remarks at the Opening of the First

needs.³⁸

B. *The Causes of Environmental Degradation*

1. The Poverty-Environment Connection

Many of the environmental difficulties facing the world today have their roots in the affluence and development models of the industrialized world.³⁹ However, poverty also plays an equally important role.⁴⁰ Ecological disaster is fueled by the poor's need to satisfy their basic, short-term sustenance needs and by misguided government policies.⁴¹ In an effort to eke out a living, the poor torch rainforests and plow under mountain slopes.⁴² These lands are not capable of sustaining "slash and burn" agricultural activity.⁴³ Consequently, the poor are rewarded with decreased crop yields for their efforts.⁴⁴

The crux of the poverty problem lies with the poor's inaccessibility to natural resources.⁴⁵ Farmers who own their land, even if poor, tend to meticulously care for it; they adopt a long-term view, prefer-

Meeting of the Preparatory Committee for the 1992 United Nations Conference on Environment and Development (1992).

Strong emphasized the importance of "additionality"—new and additional funds above and beyond those already committed, stating that:

Additionality is no mere political slogan. It reflects the stark reality that however much developing countries may recognize that investment in sustainable development makes sense in terms of their long term economic and environmental interests, they simply cannot afford the additional funds this will often require in the short term. It is in everyone's interest that they have access to these additional funds and to the most environmentally sound technologies. The sooner this is done, the less it will cost, environmentally and economically.

Id. at 11.

38. Montreal Protocol on Substances that Deplete the Ozone Layer, Final Act, Sept. 16, 1987, 26 I.L.M. 1541 (1987) [hereinafter Montreal Protocol]. See *id.* art. V (calling for Parties to the Protocol "to facilitate access to environmentally safe alternative substances and technology for Parties that are developing countries")

39. Raghavan, *supra* note 11, at 5 (explaining that the environmentally taxing production and consumption patterns of developed countries are harming the environment); Raghavan, *supra* note 15, at 12 (stating that developed countries must bear the majority of responsibility for the destruction of the global environment); See generally Gandhi, *supra* note 15, at 2.

40. DURNING, *supra* note 5, at 40; Chakravarthi Raghavan, *Poverty and Ecology: 'A Dialogue of the Deaf'*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 36.

41. DURNING, *supra* note 5, at 31, 40. See also Edward Kufour, *G77: UNCED Must Tackle International Roots of Poverty*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 38.

42. DURNING, *supra* note 5, at 40.

43. *Id.*

44. *Id.*

45. *Id.* at 41.

ring to forego short-term benefits for anticipated future gains.⁴⁶ On the other hand, ecological deterioration occurs when the poor are driven from familiar and fertile lands, and are forced to populate less fertile land, or are denied viable alternatives by laws or government policies.⁴⁷

Any successful global effort to resolve the earth's environmental problems must account for poverty's impact.⁴⁸ The poverty cycle exists concomitantly with the cycle of environmental degradation in many developing countries. Any easing of the forces propelling many of the world's inhabitants toward poverty therefore also eases those causing ecological devastation. Establishing an international mechanism to assist countries in adopting environmentally friendly technologies is one part of the solution.⁴⁹

C. A Solution: Technology Transfer

1. Technology Transfer Defined

Traditional notions of technology transfer are inadequate.⁵⁰ Basic relationships between countries must be reexamined.⁵¹ Technology transfer represents more than the simple exchange of equipment or technical information. Rather, it involves recognizing the need for cooperation between the various countries of the world.⁵² This need

46. *Id.* Control over their own natural resources is important. Access without control is a sure prescription for ecological disaster. *Id.* at 41-42. People, fearful they may soon lose access to the few assets they have, are not motivated to care for the forests, soils or water supplies they use. *Id.* at 42. For example, in Thailand's forests, squatters possessing at least some long-term property rights tend their plots more carefully than do those without any property rights. *Id.* Those squatters given outright ownership of their plots were the most conscientious land-users of all. *Id.*

47. *Id.* at 42.

48. Many of the issues presented by Third World poverty are beyond the scope of this Comment. The purpose in raising the issue of poverty's role in environmental degradation is to illustrate that a successful technology transfer program must address this problem.

49. For example, technologies that can improve crop yields, halt erosion and destruction of topsoils, and provide clean drinking water to poor villages and farming communities, among others, can occupy this role. Heaton et al., *supra* note 4, at 7-9 (surveying the relief of environmental degradation pressure brought about by potential and actual technological advances).

50. "Traditional notions" of technology transfer limit the term to the transfer of equipment and hardware only. Today the term includes more of the human-based aspects of technology transfer. Telephone interview with Jamie Koehler, Staff Member, United States Environmental Protection Agency (Oct. 22, 1991). The current terminology is "technical cooperation." It is believed that this phrase more fully captures the flavor of what is meant to be included in international environmental technology transfer. *Id.*

51. IETTAB, *supra* note 2, at 11.

52. Evidence exists that both developed and developing nations understand the depth of this interdependence. Udi Helman, *Environment and the National Interest: An Analytical Sur-*

must be acknowledged so that the mutually beneficial results of this joint enterprise may be realized.⁵³

Technology transfer covers many diverse activities, including many non-commercial activities.⁵⁴ Specifically, it includes the transfer of technical research, knowledge, training, studies and processes—the information and human components of technology transfer—as well as equipment and hardware.⁵⁵ Thousands of private entities currently engage in technology transfer transactions.⁵⁶ Their activities range in complexity from the provision of family planning techniques to the installation of complex equipment and machinery.⁵⁷ Most industrialized nations have been transferring technology to other nations for many years.⁵⁸

2. The Importance of Technology Transfer and the Role It Should Play

As poverty's influence on environmental degradation illustrates,⁵⁹ technology transfer alone will not arrest environmental degradation.⁶⁰ However, the effective dissemination of appropriate technology to developing countries represents a crucial component in the effort to stop degradation, and it is one that industrialized nations are capable of providing.⁶¹ The level of technology need not be very advanced. In fact, low-grade technology will likely be the most bene-

vey of the Literature, 13 WASH. Q. 193 (1990); James Gustave Speth, *Coming to Terms: Toward a North-South Compact for the Environment*, 32 ENV'T 16 (1990).

Upon concluding the London Conference where amendments to the Montreal Protocol were adopted, Chris Patten, Great Britain's environmental secretary, stated: "We have established here the model for the way in which we're going to have to carry out future environmental diplomacy . . . [to] save this small and fragile planet." Stammer, *supra* note 7, at A1. The executive director of the United Nations Environment Program, Mostafa K. Tolba, was equally ebullient about the Conference agreement, stating that developed and developing nations are "starting a new era of not only cooperation but, really, partnership . . ." *Id.*

The fact that the Montreal Protocol was drafted and signed by such a large number of developed and developing nations alike, in a relatively short period of time, indicates the potential for future international cooperation. See generally Montreal Protocol, *supra* note 38.

53. See Stammer, *supra* note 7, at A1.

54. IETTAB, *supra* note 2, at 1.

55. *Id.* See generally WORLD BANK, THE WORLD DEVELOPMENT REPORT: THE CHALLENGE OF DEVELOPMENT (1991) [hereinafter CHALLENGE OF DEVELOPMENT].

56. IETTAB, *supra* note 2, at 1.

57. *Id.* CHALLENGE OF DEVELOPMENT, *supra* note 55, at 88-89.

58. IETTAB, *supra* note 2, at 1.

59. See *supra* part II.B.1.

60. Ling, *supra* note 2, at 30; Martin Khor Kok Peng, *Aid is Not the Solution to the South's Ecology Problems*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 27.

61. IETTAB, *supra* note 2, at 3-4.

ficial type of technology that industrialized nations can provide.⁶² Appropriate low-grade technology can produce a dramatic impact at the local level,⁶³ profoundly affecting impoverished people by providing tangible improvements to their daily lives.⁶⁴

An effective technology transfer program can also carry important corollary benefits. For instance, simple improvements often represent uplifting and empowering experiences for people resigned to an existence of desperate poverty.⁶⁵ These improvements provide people with tangible evidence that they can control forces previously believed to be beyond their reach.⁶⁶ Moreover, a solitary, simple accomplishment is often needed to galvanize support in impoverished regions to address larger and more complex problems.⁶⁷

3. An Illustration of Technology's Impact at the Local Level

An example of a low-grade technology success story is found in Dhandhuka, a village on the plains of Gujarat, India.⁶⁸ Desertification due to overgrazing and excessive use of fuelwood caused social strife and hardship on the people of the area.⁶⁹ Frequent dry spells compounded the area's problem of diminishing natural resources.⁷⁰

Migrating laborers told villagers about plastic-lined irrigation ditches they observed elsewhere.⁷¹ Village leaders, believing the same principle could be applied to retain water in a local reservoir, organized and lined the reservoir with plastic.⁷² After the next rainy season ended, the village of Dhandhuka was well-supplied with water throughout the ensuing dry season.⁷³ Access to something as simple as sheets of plastic enabled these villagers to successfully confront one of their chief sustenance problems: the lack of a reliable water source.

62. ALAN B. DURNING, ACTION AT THE GRASSROOTS: FIGHTING POVERTY AND ENVIRONMENTAL DECLINE 20 (1989).

63. The term "local" is used generically to mean villages or other small agriculture-based communities as well as regional areas, such as the United States-Mexico border area where *maquiladoras* flourish today.

64. *Id.* See also *infra* part II.C.3.

65. DURNING, *supra* note 62, at 20.

66. *Id.*

67. *Id.*

68. *Id.* at 25.

69. *Id.*

70. *Id.*

71. *Id.*

72. *Id.*

73. *Id.* at 25-26.

III. ANALYSIS

A. *The Precedents for an International Environmental Financial Program*

The establishment of international financial arrangements to compensate for environmental injuries is not unprecedented. In 1971, the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage was created.⁷⁴ The Fund ensured adequate compensation for those individuals harmed by oil pollution and indemnified oil transport shipowners for their liability.⁷⁵ Additionally, the Montreal Protocol's Multilateral Trust Fund and the World Bank's Global Environmental Facility ("GEF") are two existing international financial models that provide a starting point in considering new financial programs to facilitate technology transfer.

1. The Montreal Protocol's Multilateral Trust Fund

a. *The Protocol's Background*

On January 1, 1989, the Montreal Protocol on Substances that Deplete the Ozone Layer entered into force,⁷⁶ binding its parties in an effort to halt destruction of the atmospheric ozone layer.⁷⁷ The Protocol is unprecedented because it represents a concerted international effort to prevent the harm to the environment before it occurs.⁷⁸

The Protocol's foundation was established by the 1985 Vienna Convention for the Protection of the Ozone Layer.⁷⁹ The Convention marks the first time the international community acknowledged the frailty of the ozone layer⁸⁰ and acted in concert to preserve the environment.⁸¹

74. U.N. Doc. UNEP/GC/INF/Z/Ser.A/43, reprinted in ALEXANDRE CHARLES KISS, *SELECTED MULTILATERAL TREATIES IN THE FIELD OF THE ENVIRONMENT* 255 (1983). Article 4 more fully describes the Fund.

75. *See id.* at 256-57.

76. *See* Montreal Protocol, *supra* note 38.

77. Bryk, *supra* note 2, at 275-76; Heaton et al., *supra* note 4, at 29-30.

78. Heaton et al., *supra* note 4, at 29-30; Wexler, *supra* note 2, at 1; Dohse, *supra* note 2, at 203.

79. Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, UNEP Doc. IG.53/5.

80. Dohse, *supra* note 2, at 200.

81. *Id.* Today, use of mass-produced, human-made chemicals called CFCs and halons is widespread. Bryk, *supra* note 2, at 277. CFCs are primarily used as coolants in refrigeration systems, while halons typically are used in fire extinguishers. *Id.* The scientific community believes that one of the byproducts of CFCs, chlorine, poses the principal threat to atmos-

b. *The London Conference Amendments*

In 1990, the Protocol was amended⁸² to allow payments to developing nations in order to assist them in meeting their obligations under the Protocol.⁸³ A \$240 million multilateral trust fund⁸⁴ was established to encourage financial and technical cooperation between industrialized and developing nations.⁸⁵ Activities covered by the fund include transfers of CFC substitute technologies,⁸⁶ reimbursement for the costs of converting factories employing old CFC-based technologies to newer and safer CFC substitutes⁸⁷ and other expenses associated with information distribution, country-specific studies, workshops and training sessions.⁸⁸

The Fund's management structure is democratic and is representative of the international parties involved in its operation.⁸⁹ The Executive Committee oversees the implementation of operating policies and administrative procedures.⁹⁰ Although a Secretariat was established to administer the fund, the World Bank will probably perform the actual distribution of funds.⁹¹ Most important, the Executive Committee, comprised of seven representatives from the industrialized nations and seven from the developing nations, will establish and oversee those policies and administrative criteria to facilitate disbursement of Trust Fund monies.⁹²

No compulsory method of ensuring adequate funding for the

pheric ozone. *Id.* at 277; Wexler, *supra* note 2, at 3-4; Jessica Tuchman Mathews, *Redefining Security*, FOREIGN AFF., Spring 1989, at 168-71.

82. Report of the Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, U.N. Environment Programme, U.N. Doc. UNEP/OzL.Pro/2/3, Annex II (1990) [hereinafter London Amendments].

83. Bryk, *supra* note 2, at 286. See Montreal Protocol, *supra* note 38, art. 5.

84. Of the \$240 million aggregate, \$80 million was allotted to India and China in exchange for their promise to join the Protocol while the remaining \$160 million is to be disbursed to the other developing countries. Bryk, *supra* note 2, at 286.

85. The Fund's existence directly contradicts the official United States policy against any multilateral fund or creation of any new body to administer such a fund. Telephone interview with Susan Drake, Staff Member, United States Environmental Protection Agency (Oct. 28, 1991). The United States wishes to avoid creating any precedent for future multilateral funds. *Id.*; Stammer, *supra* note 7, at A1.

86. Bryk, *supra* note 2, at 286.

87. *Developments in the Law*, *supra* note 33, at 1568.

88. Bryk, *supra* note 2, at 286-87.

89. See *infra* note 104.

90. Bryk, *supra* note 2, at 287.

91. *Id.*

92. *Id.* The United States will occupy a permanent seat on the Committee, while the other Committee members will be elected by Protocol parties. *Id.*

multilateral trust fund exists.⁹³ An interim funding mechanism is established as a stop-gap measure.⁹⁴ Therefore, at the end of the initial three year period, the Executive Committee must create a more fully developed funding mechanism.⁹⁵

2. The World Bank's Global Environmental Facility

a. *The Global Environmental Facility's Background*

The World Bank recently established the GEF,⁹⁶ which was first proposed by France and Germany⁹⁷ as a general fund to aid developing countries in correcting global environmental problems.⁹⁸ The GEF's priorities are preventing the deterioration of the ozone layer, pollution of international waters, and maintaining biological diversity.⁹⁹

The GEF is overseen by a high-ranking World Bank administrator, with assistance from the United Nations Environmental Programme ("UNEP") and the United Nations Development Programme ("UNDP").¹⁰⁰ While the World Bank administers the GEF's Trust Fund, UNEP and UNDP share responsibilities as strategic planners.¹⁰¹ This distinction in duties is noteworthy because UNEP and UNDP must ensure that only environmentally appropriate programs are undertaken.¹⁰² Thus, UNEP and UNDP are

93. See Holley, *supra* note 19, at 76.

94. *Id.*

95. Bryk, *supra* note 2, at 287.

96. The GEF is commonly known as the "Green Fund."

97. World Bank, *Funding for the Global Environment: The Global Environmental Facility* (Nov. 1990) (internal discussion paper) [hereinafter *Funding for the Global Environment*].

98. The GEF currently contains approximately \$1 billion in its Global Environment Trust for use in specific priority areas. *Success of Global Environment Facility Said to Depend on World Bank Reforms*, 14 Int'l Env'tl. Rep. (BNA) No. 7, at 195-96 (Apr. 8, 1991) [hereinafter *Success to Depend on World Bank Reforms*]. See also text accompanying *infra* note 105. The United States, in its 1993 foreign aid bill, will also contribute \$30 million to the GEF this fiscal year. *United States: Foreign Aid Law Shaves Military Assistance*, INTER PRESS SERVICE, Oct. 8, 1992, available in LEXIS, Nexis Library, INPRES File.

99. *Third World Suspicious of 'Green Fund' in World Bank*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 28 [hereinafter *Third World Suspicious*].

100. *Id.* The high-ranking administrator is Ian Johnson, a World Bank vice-president for policy and research. *Id.*

101. *Funding for the Global Environment, supra* note 97, at 11.

102. A study of the GEF was conducted by David Reed of the World Wildlife Fund's Multilateral Development Bank Program. See *Success to Depend on World Bank Reforms, supra* note 98, at 95. Referring to that study, Reed stated that "[i]n the coming decade, the GEF will be one of the major multilateral financing tools . . . [and] [o]ur challenge is to make sure we have in place the right environmental policy, the right institutional arrangements, and the right economics from the beginning." *Id.*

charged with reconciling environmental and development issues inherent in World Bank programs.¹⁰³

All countries may participate in the GEF, but participating countries must first contribute \$4 million to the Trust Fund.¹⁰⁴ As with the Montreal Protocol's Trust Fund, additional funding is not compulsory after a country joins.¹⁰⁵

b. Criticism of the GEF

The GEF is criticized for its management structure as well as the manner in which it was created.¹⁰⁶ No framework exists to ensure joint and democratic management of the GEF. Its organization is based on "the understanding that no new bureaucracy will be created and that only modest modifications will be made to the three implementing agencies."¹⁰⁷ Also, the GEF chairman, another World Bank official, resolves any conflicts that arise.¹⁰⁸

Many developing countries express concern, believing that the GEF reflects the World Bank's ecologically ruinous policies and top-down management practices.¹⁰⁹ Algeria's UNCED Preparatory Committee delegate, Ahmed Djogial, stated that "there is no democratic functioning in the GEF whatsoever."¹¹⁰ Likewise, Mexico's ambassador, Juan Antonio, noted that "the GEF operates under World Bank rules, not the principle of 'one-state, one-vote.'"¹¹¹ In

103. Ntambirweki, *supra* note 11, at 915.

104. *Third World Suspicious*, *supra* note 99, at 28.

105. Peng, *supra* note 60, at 27.

106. *See Third World Suspicious*, *supra* note 99, at 28.

107. Funding for the Global Environment, *supra* note 97, at 11.

108. *Id.*

109. *Id.* Some Third World representatives charge that the World Bank's loan-making policies evidence a lack of a coherent environmental vision in financing development in developing countries. *Id.* They claim that the development projects given life by World Bank loans not only exacerbate the environmental degradation caused in significant part by poverty in those countries, they altogether too frequently are themselves a prime cause. Sandra Postel & Christopher Flavin, *Reshaping the Global Economy*, in *STATE OF THE WORLD 170, 174* (Linda Stark ed., 1991). *See also* Charles Abugre, *Why the World Bank Cannot Be Relied Upon to Solve Poverty*, *THIRD WORLD RESURGENCE*, Oct.-Nov. 1991, at 24 (explaining that the World Bank is environmentally incompetent, dishonest, serves the interests of transnational corporations, and is not democratic); Vandana Shiva, *World Bank Cannot Protect the Environment*, *THIRD WORLD RESURGENCE*, Oct.-Nov. 1991, at 22 (surveying the World Bank's dismal environmental and development project records); *UN Blasts IMF-WB Policies in Africa*, *THIRD WORLD RESURGENCE*, Aug. 1991, at 14 (criticizing the World Bank's "structural adjustment" economic policies).

110. Funding for the Global Environment, *supra* note 97, at 11.

111. *Id.*

addition, many point out that the GEF focuses on preventing future environmental harm but fails to address existing environmental damage.¹¹² While many developing countries are critical of the GEF, they point to the Montreal Protocol's Trust Fund as an example of a proper international funding arrangement toward which the international community should strive.¹¹³

B. Problems with Current International Environmental Programs

1. Developed Countries Must Reduce Their Own Harmful Impact on the Environment

One of the most important lessons for industrialized nations to learn is that they must eliminate, or at least substantially reduce, their own environmentally damaging activities.¹¹⁴ Developing countries are unlikely to eschew the luxuries and advantages they now enjoy that are created by environmentally harmful activities.¹¹⁵ Indeed, industrialized countries often take for granted the many modern conveniences which are widely perceived as signs of significant economic and social progress by developing nations.¹¹⁶

2. The Creation of New International Institutions Must be Avoided

A second lesson gleaned from the Protocol's Trust Fund and the GEF is that new international institutions must be avoided.¹¹⁷ They are neither politically feasible, nor essential.¹¹⁸ It is the United States' official policy to resist attempts to create an environmental institution that operates on an international scale.¹¹⁹ Consequently, in order to

112. *Success of Global Environment Facility Depends on World Bank Reforms. Report Says*, 14 Int'l Env'tl. Rep. (BNA) No. 7, at 195 (Apr. 10, 1991). The same criticism has been leveled at the Montreal Protocol's multilateral Trust Fund. David Reed of the Washington D.C.-based World Wildlife Fund's Multilateral Development Bank Program noted the World Bank's "Green Fund" shortcoming in saying that "[i]t doesn't repair the environmental damage already done by industrialized societies." *Id.*

113. *Id.*

114. Heaton et al., *supra* note 4, at 30; *Developments in the Law*, *supra* note 33, at 1549-50. See Peng, *supra* note 11, at 11; Ghandi, *supra* note 15, at 2; Raghavan, *supra* note 21, at 21.

115. See *supra* notes 11-26 and accompanying text.

116. Widespread use of CFCs in refrigerators and air conditioners in the United States has made our lives more convenient and comfortable. Consider that China with its population of over one billion has fewer than one refrigerator per family. See *supra* note 12 and accompanying text.

117. *Natural Endowments*, *supra* note 32, at 23.

118. See *supra* note 85.

119. See *id.*

secure the United States' participation in an international technology transfer program, it is imperative not to create additional international institutions.¹²⁰ In fact, a consensus has arisen among most nations that existing programs and institutions operate at the scale necessary to effectuate an international environmental program.¹²¹

The creation of new international entities of sufficient size and scope to enact the proposed technology transfer program can only exist by detracting from present international institutions.¹²² Given this political reality, existing institutions and programs should be utilized.

IV. PROPOSAL: AN INTERNATIONAL ENVIRONMENTAL PROGRAM

A successful international program for technology transfer must address two key issues. First, large amounts of money must be generated to compensate the owners of the environmentally-friendly technologies. Second, those countries that need technology must be identified and the technologies disseminated to them. The identification and dissemination processes should be coordinated at the local, national, and international levels.

A. Revenue-Generating Models

Traditional command and control regulation and economic incentives currently allow industrialized nations to reduce their own detrimental ecological impact.¹²³ Nevertheless, in nations such as the United States market forces represent the most powerful shaping forces influencing business and consumer decision-making today.¹²⁴ A comprehensive environmental program should therefore employ elements of both approaches.¹²⁵

120. Because other developed countries, including Great Britain, Germany and Japan have a similar distaste for such institutions, it is extremely unlikely that any new or additional international organizations, in whose name funds could be raised, will be agreed to by the majority of industrialized nations. *Id.* Moreover, it is difficult to imagine how a new institution of the scale contemplated here could exist without detracting from existing national and international institutions. *Id.*

121. *Natural Endowments*, *supra* note 32, at 23-24.

122. *Id.* at 23. The United Nations agencies and programs and the World Bank are obvious examples of institutions adequately meeting their objectives. *Id.* at 24.

123. Heaton et al., *supra* note 4, at 30-31.

124. *Id.* at 31.

125. *Id.* at 25 (explaining that "neither approach is a panacea or universally applicable"). See also Betsy Carpenter, *A Marketplace for Pollution Rights*, U.S. NEWS & WORLD REP.,

However, only certain types of economic or market-based controls can be fashioned to generate revenues. The two most likely candidates are a carbon tax¹²⁶ and a system of tradeable permits.¹²⁷ Properly implementing these controls will serve three important goals: (1) environmental harm will be reduced;¹²⁸ (2) each industrialized nation can combat its most pressing environmental problems individually and efficiently;¹²⁹ and (3) revenue for technology transfer programs can be raised to decrease worldwide environmental decline.¹³⁰

1. A Carbon Tax

A significant amount of literature exists concerning the feasibility and desirability of employing economic controls.¹³¹ A global tax on fossil fuels is one of the most viable solution.¹³² The amount of tax will depend on the energy source's carbon content.¹³³ For example, coal, the energy source with the highest carbon content, will be taxed

Nov. 12, 1990, at 79 (explaining that even the most enthusiastic supporters of the tradeable permit system acknowledge that market-based regimes alone cannot solve environmental problems).

126. See Postel & Flavin, *supra* note 109, at 183; CONGRESSIONAL BUDGET OFFICE, U.S. CONGRESS, CARBON CHARGES AS A RESPONSE TO GLOBAL WARMING: THE EFFECTS OF TAXING FOSSIL FUELS (1990) [hereinafter CARBON CHARGES AS A RESPONSE]; Joshua M. Epstein & Raj Gupta, *Controlling the Greenhouse Effect: Five Global Regimes Compared*, BROOKINGS INST. 15 (1990); William Tucker, *Shaking the Invisible Hand*, FORBES, Apr. 1, 1991, at 64; Paul Wallich & Elizabeth Corcoran, *The Analytical Economist*, SCI. AM., Sept. 1990, at 171.

127. The Bush Administration showed interest in employing international market mechanisms in coping with global environmental problems, such as climate change. Robert W. Hahn & Robert N. Stavins, *Incentive-Based Environmental Regulation: A New Era from an Old Idea?*, 18 ECOLOGY L.Q. 1, 3 (1991) (citing Michael Weisskopf, *Bush Pledges Research on Global Warming: Speech to U.N.-Sponsored Panel Endorses No Proposed Remedies*, WASH. POST, Feb. 6, 1990, at A1). See also Epstein & Gupta, *supra* note 126, at 18-32; Tucker, *supra* note 126, at 171; Carpenter, *supra* note 125, at 79; *Grime and Punishment*, NEW REPUBLIC, Feb. 20, 1989, at 7; Marjorie Sun, *Emissions Trading Goes Global*, SCI., Feb. 2, 1990, at 520 (discussing the difficulties of creating a global tradeable permit system); Fred L. Smith & Kathy H. Kushner, *Good Fences Make Good Neighborhoods*, NAT'L REV., Apr. 1, 1990, at 31.

128. CARBON CHARGES AS A RESPONSE, *supra* note 126, at 15; Postel & Flavin, *supra* note 109, at 181.

129. Heaton et al., *supra* note 4, at 25-26.

130. Postel & Flavin, *supra* note 109, at 181-85.

131. See generally LESTER R. BROWN ET AL., SAVING THE PLANET 141-49 (1991) (discussing various proposed "green taxes" that could be used to replace the current income and value-added-based tax scheme).

132. *Natural Endowments*, *supra* note 32, at 23.

133. Postel & Flavin, *supra* note 109, at 183.

more heavily than oil.¹³⁴ Likewise, natural gas, which contains the least amount of carbon, will be taxed at a rate less than oil and coal.¹³⁵

The tax will be collected at the point of extraction.¹³⁶ The increased costs will be reflected in the prices of all carbon products as they move through the stream of commerce.¹³⁷ Suppliers will pay the tax directly, but all consumers of products made with coal, oil, or natural gas will eventually pay in the form of higher retail prices.¹³⁸ These higher prices should encourage conservation, provide an impetus to switch to cheaper alternative energy sources, and foster development of new technologies.¹³⁹

Significant sums of money can be raised internationally to fight environmental crises under a carbon-based tax scheme.¹⁴⁰ Tax revenues in the United States alone would generate billions of dollars. The United States Congressional Budget Office has studied the effects of a national carbon tax and estimates that it would produce annual revenues of \$110 to \$120 billion.¹⁴¹ Factoring in revenues from other countries heavily dependent on fossil fuel-based energy, large sums of money could be generated to support an international program of technology transfer.¹⁴²

2. A System of Tradeable Permits

A system of tradeable permits, like the carbon tax, is based on

134. CARBON CHARGES AS A RESPONSE, *supra* note 126, at 20.

135. *Id.*

136. *Id.* at 17.

137. *Id.*

138. *Id.*

139. This tax system was instituted in the United Kingdom, where leaded gasoline was taxed at a higher rate than unleaded gasoline to encourage use of the latter. Postel & Flavin, *supra* note 109, at 182. Unleaded gasoline's share rose from four percent to thirty percent in just one year. *Id.*

140. See BROWN ET AL., *supra* note 131, at 149. Imposition of a carbon tax in addition to the existing value-added and income-based taxes is not feasible because the overall burden on individuals and the economy would be far too severe. However, some combination of the two theories of taxation is not only workable, but has the added benefit of encouraging environmentally desirable activities and dissuading those other, environmentally less desired activities. *Id.* at 148-49.

141. CARBON CHARGES AS A RESPONSE, *supra* note 126, at 21-22. An initial charge of \$10 per ton would raise approximately \$13 billion during the first year. *Id.* Charges incrementally increased by \$10 per ton each year would garner, in the year 2000, additional revenues of between \$110 to \$120 billion in 1988 dollars. *Id.* at 21-22.

142. BROWN ET AL., *supra* note 131, at 149. Several other countries have already instituted a carbon tax, including Finland, the Netherlands and Sweden in the past year. Tucker, *supra* note 126, at 64. The European Community is considering imposing a community-wide carbon tax. *Id.*; *EC Ready With Carbon Tax*, CHEMICAL WEEK, Sept. 4, 1991, at 14.

economic incentives.¹⁴³ The premise of the carbon tax is that a market participant will act to avoid expenses and generate revenues wherever possible.¹⁴⁴ Hence, the participant will move to avoid those activities that become too expensive. In this context, the carbon tax renders the inefficient consumption of fossil fuels expensive and fiscally impractical. The tradeable permit model achieves the same result, although somewhat differently.

Under the tradeable permit system, a limit is placed on the amount of allowable emissions.¹⁴⁵ Based on this cap, an initial allotment of permits is made,¹⁴⁶ and organizations maintaining their effluents within predetermined limits are free to sell the unneeded permits from their initial allocation.¹⁴⁷ Such a market for permits induces participants to increase revenues by selling additional, unneeded permits.¹⁴⁸ However, these "unneeded" permits can only be obtained by increasing efficiency, employing available cleaner technologies, or developing new substitute technologies.¹⁴⁹

Establishing such an arrangement will not automatically raise funds. In order to raise capital for an international funding mechanism, governments must devise a stratagem for capturing revenues from the transaction. Some propose that governments hold a one-time auction when the program is instituted.¹⁵⁰ An obvious problem with a one-time auction is that future revenues are not secured. How-

143. The EPA has recently moved closer to employing a national system of tradeable permits to control sulfur dioxide in the wake of amendments to the 1990 Clean Air Act. See David C. Walters, *The Skirmish Over Permits*, CHRISTIAN SCI. MONITOR, June 4, 1992, at 7. The Chicago Board of Trade has applied to the EPA for permission to operate a permanent futures market for the trading of twenty-five ton lots of effluent rights. *Id.*

144. Hahn & Stavins, *supra* note 127, at 7. "It is no coincidence that one is reminded of Adam Smith's characterization of individual market decisions operating in the collective interests of society, as if guided by an 'invisible hand.'" *Id.* at 7 n.26 (citing ADAM SMITH, *THE WEALTH OF NATIONS* (R. Campbell et al. eds., 1976) (1776)).

145. Sun, *supra* note 127, at 520. Establishing fair, baseline pollution limits is difficult. One possibility is to use GNP as a base; another is to base limits on population. *Id.* at 520-21. Each of these methods favors some nations over others. For example, developed nations, such as the United States, would fare better under a GNP-derived base, while developing countries like India and China would enjoy an advantage on a limit which uses population as the standard of measurement. *Id.*

146. Hahn & Stavins, *supra* note 127, at 8. Tradeable permits may be loosely equated with the "right" to pollute.

147. *Id.* In addition, firms which stay below permitted levels may use the excess permits to offset emissions in other parts of their facilities. *Id.* See also CARBON CHARGES AS A RESPONSE, *supra* note 126, at 17.

148. Hahn & Stavins, *supra* note 127, at 8.

149. *Id.*

150. Robert W. Hahn & Albert M. McGartland, *The Political Economy of Instrument*

ever, the approach chosen is technically immaterial to the technology transfer program's goal to facilitate developing nations' access to appropriate technologies. The salient point is that feasible means exist for generating revenue for such an international program.¹⁵¹

B. Structure and Organizational Considerations

A coherent international program to facilitate the transfer of technology is crucial to staving off further, and perhaps irreversible, environmental harm.¹⁵² Any proposal must account for the interrelated, yet distinct, causes of environmental degradation.¹⁵³ This Comment therefore proposes that creating distinct mechanisms tailored to address those differences best achieves the goal.¹⁵⁴

Each mechanism should be charged with responsibilities in accordance with the varying societal organizational lines each is intended to serve. The advantage of such an approach is that it draws upon local, regional, and international expertise. The activities financed by both mechanisms take the form of either preventive, curative, or adaptive measures to combat problems that ultimately impact

Choice: An Examination of the U.S. Role in Implementing the Montreal Protocol, 83 Nw. U. L. REV. 592, 604 (1989); Wallich & Corcoran, *supra* note 126, at 171.

151. Use of tradeable permits or a carbon tax also has an important corollary benefit in facilitating technology transfers. IETTAB, *supra* note 2, at 5. Proper use of these economic incentives can create an economic environment in which demand for environmentally sound technologies is cultivated. *Id.*

152. Dohse, *supra* note 2, at 205-07. The Executive Director of UNEP, Mostafa Tolba, stated the following at a 1989 conference on climate changes:

We must find the means . . . to facilitate increased technology transfer from North to South. Let us be quite clear. Unless developing nations are made privy to know-how and have easy access through subsidies, preferential loans or other means to acquire plant and equipment, we can forget about making any realistic preparations for an overheated world. If even only a handful of major industrializing nations press ahead with their fossil-fuel and CFC-based development plans with outmoded and outdated technologies, everything the wealthy nations do will be negated.

Speth, *supra* note 52, at 42. See also *Developments in the Law*, *supra* note 33, at 1549 (proposing the establishment of an international institution to act as a fund for monies collected from industrialized nations to provide technical and financial assistance to developing countries).

153. See *Natural Endowments*, *supra* note 32, at 11 (proposing that multiple International Environmental Facilities can better focus on unique local problems).

154. It may be useful to create additional smaller Funds, but they should come under the broader umbrella of the RCF and GCF. See *infra* parts IV.B.1-2. These additional Funds could focus efforts and resources on specialized problems within regions or countries. Note that some developing countries are calling for a more democratic program which allows them to participate more in decision-making. However, the United States and other industrialized countries advocate a revival of the Environment Coordination Board under the chairmanship of UNEP. See Chakravarthi Raghavan, *N-S Differences on Agencies to Control Post-Rio Programmes*, THIRD WORLD RESURGENCE, Oct.-Nov. 1991, at 20.

all people.¹⁵⁵ The first could be called the Regional Cooperative Fund ("RCF"). It provides for technology transfer on a local and national scale. The other could be called the Global Cooperative Fund ("GCF"), which addresses the technological needs of international environmental concerns.¹⁵⁶

1. The Regional Cooperative Fund

The transfer of technology plays an important role in resolving issues of environmental decline at the local level.¹⁵⁷ Many low-grade technologies can have a tremendous impact here.¹⁵⁸ Often, capital-intensive technologies are not needed, nor are they appropriate—particularly at the local or regional level.¹⁵⁹ The important responsibilities of the RCF would include identifying the locale's technological needs, and then obtaining and implementing the needed technology. Such an effort would entail operating a broad-based program. However, most local governments in developing countries are ill-equipped to handle this task,¹⁶⁰ since they lack the requisite institutional technical capabilities.¹⁶¹

It is evident in considering such an undertaking that national governments must play a role in the RCF. Small and unorganized community groups alone cannot disseminate and apply new and unfamiliar technologies.¹⁶² They require wide-scale programs to harness

155. CARBON CHARGES AS A RESPONSE, *supra* note 126, at 2. Preventive action will slow the effects of environmental decline, for example, in the context of global warming by slowing the accumulation of greenhouse gases. *Id.* Curative action attempts to repair or reverse the effects of environmental decline (Attempting to reflect solar energy from the sun back into the atmosphere has been suggested as a means of curing global warming). *Id.* at 3. Finally, adaptive action seeks to adjust to changed environmental conditions that have already occurred (Changing agricultural practices and building dikes in populated coastal areas are possible adaptive responses to global warming). *Id.*

156. At the Paris Summit meeting of the Group of Seven in July, 1989, leaders concluded that "[p]rotecting the environment calls for a determined and concerted international response." *Natural Endowments*, *supra* note 32, at 25.

157. *See supra* note 63.

158. For example, India's Center of Science for Villages and the Philippine Palawan Center for Appropriate Rural Technology have used primarily rudimentary technology in their projects. DURNING, *supra* note 62, at 20. Devendra Kumar of Science for Villages states: "Technology can be a tool of rural change, because by introducing one simple device, such as a pulley with ball bearings for hauling water out of a well, rural people begin to see possibilities that they did not see before." *Id.*

159. *See supra* notes 62-73 and accompanying text.

160. *Natural Endowments*, *supra* note 32, at 5.

161. *Id.*

162. DURNING, *supra* note 62, at 51.

the ideas and unfocused drive which are found throughout the outlying communities and villages.¹⁶³ Only national governments possess the resources and sovereign authority to implement these programs.¹⁶⁴ Fortunately, successful local-national alliances exist and serve as encouraging models worthy of emulation by the RCF.¹⁶⁵

At the national level, it is particularly important to recall for whom the assistance is intended and by whom it is provided.¹⁶⁶ Well-intended projects imposed by high-level bureaucrats that do not account for local needs, indigenous capabilities,¹⁶⁷ and concerns of local residents can encounter great local resistance.¹⁶⁸

Participation by local and national nongovernmental organizations ("NGOs") plays a decisive role in the success or failure of most natural resource management projects.¹⁶⁹ NGOs are the logical choice to bridge existing organizational gaps at the community and national levels, and engender the necessary working relationships. The proliferation of grassroots organizations¹⁷⁰ during the past decade exemplifies the development and environmental crises gripping many developing countries.¹⁷¹ These groups should be recog-

163. These programs include educational systems, agricultural research programs and researching and reporting bodies. *Id.*; *Natural Endowments*, *supra* note 32, at 5.

164. DURNING, *supra* note 62, at 51.

165. For example, in South Korea and China, the government organized, at the village level, to plant very large expanses of trees, implement national population policies, and increase agricultural production. *Id.* at 51-52. In Nicaragua, after the 1979 revolution, a national literacy campaign organized 90,000 volunteers who traveled throughout the rural areas. *Id.* at 52. Their efforts were impressive; in one year Nicaragua's literacy rate dramatically increased from fifty to eighty-seven percent. *Id.*

166. *Id.* at 32-33. By definition, "grassroots" action encompasses more local involvement than does national action. Consequently, it is more likely that individuals will be forgotten at the national level. *See id.* *See also infra* note 168.

167. Heaton et al., *supra* note 4, at 30; DURNING, *supra* note 62, at 32-33.

168. For example, in India in 1987, about 2000 low-caste laborers and farmers uprooted a hundred trees planted as part of a national government reforestation effort. DURNING, *supra* note 62, at 32. At first blush, this act seems irrational, considering that the area faced a severe fuelwood shortage. *Id.* But this ignores a more fundamental rationale. More indispensable than their need for fuelwood was the Indians' need to control their own fuelwood source. *Id.* The trees had been planted on land open to all Indians as a source of fuelwood. *Id.* A government plan to ban the gathering of fuelwood would deprive them of natural resources previously available to them. *Id.*

169. *Natural Endowments*, *supra* note 32, at 5; DURNING *supra* note 62, at 32.

170. Grassroots organizations include, for example, such groups as cooperatives, mothers, clubs, suburban groundwater committees, peasant farming unions, religious study groups, neighborhood action federations, collective aid societies and tribal nations. DURNING, *supra* note 62, at 6. It is estimated that these grassroots groups now total in the hundreds of millions worldwide. *Natural Endowments*, *supra* note 32, at 7.

171. *Natural Endowments*, *supra* note 32, at 4.

nized and aided in an effort to identify and match particular local and regional technical needs with the most appropriate indigenous capabilities.¹⁷²

However, providing money, without more, is not an efficacious approach to this endeavor.¹⁷³ Efforts must be undertaken to strengthen the internal capacities and technical capabilities of grassroots and national NGOs.¹⁷⁴ Institution-building techniques should also be encouraged to increase local and national NGOs' absorptive capacities for conservation projects.¹⁷⁵

Community and nationally-based NGOs are increasingly associated with development projects, and have demonstrated their value to the success of these projects.¹⁷⁶ Without democratic, local input during the planning stages, many projects have failed.¹⁷⁷ Successful alliances can be forged with local and national organizations that have been provided with the necessary education and training.¹⁷⁸

The RCF has great promise because it can potentially effect substantive long-term change. Groups organized at the community or village level have proven to be effective and innovative problem-solvers.¹⁷⁹ Additionally, a majority of the international environmental community actively supports community-based involvement in both

172. Heaton et al., *supra* note 4, at 30.

173. Experts warn that providing excess funds can "subvert local control, distort community priorities, promote capital-intensive technologies over effective local ones, and fuel jealousy between organizations that should be allies." DURNING, *supra* note 62, at 49.

174. *Natural Endowments*, *supra* note 32, at 4.

175. Absorptive capacity is defined as the extent to which an organization can successfully assimilate additional projects and programs. In addition to providing greater funding to non-governmental organizations ["NGOs"], absorptive capacity can be increased by including the following institution-building techniques:

education and training, including [development and] conservation project preparation and implementation; [development and] environmental information gathering, monitoring, analysis and research; [development and] conservation planning, including the development of national conservation strategies and land use zoning; [development and] conservation policy analysis, including analysis of incentives for sustainable resource use; and setting up or strengthening regional development authorities and community support systems.

Id.

176. *Id.* at 6.

177. *Id.*

178. *Id.*

179. A good example of local problem-solving comes from Mexico. The Zapotec Indians live in a remote area south of Oaxaca. DURNING, *supra* note 62, at 17. They derive a meager living from farming the arid soil on which they live. *Id.* Mexico's development programs, such as road-building and agricultural improvement programs, have bypassed the Zapotecs. *Id.* However, in 1983, a young man named Eucario Angeles returned to his native village from a university he attended. *Id.* He spoke with the people of the surrounding villages to learn of

development and environment projects.¹⁸⁰

2. The Global Cooperative Fund

Technical assistance is also needed at the international level, where the public is most familiar with the level of assistance. At this level, the GCF's mission could address issues of global magnitude, such as ozone depletion¹⁸¹ and climate change.¹⁸²

Technology transfer plays a particularly important role in the GCF. Whereas the RCF should focus most of its resources on disseminating lower-grade technologies, global environmental issues require more complicated scientific solutions. For example, the Montreal Protocol's Trust Fund provides for outright transfers of technology and compensation to developing countries that have adopted the more expensive and advanced environmental technologies needed to replace ozone-destroying CFC-based technologies.¹⁸³

The GCF's final form, like the RCF's, should be the subject of intense international negotiations. Developing countries will be required to adapt to potentially severe environmental changes for which they claim no culpability.¹⁸⁴ Inevitably, this will affect future development patterns for all nations. However, hardest hit may be devel-

their concerns and needs, and discovered that a lack of a reliable source of water topped their list of worries. *Id.*

Angeles organized work crews to dig two earthen ponds near the springs in the area. *Id.* A few minnows were tossed into the ponds out of happenstance. *Id.* Later, when the minnows multiplied, someone recalled a visitor's comment about fish farming. *Id.* He went to the nearest government office to inquire about receiving government assistance, but after a couple of years of empty promises and endless bureaucratic redtape, the villagers proceeded on their own. *Id.*

Beginning with 175 fingerlings obtained from a more cooperative government official, he and the villagers stocked their ponds. *Id.* When a United States anthropologist visited the area four years later, there were twenty ponds filled with fish and water supplies that were secure year round, protecting against crop losses. *Id.* at 17-18. As for the fish, the Zapotecs had successfully devised a sophisticated scheme of rotating work schedules to feed the fish, maintain the ponds and regulate water flow rates. *Id.* at 18.

180. *Id.* at 44.

181. See *supra* part III.A.1. (discussing the Montreal Protocol and its multilateral Trust Fund).

182. One of the goals of the Earth Summit in June 1992 was to reach an agreement on a global response to global warming.

183. See *supra* text accompanying notes 85-89.

184. For example, developing nations argue that global climate change and harmful human physiological effects caused by the deteriorating ozone layer result from activity in the developed nations. Ni Bainan, *Environment: China-India Role in Montreal Pact Heats Up CFC Debate*, INTER PRESS SERVICE, June 28, 1991, available in LEXIS, Nexis Library, IN-PRES File.

oping countries.¹⁸⁵

The GCF would truly be a joint venture. Existing international institutions could be modified to provide the organizational glue in this collaborative effort.¹⁸⁶ As previously stated, the creation of new institutions should be avoided.¹⁸⁷ Several existing organizations already operate on a scale capable of confronting global environmental issues.¹⁸⁸ However, changes that ensure a more democratic and transparent management structure are critical to gathering needed financial and technological support for developing countries.¹⁸⁹ Equal representation by developing and industrialized countries alike must be guaranteed.¹⁹⁰

Like most industrialized countries, the United States believes that multilateral development banks should occupy a central role in any global financial arrangement.¹⁹¹ But most developing countries take the position that the World Bank and its subsidiaries should not be given any role.¹⁹² In contrast, near consensus has formed on the role of the United Nations.¹⁹³ The United Nations family of agencies collectively represents all the nations of the world. Its specialized environmental agencies and programs should therefore be utilized. Sim-

185. *Natural Endowments*, *supra* note 32, at 23. *But see supra* notes 19-24 and accompanying text.

186. *Natural Endowment*, *supra* note 32, at 23-24.

187. *See supra* part III.B.2.

188. *Natural Endowments*, *supra* note 32, at 24.

189. Numerous developing country delegates on the UNCED Preparatory Committee have strongly criticized the World Bank's "Green Fund" for its management structure which relies heavily on the World Bank's own hierarchical structure. *Third World Suspicious*, *supra* note 99, at 28. India's delegate to the UNCED Preparatory Committee has criticized the GEF in stating:

The decision-making processes in the GEF would be inappropriate for the new programmes of cooperation we have in mind. We need more broad-based democratic procedures than those of the GEF. This refers not only to broad policy formulation but also to project selection questions. The GEF model is quite inappropriate for this purpose.

Raghavan, *supra* note 154, at 21.

190. *See supra* notes 109-11 and accompanying text.

191. *See Developments in the Law*, *supra* note 33, at 1549. *Cf.* Martin Khor Kok Peng, *Who Will Pay—And How Much—To Implement UNCED's Programmes*, *THIRD WORLD RESURGENCE*, Oct.-Nov. 1991, at 26 (explaining the North's position that the World Bank's existing funds should be channeled to environmentally sensitive programs).

192. Shiva, *supra* note 109, at 22; Abugre, *supra* note 109, at 24. *See generally* Claude Alvares, *The Narmada Disaster Commences*, *THIRD WORLD RESURGENCE*, Sept. 1991, at 2.

193. The Brundtland Commission reported that "the United Nations, as the only inter-governmental organization with universal membership, should clearly be the locus for new institutional initiatives of a global character." *OUR COMMON FUTURE*, *supra* note 29, at 316-17.

ilar to NGOs' role with national governments,¹⁹⁴ many agencies of the United Nations can serve as intermediaries between the world's industrialized and developing nations.¹⁹⁵ However, fundamental reform within the United Nations remains a basic necessity.¹⁹⁶ Many United Nations agencies and programs are politically ineffective and underfunded.¹⁹⁷ Effective United Nations involvement requires that its programs be both politically and financially strengthened.

A theme infused throughout the GCF is the monumental scope of the problems it would address. Its goals touch issues far beyond the control of any single nation. Therefore, international cooperation is critical to an effective technological response to international environmental issues entrusted to the GCF.¹⁹⁸

C. Implementation of the Environmental Program

Implementing an effective environmental program to respond to local, national and international technology requirements represents a daunting undertaking. Numerous countries are involved, all possessing various levels of innate capabilities and distinct technology needs. Geographic and other difficulties also exist.¹⁹⁹ Thus, to harmonize these potentially troublesome matters, an implementing facility should be established. The name for the facility could be the International Environmental Facility ("IEF").²⁰⁰

The IEF could serve as an intermediary among local, regional and national NGOs, government institutions, and technology aid recipients. Its general mission will be to assist in identifying and implementing appropriately structured environmental technology programs in conjunction with local, regional and national NGOs.²⁰¹ Also, the IEF will gather and maintain governmental and institutional support during the assessment, preparation, implementation

194. See *supra* notes 169-72 and accompanying text.

195. *Natural Endowments*, *supra* note 32, at 24.

196. *Id.*

197. *Id.* UNEP is the most notably underfunded major United Nations agency in the area of the environment. *Id.*

198. For a discussion of solutions to pressing environmental issues, see *supra* part II.C.

199. Language and cultural barriers between many developed and developing nations present two of the more significant differences that must be addressed.

200. *Natural Endowments*, *supra* note 32, at 11. It should be stressed that, as conceived here, the IEF is not a new agency. Instead, the IEF is envisioned as a conglomerate of existing United Nations programs and agencies, such as UNDP and UNEP, capable of communicating with NGOs and governmental agencies. *Id.*

201. *Id.* at 12.

and expansion of specific programs.²⁰² In this capacity, the IEF will provide the critical bridge between local and regional technical needs identified by NGOs and other groups, and the resources that exist at the national level.²⁰³

The IEF's greatest contribution would be its interaction with the RCF. Both would focus effort on local, regional and international issues that impact each nation's own technology demands and capabilities. Whereas the GCF would benefit most heavily from international NGO involvement, local and regional NGO involvement would greatly benefit the RCF. However, it is at the RCF level that institutional and cultural difficulties are most likely to arise. The United Nations, with its various environmental programs, agencies, and regional expertise, is well-equipped to overcome these difficulties through coordination with local and regional NGOs.

The international architects of this facility must first focus on a detailed organizational structure. Generally, the IEF should, along with the RCF and GCF, imitate the management structure of the Montreal Protocol's Multilateral Trust Fund.²⁰⁴ This requires an executive board to report to a governing body, equally represented by donor and recipient member-nations, local and national NGOs, and United Nations organizational representatives.²⁰⁵ In addition, the IEF should be required to maintain close and continuous contact with its field programs in host locations.²⁰⁶ Maintaining local offices would allow the IEF to fulfill its role as the link between those charged with assessing technology needs and those possessing the power to acquire and implement those technologies.

V. CONCLUSION

The underlying message of this Comment is that immediate and concerted action must be taken to arrest the current destruction of the environment and to ensure its protection in the future. But why is this important? Why should nations commit scarce resources, mone-

202. *Id.*

203. The quintessence of this basic necessity is captured in the following statement: "It is not difficult to see the absurdity of people thousands of miles away continually shaping new solutions to problems they have never experienced . . . for the purpose of assisting people whom they have never consulted." DURNING, *supra* note 62, at 48 (citing STEPHEN HEL-LINGER ET AL., AID FOR JUST DEVELOPMENT (1988)).

204. *See supra* notes 90-95 and accompanying text.

205. *Natural Endowments, supra* note 32, at 13.

206. Establishing regional offices could help to meet this exigency. *See id.*

tary and otherwise, to a problem they cannot see or that they believe does not directly affect them? Quite simply, because they must.

Even if the scientific community's predictions are inaccurate as to the extent of future harm,²⁰⁷ the fact remains that significant damage has already occurred. Regarding atmospheric ozone depletion, the latest scientific evidence reveals that depletion has spread to heavily populated regions, including the United States.²⁰⁸ It is no longer a problem limited to the unpopulated polar regions.²⁰⁹ Also, human beings are irreversibly altering the environment by their actions in an unprecedented manner and at an unprecedented rate. If this moral consideration alone is unpersuasive, then the following practical consideration dictates that we must act now to reverse this trend. Scientists, just as they currently do not understand the extent of the ozone depletion phenomenon,²¹⁰ similarly do not understand the future ramifications of permanently mutating the Earth's ecological balance.

The problems facing the Earth's inhabitants are of global importance and command global attention. A critical element of that attention includes the creation of an international financing mechanism such as the GCF, the RCF and its IEFs proposed in this Comment. A comprehensive program that ensures proper distribution of available technology to the impoverished farmer, villager, as well as the national governments, is a necessary part of a successful global response.

Meeting this end will require convincing the governments of the world that their participation and cooperation are absolutely crucial. Politically expedient platitudes offered to placate citizens today will provide little solace to future generations that will inherit an ecologically decimated Earth. The Persian Gulf War²¹¹ and the unfolding environmental nightmare in the former Soviet Union²¹² vividly illus-

207. Wexler, *supra* note 2, at 11.

208. Rudy Abramson, *Ozone Depletion is Year-Round, Scientists Find*, L.A. TIMES, Oct. 23, 1991, at A1.

209. *Id.*

210. Wexler, *supra* note 2, at 10-11 n.35.

211. Sylvia A. Earle, *Persian Gulf Pollution: Assessing the Damage One Year Later*, NAT'L GEOGRAPHIC, Feb. 1992, at 122. Events during the Persian Gulf War resulted in an environmental disaster. The amount of air pollution alone, caused by more than 600 oil well fires burning from May 16 to June 12, 1991, has been substantial. *Id.* at 129. It is estimated that 4.6 million barrels burned each day (an amount roughly equal to the amount the United States imports daily); 86 billion watts of heat were generated (approximately the same as a 500 acre forest fire generates); and 12,000 metric tons of particles were emitted daily (equal to ten percent of the particles emitted daily from biomass burning worldwide). *Id.*

212. Douglas Stanglin, *Toxic Wasteland*, U.S. NEWS & WORLD REP., Apr. 13, 1992, at 40

trate the tremendous destruction humanity is capable of inflicting upon the Earth's delicate ecobalance. The world's governments must act together, today, before a truly global calamity strikes.

Albert Einstein observed that people would have to change after the discovery of atomic energy. He said that "we shall require a substantially new manner of thinking if mankind is to survive."²¹³ No less is required on the global environment front.

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(describing the catastrophic dimension of pollution and environmental degradation in the former Soviet Union).

213. Mathews, *supra* note 81, at 177.

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