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MULTILATERAL ENVIRONMENTAL AGREEMENTS: FROM MONTREAL TO KYOTO – A THEORETICAL APPROACH TO AN IMPROVED CLIMATE CHANGE REGIME

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"[T]here is no durable treaty which is not founded on reciprocal advantage, and indeed a treaty which does not satisfy this condition is no treaty at all, and is apt to contain the seeds of its own dissolution. Thus the great secret of negotiation is to bring out prominently the common advantage to both parties of any proposal, and so to link these advantages that they may appear equally balanced to both parties." François de Calliéres, De la Maniere de Negocier Avec les Souverains (1716).

I. INTRODUCTION

Stratospheric ozone depletion and climate change are the two most significant environmental challenges facing the world today. There is no longer any doubt that an ambitious global plan must be crafted to address and reverse catastrophic environmental harm. However, the level of government cooperation that is needed and the fundamental change that is required in human economic and social behavior makes climate change and ozone depletion difficult to reverse.[1] The causes of climate change and its adverse impacts are closely linked to industrialization, economic development, poverty alleviation and energy security – necessitating an approach to climate mitigation that is sensitive to these concerns. Moreover, both climate change and ozone depletion cannot be reversed without a global effort involving all countries, and hence mandate that multilateral environmental agreements (MEAs) form the basis of any potential solution.[2]

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1. Cass R. Sunstein, *Of Montreal v. Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1, 2 (2007).

2. *See id.*

While climate change and ozone depletion are manifestations of different harmful processes, they share four fundamental similarities: (1) both present serious issues of international equity in that developed countries are the primary contributors to both environmental problems and, hence, need to assume predominant roles in mitigation efforts; (2) both problems involve extremely serious difficulties due to intergenerational equity, as future generations are likely to face greater environmental risks than current generations; (3) both environmental concerns involve the tragedy of commons problem, in that states are encouraged to simply "free ride" on the efforts of other states by benefiting from the significant costs borne by parties that comply with their obligations; and (4) both problems need the active participation of the United States (U.S.) for any solution to be lasting and effective.[3]

Despite these similarities, the two MEAs that currently address ozone depletion and climate change, respectively, have enjoyed very different levels of success. The Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) has been ratified by 193 countries around the world.[4] In addition, the parties to the Montreal Protocol are complying with their obligations, and as a result, ozone-depleting substances (ODSs) have been drastically reduced, and monitoring of the ozone layer indicates that the ozone is recovering.[5] Due to the enormously successful efforts of the parties to the Montreal Protocol, the treaty is frequently hailed as the most successful environmental treaty ever devised.[6]

The global effort to mitigate climate change, however, presents an altogether different story. Despite the fact that the Kyoto Protocol to the Convention on Climate Change entered into force in 2005 and has been ratified by 174 countries[7], it has been largely ineffective in mitigating climate change.[8] Indeed, despite high participation (with the notable exception of the United States), it is widely known that many parties to the Kyoto Protocol may not be complying with their obligations.[9] The marginal results achieved under the Kyoto Protocol have led to

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3. *See id.* at 3; *see also* Laura Thomas, *A Comparative Analysis of International Regimes on Ozone and Climate Change with Implications for Regime Design*, 41 COLUM. J. TRANSNAT'L L. 795, 797-99 (2003).

4. Ozone Secretariat, United Nations Environment Programme (UNEP), Status of Ratification (2008), http://ozone.unep.org/Ratification_status/.

5. The Scientific Assessment Panel of the Motreal Protocol on Substances that Deplete the Ozone Layer, *Executive Summary of the Scientific Assessment of Ozone Depletion: 2006 (WMO/UNEP)*, 1-3 (Aug. 18, 2006), http://ozone.unep.org/Assessment_Panels/SAP/index.shtml (suggesting that there is clear evidence of a decrease in the atmospheric burden of ozone-depleting substances in the lower atmosphere and in the stratosphere, and that early signs of recovery are also evident).

6. RICHARD E. BENEDICK, OZONE DIPLOMACY: NEW DIRECTIONS IN SAFEGUARDING THE PLANET 1 (2nd ed. 1998); *see also* Thomas, *supra* note 3, at 797.

7. *See* Kyoto Protocol, Status of Ratification, http://unfccc.int/files/kyoto_protocol/background /status_of_ratification/application/pdf/kp_ratification.pdf (last visited Nov. 5, 2008).

8. Laurie Goering, *UN: Time is now to fix warming Ahead of bid to replace Kyoto pact, urgent action urged*, CHI. TRIB., Nov. 18, 2007.

9. *See, e.g.*, Sunstein, *supra* note 1, at 21; *see also* Congressional Research Service, *Greenhouse Gas Emissions: Perspectives on the Top 20 Emitters and Developed Versus Developing Nations*, at 12,

significant academic criticism of the climate change regime and has increased public demand for more effective international cooperation to reverse the significant environmental degradation that has been allowed to continue unchecked.[10]

This paper, therefore, attempts to develop a dynamic theory of multilateral environmental treaty creation that builds on legal, economic and international relations theory. Based on the theoretical framework developed, this paper also seeks to outline why the Montreal Protocol has been extremely effective in curtailing the production of ODSs, and why the Kyoto Protocol has been ineffective in reducing greenhouse gas (GHG) emissions. This paper will also recommend possible improvements and changes to the Kyoto Protocol to transform it into a viable vehicle for lasting climate change alleviation. In doing so, this paper makes the assumption that states act predominantly out of self-interest. Thus, within the cooperation continuum, my analysis will be based somewhat on political economic theory within the Realist school of thought.

Section II will propose a theoretical framework for lasting and effective multilateral environmental agreements. In doing so, this paper goes beyond mere formal treaty provisions by discussing, from a political economic perspective, extra-legal strategies to encourage participation and compliance. It incorporates basic game theory to illustrate the complexity of multilateral treaty creation. Against this backdrop, section III will examine the Montreal Protocol and highlight some of its unique mechanisms and approaches that make it an effective MEA. Section IV will examine the Kyoto Protocol by describing the negotiations leading up to its creation and highlighting the approaches and mechanisms that undermine its effectiveness and efficacy. Section V will conclude with recommended changes to the existing climate change regime, based not only on its obvious weaknesses, but also on some of the theories and approaches developed in this paper.

II. MULTILATERAL ENVIRONMENTAL TREATIES: A THEORETICAL FRAMEWORK

A. The Complex Nature of Environmental Protection

International environmental concerns, along with any resulting call for global action, raise a unique problem within the field of international relations. Specifically, each country does not want to pay to protect the environment, but each country also recognizes that if every other country takes this stance, the environmental implications would be catastrophic. To make matters worse, even if nations feel obliged to act, unilateral action will not work where the solution to an international environmental risk is dependent on what other countries do to advance the problem, and what other countries will do to solve the same problem.[11] In other words, actions and choices of any given state frequently affect the welfare of other states, whether positively or negatively. In this way, most environmental

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RL32721 (2008) (*prepared by* Larry Parker & John Blodgett), *available at* https://ncseonline.org/NLE/CRSreports/08Feb/RL32721.pdf.

10. *See, e.g.*, Sunstein, *supra* note 1, at 4; Thomas, *supra* note 3, at 797.

11. SCOTT BARRETT, ENVIRONMENT AND STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING 50-52 (2003).

problems involve multilateral externalities, namely environmental effects felt from activity outside a country's border, and actions that need to be taken outside a given country's realm of direct control.[12] While many externalities are bilateral, and hence easier to overcome, in the case of climate change and ozone depletion, the multilateral externalities are reciprocal in a sense that (to varying degrees) each country imposes externalities on the other countries sharing the same resource.[13] Despite varying levels of emissions, every country emits ozone depleting substances and GHGs, and, more importantly, every country is susceptible to harmful effects caused by these emissions. But, to the extent that externalities exist in ozone and climate change concerns, they can be characterized as asymmetric because they affect nations differently.[14] Also, it is in the nature of global environmental problems that the damage each country suffers is never proportional to its share of global emissions.

Ultimately, solutions to transnational environmental problems are difficult to create because they invariably involve (and mostly conflict with) the principle of sovereignty.[15] Thus, the absence of a world government forces states to create a system of rules and a system of incentives to change state behavior. Indeed, states are forced to negotiate and cooperate to simultaneously minimize joint costs and collectively maximize joint benefits. Reality, however, presents a difficult working environment within which to come to lasting agreement. Specifically, transaction costs are unequal, information is imperfect, bargaining power remains asymmetrical and states remain wary of "opportunism through actual or threatened intentional noncompliance."[16] Despite these impediments to cooperation, states nevertheless frequently recognize that cooperation is the only available option. The key consideration, then, necessarily becomes the means with which to achieve such cooperation. Ideally, participation in an environmental treaty must be voluntary, targets must be accepted by consensus, and obligation must be implemented and enforced by the parties to the treaty.[17] History has shown, however, that this is not easy to achieve.

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12. *Id.* at 52.

13. *Id.*

14. *Id.* (citing as examples: island states, coastal states, and those countries near the poles because all have more to lose than many other states).

15. *See id.* at xiii-xiv (assuming that states act primarily out of self-interest and, hence, approach solutions to transnational problems with the view that any action needs to maximize this self interest); VED P. NANDA & GEORGE PRING, INTERNATIONAL ENVIRONMENTAL LAW FOR THE 21ST CENTURY 17-18 (2003); Michael Weisslitz, *Rethinking the Equitable Principle of Common but Differentiated Responsibility: Differential Versus Absolute Norms of Compliance and Contribution in the Global Climate Change Context*, 13 COLO. J. INT'L ENVTL. L. & POL'Y 473, 484 (2002) (highlighting that developing countries were reticent to assume even voluntary commitments at the negotiations leading up to the signing of the United Nations Framework Convention on Climate Change out of fear that such commitments would infringe with their sovereign right to economic development).

16. Brett Frischmann, *A Dynamic Institutional Theory of International Law*, 51 BUFF. L. REV. 679, 692 (2003).

17. Christoph Bohringer & Michael Finus, *The Kyoto Protocol: Success of Failure?, in* CLIMATE-CHANGE POLICY 258 (Dieter Helm ed., 2005).

B. Restructuring Incentives to Encourage Participation and Compliance

The object of any MEA is ultimately to change state behavior to mitigate harmful environmental degradation. In doing so, however, MEAs cannot rely exclusively on moral necessity to encourage cooperation. Instead, MEAs that seek to fundamentally alter state behavior and encourage widespread participation have to restructure incentives to overcome constraints imposed by sovereignty.[18] Treaty design becomes a key consideration, and ultimately plays a determining factor in the lasting efficacy of any agreement. Despite similarities between various environmental concerns, no two treaties can be alike. Indeed, an examination of existing international legal institutions suggests that a one-size-fits-all approach is doomed to fail.[19] The larger question therefore becomes: under what circumstances, or under what treaty design, can lasting environmental mitigation be encouraged? Scott Barrett, a prominent scholar within the Rationalist school of thought, articulates three broad requirements:

> First, a treaty must be *individually rational.* This means that no party to the treaty can gain by withdrawing, given the choices made by every other country, and that no non-party (if any) can gain by acceding .... It also means that no party can gain by failing to comply, given the treaty's design. And it means that no non-party (again, if any) can gain by changing its behavior (by polluting more or less, say), given every other country's behavior.... Second, a treaty must be *collectively rational.* This assumption recognizes negotiation to be a collective activity, and requires that it not be possible for parties to gain collectively by changing their treaty.... Finally, a self-enforcing treaty must be "fair." Put differently, it must be perceived by the parties as being legitimate.[20]

It is because of these three broad requirements that no two MEAs can be alike, because each multilateral agreement needs to be both rational to individual countries and to the collective group. For each environmental concern, an agreement will therefore have to create a different incentive structure to ensure both participation and compliance, and to minimize the problems associated with the "tragedy of commons," or "free-riding."[21] Closely associated is the necessity of creating favorable cost-benefit structures for each prospective party to a MEA. Indeed, the treaties that effectively deter non-participation and non-compliance enjoy the most success.[22]

The process of creating, or at least restructuring, incentives, however, is not easy. One variable is the nature of the good or the behavior that is being regulated and the means by which the regulation is put into place. Regulating a public good

18. Barrett, *supra* note 11, at 18.

19. Frischmann, *supra* note 16, at 689.

20. Barrett, *supra* note 11, at xiii-xiv.

21. Frischmann, *supra* note 16, at 693-95.

22. An example is the North Pacific Fur Seal Treaty where both participation and compliance was encouraged by creating a treaty that maximized joint payoffs and, hence, created incentive. For an in-depth discussion on the success of this treaty *see* Barrett, *supra* note 11, at 19-39.

such as pollution creates difficulty in that there is an increased incentive for states to "free-ride" on the collective efforts of other states.[23] Thus, a high degree of participation becomes key. Once a treaty enjoys adequate participation, the necessity of effective enforcement measures becomes self-evident: non-compliance with a treaty undermines its ultimate purpose. Hence, where states agree that collective action is required, any resulting MEA has to create a system of incentives that would dissuade a state from non-compliance. George Downs maintains that "the level of threatened punishment needed to dissuade a State from violating an agreement depends on the benefits that the State would gain from defection."[24] Specifically, he maintains:

> The larger the amount [of benefits from defection], the greater the incentive to defect and the greater the threatened punishment that is necessary to deter it. For example, to prevent a State from violating an environmental agreement where the violation would save the State twenty million dollars in pollution abatement costs requires more aggressive enforcement and a larger penalty than is necessary to prevent a violation that would save it only two million dollars.[25]

C. Using Game Theory as a Model to Understand Rational Choice

This section introduces a game theoretical approach to international environmental treaty creation. Scholars frequently use game theory as a theoretical model through which to examine and predict individual and group behavior. Specifically, game theory attempts to analyze behavior in situations where the utility of a state's available choices depends on the choices of other states, or at least the perceived choices of other states.[26] Game theory therefore provides a useful framework for analysis of international treaty building and the primary concerns that impede lasting and effective cooperation.[27] In this context, game theory assumes that states are unitary rational actors that seek to maximize their "individual" welfare by making decisions based on an expected payoff structure[28] associated with each choice it could make.[29] A central tenet of game theory is that the choice of one state can affect the welfare of the other state.[30]

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23. Barrett, *supra* note 11, at 83, 219.

24. George W. Downs, *Enforcement and the Evolution of Cooperation*, 19 MICH. J. INT'L L. 319, 324 (1998).

25. *Id.*

26. For a more thorough explanation of Prisoner's Dilemma *see* EconPort, Beginner's Guide, http://www.econport.org/econport/request?page=man_gametheory_exp_prisondil (last visited Nov. 26, 2008).

27. *See, e.g.*, Frischmann, *supra* note 16, at 700.

28. *Id.* at 704 (maintaining that "payoffs associated with cooperation are generally diffuse, widespread, long-term, and arguably more closely linked to perceptions of national welfare, while the payoffs associated with defection are generally concentrated among particular industry groups, short-term, and more closely linked to the welfare of politicians and special interests.").

29. For a successful application of game theory to the environmental treaty regime, states are presumed to be the dominant actors in international relations.

30. Frischmann, *supra* note 16, at 706.

In its most basic form, game theory is illustrated in a simple two-player game called Prisoner's Dilemma.[31] In the context of environmental treaty negotiation, we can assume, therefore, that two states are presented with a situation where they have the choice to abate (stop polluting) or to continue polluting. In essence, state A and B each face a decision regarding whether to cooperate with each other, without being certain as to what the other state will choose. To make matters less certain, different outcomes lead to different payoff structures, illustrated in the following example by simple monetary figures to represent overall economic benefits associated with each choice. For example, in the classic Prisoner's Dilemma, if both states choose to cooperate and abate, they will both enjoy a net payoff of $5, for a total of $10. If, however, both players choose to continue polluting, they each receive a payoff of only $3, for a total of $6. Last, if one state chooses to cooperate by abating and the other state chooses to pollute, the cooperating state receives a payoff of $2, while the polluter receives a payoff of $7, for a total of $9. Thus, one can see that the best possible outcome is that both states abate and receive a combined payoff of $10. However, when making their choice, each state recognizes that if they cooperate and the other state defects, their net payoffs will be less than it would be had they chosen to defect (compare a payoff of $2 with a payoff of $3). In this way, uncertainty and the nature of the problem force states to accept that polluting is their dominant strategy because the individual payoffs are higher, whether the other state chooses to cooperate or abate.

Based on the situation in a Prisoner's Dilemma, it therefore becomes necessary for the parties to give each other mutual assurances before "the game," and for states to create a situation where the dominant strategy is to abate. In reality, states are forced to try and manipulate the nature of the game by tying their hands and committing to cooperate by creating mechanisms and institutions to encourage, monitor and enforce participation and compliance.[32] In this way, the institution or regime can reward cooperators or punish defectors, and hence,

31. The classical Prisoner's Dilemma (PD) is as follows:
Two suspects, A and B, are arrested by the police. The police have insufficient evidence for a conviction, and, having separated both prisoners, visit each of them to offer the same deal: if one testifies for the prosecution against the other and the other remains silent, the betrayer goes free and the silent accomplice receives the full 10-year sentence. If both stay silent, both prisoners are sentenced to only six months in jail for a minor charge. If each betrays the other, each receives a five-year sentence. Each prisoner must make the choice of whether to betray the other or to remain silent. However, neither prisoner knows for sure what choice the other prisoner will make. So this dilemma poses the question: How should the prisoners act? Keep in mind that the best option for both is to keep silent; however, remaining silent puts the silent prisoner at risk of a ten-year sentence if the other prisoner decides to cooperate. In this way, each would likely decide to betray each other because, at worst, they will only receive a five-year sentence, compared to the worst case scenario of receiving a ten-year sentence for remaining silent. Thus, the Prisoners Dilemma is used by scholars to rationalize the choices states make in deciding whether to abate or continue polluting in light of the payoffs of each option. In the classic Prisoners' Dilemma story, the payoffs refer to the expected length of jail sentences depending on each outcome. Payoffs, in the context of this note, refer simply to the measure of utility of each choice faced by countries engaged in treaty negotiation.

32. Frischmann, *supra* note 16, at 719.

directly influence the payoff structure of present and future iterations (games).[33] This, in turn, leads to different choices and outcomes. Take for example, the radically different outcome in the counterpart to Prisoner's Dilemma, a game aptly referred to as Harmony.

In Harmony, if both states choose to cooperate and abate, they both enjoy a net payoff of $6, for a total of $12. If, however, both players choose to continue polluting, they each receive a payoff of only $2, for a total of $4. Last, if one state chooses to cooperate by abating and the other state chooses to pollute, the cooperating state receives a payoff of $4, while the polluter receives a payoff of $3, for a total of $7. Like Prisoner's Dilemma, the best possible outcome is created when both states abate and receive a combined payoff of $12. However, when making their choice, each state recognizes that the individual payoff associated with abatement is higher regardless of what the other state does. In this way, abatement becomes each state's dominant strategy.

While these games may be too simple to completely capture the complexities inherent in treaty negotiation and creation, they nonetheless provide insightful illustrations of the basic choices and outcomes that are important variables in the MEA negotiation process. In addition, the illustrations above suggest that in order to encourage participation and compliance, states can jointly restructure payoffs and incentives by either punishing non-cooperation, or creating positive payoffs for cooperation.

Frischmann identifies three stages of the game, as it relates to MEAs. The first stage involves *framing the game* whereby states recognize an interdependent problem and propose potential solutions.[34] This stage may involve varying levels of scientific, political and economic uncertainty.[35] The second stage involves the *forming of the game*, whereby states negotiate an agreement and create monitoring and compliance procedures.[36] Indeed, it is here that states change the payoff structure of cooperation by creating commitments, making concessions, and establishing compliance procedures.[37] The third stage is where states *play the game*.[38] Here, states implement and enforce the agreement, and individual participants choose to either cooperate or pollute.[39] At this stage, a well-crafted agreement should include the flexibility to respond to exogenous influences that change the nature of the game. For example, scientific uncertainty may slowly dissolve, transaction costs may diminish, and technological advancements may be revealed.[40] In this way, parties to an agreement need not go back to the drawing board to *reform* and *reframe* the game – a process that we shall see, is extremely difficult.

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33. *Id.* at 681, 683.
34. *Id.* at 723.
35. *Id.* at 724
36. *Id.* at 724-25.
37. *Id.*
38. *Id.* at 727.
39. *Id.* at 728.
40. *Id.* at 729-30.

Indeed, a close examination of the Montreal Protocol provides an example of how states successfully *framed* the game; changed the *formation* of the game by negotiating the implementation of effective treaty mechanisms; and continue to *play* the game by changing payoffs through both positive incentive and punishment, and jointly encouraging participation and compliance.

III. THE MONTREAL PROTOCOL: A MODEL OF SUCCESS?

A. Negotiations Leading up to the Montreal Protocol

In 1974, Marion Molina and Sherwood Rowland published a scientific paper suggesting that the stratospheric ozone layer was being destroyed by chlorofluorocarbons (CFCs), a man-made chemical substance.[41] Although the causal link between the release of CFCs and the depletion of the ozone was largely unproved in the late 1970s, many countries began to unilaterally reduce and restrict CFC production and consumption.[42] However, despite significant unilateral action on the part of major contributors, such as the United States, CFC production and consumption began to rise in the 1980s, necessitating the need for international cooperation in protecting the ozone layer by phasing out the use of harmful ozone depleting substances.[43] In 1981, United Nations Environment Programme (UNEP) established a Working Group of legal and technical experts to agree on and draft a global framework convention.[44] The resulting Vienna Convention for the Protection of the Ozone Layer (Vienna Convention) was adopted and signed by twenty countries plus the European Union, and entered into force on September 22, 1988.[45] Although the convention included no binding controls on the production and emission of ozone depleting substances, the Vienna Convention played a pivotal role in creating a foundation on which significant progress has been made. Indeed, at the Convention the parties agreed to: (1) conduct further scientific research and assessments to overcome uncertainty, (2) to exchange information for the benefit of all participants, and (3) to adopt "appropriate measures" to deal with the problem.[46]

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41. Mario J. Molina & F. S. Rowland, *Stratospheric Sink for Chlorofluoromethanes: Chlorine Atomcatalysed Destruction of Ozone*, 249 NATURE 810 (1974); *see also* DAVID HUNTER, JAMES SALZMAN & DURWOOD ZAELKE, INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 567-69 (3rd ed. 2007) (discussing the basic science of ozone depletion). When released CFCs rise to the stratosphere, long exposure to solar radiation causes the CFCs to break down and release chlorine, which is the source of ozone depletion, not the CFCs themselves. The consequence of ozone destruction is both life-threatening and massive in scale because it is the ozone layer that absorbs harmful ultraviolet radiation. An excess of UV radiation would result in increased cases of skin cancer and eye cataracts, lower yields in agriculture and fisheries, and an accelerated increase in ground level ozone (smog), among other disastrous effects.

42. Barrett, *supra* note 11, at 223.

43. *Id.*

44. Edith Brown Weiss, *The Five International Treaties: A Living History, in* ENGAGING COUNTRIES: STRENGTHENING COMPLIANCE WITH INTERNATIONAL ENVIRONMENTAL ACCORDS 89, 136 (1998).

45. Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, T.I.A.S. No. 11,097, 1513 U.N.T.S. 293 [hereinafter Vienna Convention].

46. *See also id.* arts 2-7, annex I-II; Frischmann, *supra* note 16, at 792.

Frischmann maintains that this was an important first step "because it broadly *framed* the relevant issues at a time where the underlying problem and potential solutions were relatively uncertain and States were understandably hesitant to undertake specific commitments."[47] Indeed, parties to the convention "fully expected that their commitments would evolve over time,"[48] and articulated that a protocol with more specific obligations and targets would be negotiated in the future.

B. The Montreal Protocol: An Assessment

On September 16, 1987, twenty-four states signed the Montreal Protocol, which expanded the goals of the Vienna Convention by creating a treaty that obligated parties to reduce their ozone depleting substance emissions in relation to 1986 base-levels.[49] From the outset, the negotiating parties to the Montreal Protocol recognized the existence of scientific uncertainty and, hence, placed no specific limit on any of these harmful substances. However, the negotiators did create a separate limit for the total amount of ozone depletion caused by the parties to the Protocol.[50] In this way, the negotiators built sufficient flexibility into the functioning of the Montreal Protocol. Richard Benedick, the chief U.S. negotiator to the Montreal Protocol, also maintains that the Montreal protocol was designed to be flexible "to be reopened and adjusted as needed, on the basis of the periodically scheduled scientific, economic, environmental, and technological assessments."[51] Thus, as scientific data progressed, the parties began to implement direct controls on specific substances through subsequent amendments.[52]

The Montreal Protocol also implemented two important provisions during the framing of the agreement. The first was the ability to "adjust" reduction targets, ideally by consensus, but if necessary, by two-thirds majority of the parties representing at least half of the total consumption of all the parties.[53] Such adjustments are binding on all parties even on non-consenting parties.[54] The

47. Frischmann, *supra* note 16, at 792 (emphasis added).

48. *Id.*

49. Protocol on Substances that Deplete the Ozone Layer, art. 2, Sept. 16, 1987, *reprinted in* 52 Fed. Reg. 47515, 26 I.L.M. 1541 (1987) (entered into force Jan 1, 1989) [hereinafter Montreal Protocol]; *see also* Nanda & Pring, *supra* note 15, at 259. Interestingly, 1986 was chosen as a base-level to avoid strategic maneuvering by states to increase their production so as to change their bargaining positions. Had a future year been chosen, this might have encouraged many countries to increase their production levels immediately to establish a higher basis from which subsequent cuts would have to be made. In subsequent amendments, the base-level year was changed for many controlled substances as a response to scientific data.

50. Nanda & Pring, *supra* note 15, at 259-60.

51. Benedick, *supra* note 6, at 99. We can see that this has indeed happened and the assessments still form a major part in process of decision-making.

52. To date, the Montreal Protocol has undergone many transformations: Adjusted in Vienna (1995); amended in Beijing (1999); adjusted and amended in London (1990), Copenhagen (1992), and Montreal (1997). Therefore, a country that joins the Montreal Protocol today is joining a very different treaty from the one negotiated in 1987. *See* Weiss, *supra* note 44, at 140-44; Barrett, *supra* note 11, at 153.

53. Montreal Protocol, *supra* note 49, art. 2, ¶ 9.

54. *See* Barrett, *supra* note 11, at 226.

second provision was that the ability to broaden the agreement to include new substances would have to be included through treaty amendments and, hence, would be legally binding on parties to any such amendment.[55] In this way, the parties created institutional mechanisms that would adjust commitment levels and payoff structures in response to unforeseen developments without requiring renegotiation of the underlying game.[56]

From the beginning, the Montreal Protocol also created a weighted list of chemicals with ozone depleting potentials.[57] As a result, the Montreal Protocol created incentives to reduce the more harmful ozone depleting substances at a higher rate than those that were less damaging to the ozone. In creating emissions "offsets," the weighted list effectively lowered the cost of compliance associated with binding obligations.[58] Additionally, since 1987, as scientific knowledge has improved, the parties to the Montreal Protocol have increased the number of controlled substances from eight to ninety-six.[59]

1. Trade Leakage Concerns

A major concern for the negotiators of Montreal was the potential for "trade leakage," whereby the production of ozone depleting substances would merely shift from the parties to the Protocol to non-parties, in other words, from the industrialized countries to the developing countries.[60] Under such a scenario, the Montreal Protocol would only serve to redistribute, rather than reduce, the production and consumption of ozone depleting substances. In this way, trade leakage would merely serve to increase the payoffs for non-cooperation, and hence, would undermine participation and compliance. From the outset of negotiations, the parties therefore worked hard to include measures to stop trade leakage.[61] Negotiations, focused on two solutions: (1) to create incentives for developing countries to also assume obligations for the public good, and (2) to implement tough trade measures to encourage participation.[62] However, this did not prove to be easy. Specifically, developing countries felt that they were responsible for only a small portion of the ozone problem, and therefore argued

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55. *See* Montreal Protocol *supra* note 49, art. 2, ¶ 9(d). This is helpful in that if, at the time of negotiation, parties are uncertain as to the future environmental implications, and if at the time parties expect this uncertainty to diminish, then countries may wish to negotiate an initial agreement that keeps the option of renegotiation open in the future.

56. Recall Frischmann's three stages of the treaty negotiation game, *supra text* section II(C).

57. Montreal Protocol, *supra* note 49, annex A.

58. Benedick, *supra* note 6, at 78.

59. Montreal Protocol, *supra* note 49, annex A C. The most common controlled substances include: Halo carbons, notably chlorofluorocarbons (CFCs) and Halons; Carbon tetrachloride; Methyl chloroform (1,1,1 trichloroethane); Hydrobromofluorocarbons (HBFCs); Hydrochlorofluorocarbons (HCFCs); Methyl bromide (CH3Br); and Bromochloromethane (BCM), a new ozone-depleting substance that some companies sought to introduce into the market in 1998, which has been targeted by the 1999 Beijing Amendment for immediate phase-out to prevent its use.

60. Barrett, *supra* note 11, at 231; *see also* HUNTER, SALZMAN & ZAELKE, *supra* note 41, at 584-85.

61. Benedick, *supra* note 6, at 91-92.

62. Barrett, *supra* note 11, at 231, 313, 321, 346-49 (discussing the specific mechanisms introduced to address these concerns).

that they should not be held to the same standards as the industrialized countries.[63] After lengthy negotiations, the parties settled on mechanisms such as "basic domestic needs," under which developing counties (Article 5 countries) could increase their ozone depleting substances production to specified levels for ten years, after which they were subject to a fifty percent reduction for the next ten years.[64] In 1992, the parties to the Montreal Protocol also created a comprehensive funding mechanism to support efforts to develop "cleaner" technology.[65] These actions simultaneously strengthened control measures by creating incentive for developing countries to ratify, and increased the number of parties to the Montreal Protocol by improving the cost-benefit positions of most developing countries.[66] As a result, we can see that the parties to the Montreal Protocol ensured that payoffs for participation and compliance increased, and payoffs for non-cooperation diminished. Importantly, these incentives effectively countered the Prisoner's Dilemma, and subtly helped to shift states' dominant strategy from one of defection (continued pollution) to one of abatement.

2. Trade Restriction Mechanisms

The parties also managed to create robust trade restriction measures that effectively created favorable cost-benefit structures for states that were considering whether to join the Montreal Protocol.[67] In this way, the trade restriction mechanism made participation *individually rational* for countries.[68] Again, by implementing these restriction mechanisms the parties to the Montreal Protocol diminished the potential payoff structure of non-cooperation and reformulated the environment (or game) within which countries had choose to cooperate or not. Ultimately, trade restriction effectively deterred free-riding and restructured

63. Sunstein, *supra* note 1, at 16.

64. *Id.* at 17. The phase out schedules for developed countries are as follows: Phase out Halons by 1994; phase out CFCs, carbon tetrachloride, methyl chloroform, and HBFCs by 1996; reduce methyl bromide by 25% by 1999, 50% by 2001, 70% by 2003, and phase out by 2005; reduce HCFCs by 35% by 2004, 65% by 2010, 90% by 2015, and 99.5% by 2020, with 0.5% permitted for maintenance purposes only until 2030; phase out HBFCs by 1996 and phase out BCM immediately. *See* Multilateral Fund for the Implementation of the Montreal Protocol, About the Multilateral Fund: History, http://www.multilateralfund.org/history.htm.

65. Sunstein, *supra* note 1, at 17. Currently, the Multilateral Fund for the Montreal Protocol is administered by an Executive Committee of seven developed and seven developing countries chosen by the Parties on annual basis. The Fund has been replenished six times: $240 million (1991-1993), $455 million (1994-1996), $466 million (1997-1999), $440 million (2000-2002), $474 million (2003-2005) and $400.4 (2006-2008). The total budget for the 2006-2008 triennium is $470 million. $59.6 million of that budget is from the 2003-2005 triennium and $10 million will be provided from interest accruing to the Multilateral Fund during the 2006-2008 triennium. As of March 2007, the contributions made to the Multilateral Fund by some forty-nine industrialized countries (including Countries with Economies in Transition or CEIT countries) totaled over U.S.$ 2.2 billion. *See* Multilateral Fund for the Implementation of the Montreal Protocol, About the Multilateral Fund: History, http://www.multilateralfund.org/history.htm.

66. Nanda & Pring, *supra* note 15, at 265-66.

67. Montreal Protocol, *supra* note 49, art. 4.

68. Recall Barrett's three requirements for a successful environmental treaty, *supra* text section I. Barret, *supra* note 11, at xiii-xiv.

incentives to encourage broad and deep participation.[69] Specifically, the Montreal Protocol prohibits parties from importing controlled substances and products *produced* with controlled substances from non-parties.[70] In addition, the Montreal Protocol bans parties from exporting controlled substances unless the recipient country can show full compliance with the Protocol's reduction schedules.[71] To discourage countries from holding out for short-term competitive advantage, the parties also agreed that the Protocol would only enter into force when eleven countries, representing two-thirds of global ozone depleting substances consumption, had ratified.[72]

3. Implementation and Non-compliance

In 1997, in the Copenhagen Amendments, focus shifted from target setting to effective implementation.[73] The parties focused on increasing participation, limiting the growth of emissions by developing countries, promoting universal compliance, and controlling the emerging black market trade in CFCs.[74] Indeed, the Montreal Amendments created institutional mechanisms to determine, and effectively deal with, non-compliance, thereby making it *collectively rational* for the parties to comply with their obligation.[75] Specifically, the parties created an Implementation Committee that has both a dispute resolution element and an implementation element to make compliance issues *fair* to all the parties.[76] Measures that can be taken under the Montreal Protocol for non-compliance include:

> (1) assistance [in the form of financial and technological assistance];
>
> (2) "issuing cautions"; and
>
> (3) suspension... of specific rights and privileges under the Protocol... including those concerned with industrial rationalization, production, consumption, trade, transfer of technology, financial mechanisms and institutional arrangements.[77]

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69. Also, because of such enforcement mechanisms, the Montreal Protocol suffers from virtually no free-riding. Indeed, after the trade restrictions were put into place, the number of developing countries that joined the Montreal Protocol increased rapidly.

70. HUNTER, SALZMAN & ZAELKE, *supra* note 41, at 584-85.

71. *Id.*

72. *E.g.*, *id.* at 586. As it turned out, the initial participation far exceeded this number in that 30 parties representing 83 percent of global consumption were founding parties to the Montreal Protocol.

73. Barrett, *supra* note 11, at 237. Again, recall Barrett's three requirements for a successful environmental treaty, *supra* text section I.

74. *See* Adjustments and Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer Adopted at Copenhagen, Nov. 25, 1992, S. TREATY DOC. No. 103-9, 32 I.L.M. 874 (1993) (entered into force June 14, 1994) [hereinafter Copenhagen Amendments].

75. HUNTER, SALZMAN & ZAELKE, *supra* note 41, at 603-06.

76. *See* Copenhagen Amendments, *supra* note 74.

77. Barrett, *supra* note 11, at 288; UNEP, *Report of the Fourth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer*, Annex V, UNEP/OzL.Pro.4/15 (November 25, 1992), *available at* http://www.unep.org/ozone/4mop_cph.shtml.

Indeed, by approaching the Implementation Committee, a party can request assistance from other parties to meet its obligations.[78] This approach, therefore, recognizes the need for collective action *and* assistance in solving the ozone problem. In addition, the Montreal Protocol requires that parties submit reports with data on import, exports and production of controlled substances to the Implementation Committee.[79] The Implementation Committee has worked extremely hard to enforce this reporting requirement, frequently threatening to withhold critical financial assistance to Article 5 countries (developing countries) that do not comply with the reporting requirement.[80]

Thus, we can see that the framers of the Vienna Convention and the accompanying Montreal Protocol *framed* and *formed* the game to maximize payoff structures of cooperation. In addition, the parties to the Montreal Protocol created an agreement that allows each party to continue to *play* the game, with a high level of certainty that other states will do the same. Indeed, despite what other countries may chose to do, each country's dominant strategy under the Montreal Protocol remains participation and full compliance. As a result, there is almost full compliance and participation in the Montreal Protocol and its subsequent amendments continue to increase.[81]

IV. THE KYOTO PROTOCOL

A. Similarities with Montreal Protocol

This paper has already described the similarities between the nature of ozone depletion and climate change. Despite these similarities, it should be noted that climate change mitigation raises a much greater challenge than that presented by ozone depletion. First, climate change is a much more difficult phenomenon to regulate because it is more scientifically complex than ozone depletion and is still characterized by high uncertainty and sharp asymmetrical vulnerabilities.[82] Indeed, this uncertainty still plagues global efforts to reach consensus on lasting climate change alleviation.[83] Perhaps more important, is the fact that climate change mitigation affects core global economic activity and inherently involves issues of

78. Montreal Protocol, *supra* note 49, art. 10.

79. *Id.*, art. 7; *see also* Barret, *supra* note 11, at 149.

80. The Montreal Protocol has a discrete approach to non-compliance and monitoring. Suspected instances of non-compliance must be brought to the Implementation Committee, which reviews the evidence and considers the circumstances that may have precipitated the non-compliance. It then makes recommendations regarding actions to be taken. In a sense, therefore, the process may encourage non-compliance, but the careful exercise of discretion may also prevent the punishment of a country that has a legitimate reason beyond its control for non-compliance. *See generally* Barrett, *supra* note 11, at 150-51.

81. As of June 2008, 193 countries have ratified the Montreal Protocol. Ratifications of the amendments are: 189 countries for the London Amendments, 184 for the Copenhagen Amendments, 167 for the Montreal Amendments, 144 for the Beijing Amendments. Ozone Secretariat, *supra* note 4.

82. Thomas, *supra* note 3, at 823; *see also* Sunstein, *supra* note 1, at 2-4, 45.

83. Thomas, *supra* note 3, at 824. It should be noted that while scientific uncertainty within the climate change regime has diminished with time, a significant obstacle to a lasting agreement is still presented by a high degree of uncertainty regarding the economic impacts associated with proposed global responses.

competition between nations.[84] Specifically, climate change alleviation implicates multiple sectors of the global economy, particularly those that have, throughout modern history, served as the backbone to industrial growth and development.[85] While it is conceptually accepted that mitigation of climate change calls for the restructuring of our global energy-based society, this in itself is not enough. Indeed, it is the necessity of cheap energy as a foundation to growth and development in less-developed countries that illustrates a particularly acute problem, at least in climate change negotiation.[86]

Despite the differences between climate change and ozone depletion, the response to the two environmental challenges nevertheless share many common elements. First, the extent of scientific cooperation and involvement in climate change negotiations has been just as great, if not greater, than that of the ozone regime.[87] Second, climate change negotiation also followed an incremental approach through the use of a convention-protocol scheme, and the creation of targets and timetables to create binding emissions reduction standards.[88] Third, like Montreal, the negotiators of the Kyoto Protocol advanced the "common but differentiated responsibility" principle, and created multiple mechanisms to encourage and aid developing countries to participate.[89] As we shall see, however, despite these similarities between the two Protocols, key differences have exposed many fundamental problems with the current Kyoto regime. Specifically, differences concerning treaty negotiations, structure, and institutional mechanisms have led to a vastly different outcome that must be addressed and amended in order to sustain lasting climate change mitigation.

B. The Early Response to Climate Change

Despite the remarkable response to the problems of ozone depletion, the world has yet to adequately respond to climate change - the "defining ecological issue of the 21st century."[90] Over the past two decades, scientific consensus has established that increasing levels of man-made greenhouse gases being released into the atmosphere are causing global warming and changing the earth's fragile climate.[91] Even before such consensus was reached, many scientists called for

84. *Id.* at 823.

85. *See id.* at 812.

86. *Id.* at 824-25.

87. *Id.* at 817; *see also* JORGEN WETTESTAD, DESIGNING EFFECTIVE ENVIRONMENTAL REGIMES: THE KEY CONDITIONS 221-23 (1999) (noting that the climate change has an "extraordinarily well-developed scientific-political complex, with several organizational entities and bodies fulfilling advisory and communicatory functions.").

88. Nanda and Pring, *supra* note 15, at 293-94.

89. For a discussion on the common but differentiated responsibility approach, *see* Kyle Danish, *An Overview of the International Regime Addressing Climate Change*, 7 SUSTAINABLE DEV. L. POL'Y 10 (2007).

90. HUNTER, SALZMAN & ZAELKE, *supra* note 41, at 631.

91. Climate change refers to the change in the earth's climate brought about by increased concentrations of greenhouse gases, which at normal levels are actually indispensable to life on earth. However, due to man-induced pollution problems, the delicate balance of greenhouse gases is being affected, and is, in turn, causing the earth's temperature to rise. These gases earn their name because, much like a greenhouse, they allow sunlight to pass through the atmosphere while trapping heat, or

international action back in the 1970s and 1980s.[92] Indeed, after the danger of man-made greenhouse gases became more apparent, many industrialized countries committed to reducing emissions of greenhouse gases, but unlike the same unilateral commitments for ODSs, many countries did not follow through with concrete action.[93] The first major effort to regulate climate change took place in 1992, with the creation of the Framework Convention on Climate Change (FCCC), signed at the 1992 Rio Earth Summit.[94] The FCCC did not include any binding measures or obligations, but it did establish a general framework on which further action was taken.[95] In 1997, in response to scientific evidence that emphasized the need for binding targets and timetables, the parties to the FCCC negotiated the Kyoto Protocol to the Convention on Climate Change.[96] As we shall see, however, the Kyoto Protocol has been the target of widespread criticism, and has had very little success at mitigating climate change.

C. The Kyoto Protocol: An Assessment

In February 2005, the Kyoto Protocol entered into force without the participation of the United States.[97] Despite U.S. withdrawal, the parties hailed this as a milestone in the global effort to mitigate climate change.[98] This does not, however, deter scholars from severely criticizing the Kyoto Protocol. Specifically, scholars argue that under the current provisions of the Protocol, impacts on global emissions will be negligible. For example, Olmstead and Stavins maintain: "[b]ecause the Kyoto Protocol's ambitious targets apply only to the short term (2008-2012) and only to industrialized nations, the agreement will impose relatively high costs and generate only modest short-term benefits, while failing to provide a real solution."[99] While this condemnation has enjoyed widespread support among scholars, the most common criticism of the Kyoto Protocol can be summarized in four propositions:

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infra-red radiation, close to the earth's surface. Thus, an increase in the concentration of greenhouse gases leads to increased warming, which in turn is adversely effecting the earth's fragile environment. Harmful chemicals that have led to increased greenhouse gas concentrations include: carbon dioxide, methane, nitrous oxide, halocarbons (regulated by Montreal), and other halogenated substances such as CFCs and HCFCs.

92. HUNTER, SALZMAN & ZAELKE, *supra* note 41, at 632.

93. Barrett, *supra* note 11, at 367.

94. UN Framework Convention on Climate Change, *opened for signature* May 29, 1992, 1771 U.N.T.S. 107 (entered into force Mar. 24, 1994), [hereinafter *UNFCCC*].

95. Nanda & Pring, *supra* note 15, at 290-94 (noting that the basis for international law to address climate change is Principle 21 of the Stockholm Declaration).

96. HUNTER, SALZMAN & ZAELKE, *supra* note 41, at 632.

97. Kyoto Protocol to the United Nations Framework Convention on Climate Change, *adopted* Dec. 11, 1997, 37 I.L.M. 22 (entered into force Feb. 16, 2005) [hereinafter Kyoto Protocol]. As of October 16, 2008, there were 182 Parties to the Kyoto Protocol. *See* Kyoto Protocol, Status of Ratification, *supra* note 7.

98.

99. Robert N. Stavins & Sheila M. Olmstead, *An International Policy Architecture for the Post-Kyoto Era,* 96 AM. ECON. REV. PAPERS AND PROCEEDINGS 35, 35 (2006), *available at* http://belfercenter.ksg.harvard.edu/publication/4014/international_policy_architecture_for_the_postkyoto_era.html.

1. Negotiations leading up to the Kyoto Protocol were politically motivated and led to diluted targets that will have very little effect on climate change.[100]

2. The non-inclusion of developing countries in binding targets undermines the efficacy of the Kyoto Protocol.[101]

3. The cost-benefit structure of the Kyoto Protocol undermines its effectiveness and encourages non-participation.[102]

4. Ineffective enforcement mechanisms help to encourage lackluster results and encourage free-riding and trade leakage.[103]

1. Negotiations Leading up to The Kyoto Protocol

Right from the start of negotiations, the Kyoto Protocol presented a more complex political problem than that experienced during the Montreal negotiations. However, it wasn't until the U.S. made public its intention not to become a party to the agreement that the real problems associated with the negotiations started to surface.[104] In 2001, after several years of negotiations between the U.S. and the other parties to the Kyoto Protocol, President George W. Bush withdrew the U.S. from the Kyoto Protocol, invoking great dissatisfaction from the rest of the world.[105] The U.S. maintained that it would not sign the Kyoto Protocol (1) unless developing countries were included, and (2) as long as the U.S. considered it to be harmful to its economic interests.[106] The U.S. Senate concluded that any "exemption for Developing Country Parties is inconsistent with the need for global action on climate change and is environmentally flawed" and strongly believed that proposals leading up the Kyoto Protocol "could result in serious harm to the

100. *See, e.g.,* Barrett, *supra* note 11, at 371-74.

101. *See generally* Sunstein, *supra* note 1, at 4-7; Anita M. Halvorssen, *Common, But Differentiated Commitments in the Future Climate Regime: Amending the Kyoto Protocol to Include Annex C and the Annex C Mitigation Fund*, 18 COLO. J. INT'L ENVTL. L. & POL'Y 247, 248-51 (2007).

102. *See, e.g.,* Barrett, *supra* note 11, at 377-80.

103. *See* Bohringer & Finus, *supra* note 17, at 279, 284, 294 (highlighting that more realistic and effective punishments can provide incentives for compliance, and that strategic links among countries can counter trade leakage). Recall discussion, *supra* text section III(B)(1).

104. *See generally Oh no, Kyoto*, THE ECONOMIST, April 7, 2001. (discussing the reactions after the U.S. withdrawal from Kyoto, and the difficulties that soon became apparent after the withdrawal).

105. Barrett, *supra* note 11, at 371; *see also* Sunstein *supra* note 1, at 28 (suggesting that leading up to the creation of the final draft of the treaty, it was common knowledge that the U.S. could never join the treaty as drafted).

106. S. Res. 98, 105th Cong. ¶ 1 (1998), *available at* http://thomas.loc.gov/cgi-bin/query/D?c105:1:./temp/~c105F6Lwz2::. It should be noted that, despite the frequent accusations of partisan political approaches, the U.S.'s involvement was virtually doomed from the start, even before President Bush came into office. In fact, even during the Clinton Administration the Senate voted 95-0 against joining the Kyoto Protocol. Despite this, however, it should be recognized that many scholars argue that it was the way in which President Bush withdrew that increased the dissatisfaction felt by other parties at the U.S. withdrawal. *E.g.,* Barrett, *supra* note 11, at 371.

United States economy, including significant job loss, trade disadvantages, increased energy and consumer costs, or any combination thereof."[107]

Despite the obvious problems associated with the non-participation of the U.S. in a global action to mitigate climate change,[108] several prominent scholars also point to the resulting concessions made in an effort to save the Kyoto Protocol from an early death.[109] Specifically, in the wake of the U.S. withdrawal, many Annex 1 countries enjoyed significantly more bargaining power and effectively renegotiated the Kyoto Protocol, resulting in a vast downgrade of original targets.[110] Such downgrading included large concessions concerning "sinks" and "hot air" trading.[111] With the addition of hot air trading, the Kyoto Protocol allows countries to purchase credits from countries that have achieved surplus reductions. While many defend this as an effective mechanism to encourage participation, allowances have been subject to vast abuse and mismanagement.[112] For example, after the U.S. withdrew, Russia was able to negotiate double the amount of sink credits permitted toward calculations of its emissions.[113] In this way, the hot air trading scheme undermines the effectiveness of the Kyoto Protocol by merely shifting excess surplus to countries that are not meeting target reductions, with the end-result being that total emissions reduction is significantly diluted.[114] Ironically, the determination of the remaining parties to make Kyoto work also led to concessions on a number of issues that the U.S. had lobbied for prior to its withdrawal.[115]

Another example of how politics drove the negotiations leading up to Kyoto is that choosing the year 1990 as the base level for reductions conferred significant advantages for many of the negotiating parties.[116] Specifically, during the

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107. S. Res. 98, *supra* note 106, paras. 10-11.

108. *See* Parker & Blodgett, *supra* note 9, at summary (showing that the U.S. emits roughly 20 percent of global GHGs); *see also Oh no, Kyoto*, *supra* note 104.

109. *See, e.g.*, Barrett, *supra* note 11, at 371-74; *see also* Thomas, *supra* note 3, at 821.

110. *See* Scott Barrett, *Kyoto Plus*, *in* CLIMATE-CHANGE POLICY, *supra* note 16, at 295.

111. Barrett, *supra* note 11, at 371. Another example of the weakening of the Kyoto Protocol is that countries like Canada, in acceding, have actually unilaterally claimed credits (in the case of Canada – 30 percent credit for exports of "clean" energy to the U.S.). Hot air refers to the surplus of emission reduction for the former communist countries of Europe. For example, Russia is required to stabilize (0% increase) its emissions under the Kyoto agreement, but. in actual fact its emissions in 2000 were roughly 70 percent of the 1990 level. With the surplus emission reduction, other countries can trade with Russia to comply with their obligation; in other words, not by reducing emissions, but by paying Russia to transfer a portion of its surplus. Barrett, *supra* note 110, at 294.

112. *See* Barrett, *supra* note 11, at 371-74.

113. Thomas, *supra* note 3, at 821.

114. *Id.*

115. Barrett, *supra* note 11, at 371; *see also* Nanda & Pring, *supra* note 15, at 294-300 (discussing the U.S.'s position during the Kyoto negotiations and its subsequent decision to withdraw from Kyoto).

116. Richard Benedick, *Morals and Myths: A Commentary on Global Climate Policy*, 109 WZB-MITTEILUNGEN 15, 15 (2005). The UK's official target was 8 percent, but in 1997 its emissions were actually 5 percent lower than 1990. In addition, Russia's target was 100 percent of 1990, but its actual emissions were at least 30 percent below that level due to the collapse of communism. In contrast, the United States, which was enjoying a period of huge economic boom, was by 1997 emitting greenhouse gases at a 12 percent increase from 1990 levels. Interestingly, this created a desire by the United States

negotiations of the Kyoto terms, a group of thirty industrialized nations agreed to reduce their combined GHG emissions by five percent of 1990 levels by 2012. However, in 1997, the combined emissions of these countries were already three percent below 1990 levels.[117] Indeed, many nations at the time knew they would not have to undergo significant reductions to meet the target, with the exception of the United States, which had enjoyed a period of economic boom in the 1990s.[118] Richard Benedick believes that the basic underlying problem with Kyoto was

> a lack of genuine political will on all sides. After years of wrangling over further weakening its provisions, the treaty finally became law in 2005, but the self-congratulations could not disguise that its impact on global emissions is negligible and its short-term orientation makes it impossible for industry to plan long-term investments.[119]

In sum, because of the negotiation process, the parties to the Protocol eventually signed and ratified a significantly diluted treaty. Moreover, unlike the successful *framing* of the game which created a conducive environment during the early days of the Montreal Protocol, the parties to the Kyoto Protocol have created an environment where costs are significantly different for states, where the U.S. has a dominant strategy to continue polluting, and where even participating countries have incentive to ignore their obligations.

2. The Exclusion of Developing Countries from Binding Targets

The Kyoto Protocol currently imposes quantitative restrictions on industrialized countries, but does not impose similar obligations on developing countries.[120] Although the Montreal Protocol had to overcome the same difficulties with regards to developing nation participation, the Montreal Protocol was successful in adopting a more rational sequential approach to negotiations. First, the parties to Montreal focused on creating binding targets for industrialized nations and hence tackled the most pressing issue first.[121] Only then did the parties turn to the sensitive but secondary issue of developing world participation. The negotiators therefore managed to solve the common but differentiated responsibility dilemma by separating the two fundamental issues of industrial commitments and developing world commitments. At the Kyoto negotiations, however, the issue of developing world participation became entangled with negotiations over binding targets in the industrial world. As Laura Thomas states, "the climate change negotiations have taken an 'inclusive' approach in which both

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to secure an emissions trading scheme, so that it could essentially make up for its projected inability to comply with the targets by buying emissions credits from Russia. At the same time, the EU opposed (and correctly so) such a scheme under the pretext that it would easily meet its emissions targets. However, after U.S. withdrawal, the parties to the Kyoto Protocol nevertheless included an emissions trading scheme. Then, when it became clear that the EU would not likely meet its obligatory targets, it actively enticed Russia to ratify in order to gain access to its excess emissions credits. *Id.*

117. *Id.* at 15.

118. *Id.* at 16.

119. *Id.* at 17.

120. Kyoto Protocol, *supra* note 97, annex B; *see also* Barrett, *supra* note 11, at 370.

121. Thomas, *supra* note 3, at 837-39.

industrialized and developing nations have been involved in the negotiating process."[122] Compounding the problem, many industrialized nations have been reticent to agree to meaningful binding targets without the simultaneous participation of developing countries.[123] In this way, misplaced focus on the developing world undermined and significantly diluted negotiations that should have been focused solely on binding targets for industrialized countries. Indeed, involvement of developing countries in the initial negotiations undermined the parties' ability to *form* and *frame* a clear and foreseeable series of iterations (or games representing different stages of agreement), through which uncertainty would not have undermined cooperation.

The inclusion of binding targets for the developing world, albeit at a later stage, is necessary to the long run effectiveness of the Kyoto Protocol. The argument for imposing mandatory obligations on developing countries is not that their exclusion is unfair, but rather, that a partial agreement (one not including developing countries) is environmentally ineffective and costly at the same time because the Annex 1 industrial countries would presumably undertake significant costs only to see emissions migrate to developing countries.[124] In addition to concerns for production shifting, many critics point out that without the participation of developing nations, particularly those with high growth rates, the Kyoto Protocol will have a negligible effect on global greenhouse gas emissions.[125] It is significant that eight of the top twenty emitter countries are rapidly industrializing, highly competitive "developing" countries.[126] Moreover, India's greenhouse gas emissions exceed Germany's, those of South Korea exceed France, and China recently became the largest emitter of greenhouse gases in the world.[127] Yet, none of these countries is obligated to comply with the Kyoto Protocol. While many development scholars argue that the industrialized countries need to lead by example, Barrett counters that leading by example is fundamentally flawed because, if the current parties obligated under Kyoto *do succeed* in reducing their emissions substantially, the costs paid by their respective industries will rise and the incentive for other countries (developing countries) will fall because of a shift in comparative advantage, or leakage.[128] In addition, it is generally the case that

122. *Id.* at 839.

123. *Id.*

124. Barrett, *supra* note 11, at 305. The concept of trade leakage is discussed *supra* text section III(B)(1).

125. *See* Thomas, *supra* note 3, at 821-22.

126. *See* Parker & Blodgett, *supra* note 9, app. A.

127. *Id.*; *see China Tops U.S. in Greenhouse Gas, Group Finds*, N.Y.TIMES, June 21, 2007, at A; *see also* Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 S. CAL. L. REV. 905 (2008) (discussing how to create incentives for China and the United States to make prompt, large emissions reductions in light of the fact that they are the two largest emitters of GHGs).

128. Barrett, *supra* note 110, at 283-84. It should be noted that the author does not mean to undermine the reality that the industrialized countries are certainly responsible for the vast majority of the increase in GHG emissions over the past few decades, and that they need to take on significant costs as a result. This paper merely seeks to point out that developing nations collectively will soon overtake the industrialized (Annex 1) countries in global GHG emissions, and hence, must become part of a long-term solution.

wider participation in environmental treaties significantly lowers the cost to each individual country participant.[129] To put the exclusion of developing nations into perspective, Scott Barrett highlights that:

> [T]he Kyoto Protocol would only limit the emissions of about 30 of the world's 200 or so countries by only about 5 per cent for a period of just 5 years. Even if Kyoto worked as intended, the emissions of the countries unconstrained by the agreement would rise, making it very unlikely that Kyoto would even stabilize global emissions, let alone reduce them, even over such a short period.[130]

3. Unfavorable Cost-benefit Structures of Participation

Undoubtedly, one of the largest factors undermining the Kyoto Protocol is that, under the current terms, the treaty has an unfavorable cost-benefit structure. Mitigating climate change will present the industrialized nations with "unprecedented challenges, because it can only be achieved through extraordinary changes in the production and consumption of energy, thus affecting virtually all areas of economic activity..."[131] This cost cannot be avoided, and must be undertaken by the global community to begin to reverse the effects of global warming. However, under the current climate change regime, incentives are not structured to minimize non-cooperation payoff structures and do not coincide with the optimum cost-benefit positions.[132] Bohringer and Finus argue that "decision-making in climate policy requires balancing total costs of greenhouse-gas-emission abatement and total benefits of avoided undesirable consequences of global warming."[133] They also note that abatement costs are equalized across time.[134] That is, abatement should be undertaken when it is cheapest and most effective, taking into account that such abatement costs can lower as technology progresses. Such arguments suggest that the Kyoto should create targets and timetables that are sensitive to the immediate high costs of such reductions, with the aim of increasing target reductions as costs start to fall.

To add to this, Barrett and Sustein argue that the Kyoto Protocol needs to restructure its payoffs to create incentives for wide participation and to encourage compliance.[135] This is based on the premise that the current climate change regime presents a Prisoner's Dilemma, where the dominant strategy is to pollute (or fail to comply). Instead, the parties to the Kyoto Protocol need to create an environment that is more reflective of that present in a game of Harmony, where the dominant strategy is cooperation or abatement. Remember, in a choice between continuing to

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129. *Id.* at 304.

130. Barrett, *supra* note 110, at 288.

131. *See* Rudiger Wolfrum & Jurgen Friedrich, *The Framework Convention on Climate Change and the Kyoto Protocol, in* ENSURING COMPLIANCE WITH MULTILATERAL ENVIRONMENTAL AGREEMENTS: A DIALOGUE BETWEEN PRACTITIONERS AND ACADEMIA 53, 53 (Ulrich Beyerlin, Peter-Tobias Stoll & Rudiger Wolfrum eds., 2006).

132. Bohringer & Finus, *supra* note 17, at 254-55 (discussing optimum cost-benefit positions).

133. *Id.* at 254.

134. *Id.* at 255.

135. *See* Barrett, *supra* note 11, at 389.

pollute and abating pollution, countries will choose to do that which presents a higher payoff.[136] It is, therefore, imperative that the climate change regime improve incentives to cooperate or diminish payoffs associated with non-cooperation.

One suggestion is the inclusion of trade restriction mechanisms similar to those under the Montreal Protocol.[137] Article IV of the Montreal Protocol successfully led to increased country participation by providing market incentives to join and diminishing the payoff structure of non-cooperation by deterring trade leakage. Indeed, because the industrialized countries did not have to worry about trade leakage, they were far more willing to accept binding targets with the knowledge that trade restrictions, coupled with financial incentives, would encourage broader participation at a later stage.[138] The Kyoto protocol, however, includes no such trade restrictions, and industrialized countries do not enjoy the security of assured mutual participation. The inclusion of trade restriction mechanisms would ultimately *reform* and *reframe* the game by assuring higher expectations of compliance in others. In this way, the Prisoner's Dilemma faced by most parties to the Kyoto Protocol, could be changed to represent a situation more like the game of Harmony.

An examination of the underlying reasons for the U.S. withdrawal from the Kyoto Protocol offers convincing proof of the need for renewed incentives to encourage participation. Sustein argues that the cost-benefit of participating and complying with the Kyoto Protocol suggest that the U.S. should not comply with the Kyoto Protocol even if all other countries do. Sustein states:

> To the United States, the monetized benefits of the Montreal Protocol dwarfed the monetized costs, and hence the circumstances were extremely promising for American support.... The Kyoto Protocol presented a radically different picture... the monetized benefits of the Kyoto Protocol would be dwarfed by the monetized costs...Hence the circumstances were unpromising for a successful agreement – and they were especially unpromising for American participation...[139]

It is plausible to suggest that the U.S. will only participate in an agreement that leads to at least a convergence of the perceived domestic costs of emission reductions with that of the perceived domestic benefits from such reduction.[140] In

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136. For a more complete discussion on the Prisoner's Dilemma and its application to multilateral environmental treaties *see generally* Barrett, *supra* note 11, at 53-61, 196, 290.

137. It should be noted, however, that a trade restriction mechanism would be far more difficult to create and manage than that created for ODSs; however, some scholars have proposed that it is certainly possible. One thing is clear – the Kyoto Protocol could certainly benefit from "a better integration of the two competing realms of international trade and environmental law." Thomas, *supra* note 3, at 850.

138. *Id.*

139. Sunstein, *supra* note 1, at 5-6. This cost-benefit analysis also helps to explain why there are different levels of compliance between the Montreal Protocol (which enjoys near perfect compliance) and the Kyoto Protocol (which is known to suffer from widespread non-compliance).

140. WILLIAM NORDHAUS & JOSEPH BOYER, WARMING THE WORLD 162-68 (2000). Norhaus and Boyer tabulated the costs associated with the U.S. involvement in Kyoto. According to them, for the U.S., under a treaty that involves a trading scheme, the cost of compliance would be roughly $325

this regard, convergence will take place when the climate change regime creates incentives that either increase the benefits of participation (mitigating the cost of participation) or increase the cost of *non-participation*. It is in the latter notion of increasing the costs of non-participation that the current regime can affect the most change. Again, a good example is the inclusion of trade restriction measures like those under the Montreal Protocol, which effectively create an incentive for countries to participate, and impose significant costs on non-participation.

4. Unfavorable Cost-benefit Structures of Compliance

With the notable exception of the U.S., and the non-binding obligations imposed on developing countries, the Kyoto Protocol enjoys a significant participation with 174 parties. But is this enough? The majority of literature devoted to answering this question maintains that it is not. Indeed, several critics point to the fact that despite the broad participation in the Kyoto Protocol by industrialized nations, compliance remains largely weak.[141] The larger point is, therefore, that despite significant participation, climate change issues are not being adequately solved, bringing the efficacy of the Kyoto Protocol into question.

Thus, in addition to broad participation, an effective multilateral environmental agreement necessarily needs to "deepen" cooperation.[142] Indeed, many scholars argue that broad participation can, in fact, be a product of mostly shallow cooperation.[143] To deepen cooperation, a treaty or MEA must necessarily design an effective compliance system to enforce commitments. Compliance systems therefore play an important role in *framing* the rules of the game. Scholars devoted to the study of compliance and enforcement advance two general approaches to maintaining compliance: (1) an "enforcement approach" where non-compliance is deterred through the use of threats, sanctions and other methods of punishment; and (2) a "management approach" where the parties clearly delineate obligations and use positive incentives to encourage compliance with these obligations.[144] While both approaches seek the same outcome, they use very different means of ensuring such an outcome. Frischmann describes how the enforcement approach uses a variety of "hard" sanctions (such as trade sanctions or economic penalty), whereas the management approach uses a variety of "soft" sanctions (such as noncompliance reports and privilege suspension).[145] A closer look at the Montreal Protocol, however, illustrates that the two approaches are not

billion. In the same light, the benefits of complying with the Kyoto Protocol are estimated to be roughly $12 billion. For the world as a whole, the costs are actually lower, standing at about $217 billion. On the other hand, according to estimates, the cost of climate change globally stands to be around $4 trillion. As a result, it is difficult to doubt that any treaty that has the potential to mitigate such costs is not a worthy goal; however, in the case of Kyoto, the net benefits are at best marginal because it will only have a small effect on aggregate emissions worldwide.

141. *See, e.g.*, Sunstein, *supra* note 1, at 4; *see also* Parker & Blodgett, *supra* note 9, at 12.

142. *See* George Downs et al., *Is the good news about compliance good news about cooperation?*, 50 INT'L ORG. 379, 383 (1996).

143. *See, e.g.*, David G. Victor, *Enforcing International Law: Implications for an Effective Global Warming Regime*, 10 DUKE ENVTL. L. & POL'Y F. 147, 152 (1999).

144. *See, e.g.*, Frischmann, *supra* note 16, at 737.

145. *Id.* at 738-39.

necessarily mutually exclusive. In fact, the Montreal Protocol's use of both enforcement approaches ultimately plays a large role in ensuring almost full compliance. For example, the trade restriction mechanism (hard sanction) helps to encourage participation, while reporting requirements and technical assistance (soft sanctions) help to undermine uncertainty and encourage compliance.[146] Why then, can the Kyoto Protocol not adopt the same approach?

Shallow cooperation, at least concerning the Kyoto Protocol, is encouraged because of the fact that enforcement mechanisms are not legally binding and can only become legally binding by an amendment.[147] Since any party can decline to ratify an amendment, it can avoid being punished for failing to comply.[148] Moreover, the current compliance mechanisms under the Kyoto Protocol, agreed on in Bonn in 2001, are fundamentally flawed. It is even suggested that they merely encourage *non-compliance* and might actually encourage *non-participation*.[149] Currently, if a party does not meet its obligations it can be "punished" in two ways: (1) by accepting additional reductions in its emissions during the control period following the period in which the country failed to comply, and (2) by being excluded from the emission trading scheme.[150] Thus, the enforcement mechanisms merely delay punishment and actually ignore the fact that delayed penalties increase participation costs with each control period. In this way, the non-compliance measures make non-participation *more* attractive.[151] This does not mean that the Kyoto Protocol is incorrect for trying to encourage states to comply with their obligations. On the contrary, "coercive enforcement measures are sometimes needed, particularly when the cooperation is deep and incentives to defect are high."[152] This would suggest that there is a trade-off between encouraging participation and deepening cooperation. The Montreal Protocol provides a good example of a treaty that established a healthy balance between the two: creating an optimum cost-benefit structure to encourage participation through incentives, including adequate enforcement mechanisms to deepen cooperation. Kyoto, on the other hand, has large participation, a sub-optimal cost-benefit structure and inadequate enforcement mechanisms to encourage deeper cooperation.

146. *See id.* at 797-804; Weiss, *supra* note 44, at 147, 152-53.

147. Kyoto Protocol, *supra* note 97, art. 20. Article 20 states that an amendment requires at least three-fourths of the parties present and voting at the meeting.

148. Barrett, *supra* note 11, at 384.

149. *Id.* at 384, 386.

150. *Id.* at 386.

151. *Id.* Another flaw is that compliance relies on self-punishment, in that it is only legally binding if a nation chooses to ratify any such amendment. Countries that are most likely to fall short of compliance will be the very countries that are least likely to approve such an amendment.

152. Teall Crossen, *Multilateral Environmental Agreements and the Compliance Continuum*, 16 GEO. INT'L ENVTL. L. REV. 473, 493; *see also* Victor, *supra note* 143, at 151.

V. CONCLUSION AND RECOMMENDATIONS

Scott Barrett sums up participation in the Kyoto Protocol as follows:

> The USA failed to participate (at least in part) because the costs of participation were high. Other countries agreed to participate (at least in part) because the costs to them of participating were low (as is true for some EU states), zero (as is true for all non-Annex I states) or even negative (as is true for the states given 'hot air' allowances). The Annex I countries likely to have the hardest time complying (Canada and Japan) agreed to participate only on the condition that their initial reduction obligations be diluted.[153]

Thus, one can see that the negotiations leading up to the creation of the Kyoto Protocol ultimately led to a diluted agreement that has done very little to curb GHG emissions, and will continue to do very little unless significant changes are made. On the contrary, the Montreal Protocol is a model of efficacy and effectiveness in that it enjoys near perfect compliance and has done a great deal to reverse damage to the ozone layer.[154] While the two agreements were created to address the two most significant environmental threats facing mankind, their structure, provisions, and respective mechanisms have led to radically different outcomes.

The goal of any MEA is to encourage both broad participation and deep cooperation. However, the Kyoto Protocol exhibits mostly broad participation, along with shallow cooperation and weak compliance. This was a result of the failed negotiation process that created a settlement for the lowest common denominator of the parties to the agreement.

However, to encourage deeper cooperation, the Kyoto Protocol needs to restructure incentives to ensure participation *and* compliance. Such incentives include encouraging participation and then discouraging "defection" by implementing coercive compliance mechanisms that change the cost-benefit structure of potential defection. Such a treaty would satisfy the following criteria introduced at the start of this paper:

> *Individually rational*: such individual rationalism comes about when the cost-benefit assessment is favorable for a nation to gain (or at least not lose significantly) from treaty participation, either through the costs of non-participation or direct benefits of participation.
>
> *Collectively rational*: such rationalism is created when countries are encouraged to participate *and* comply with the obligations imposed by the treaty by creating a system of incentives, constrained by the credibility of threats or enforcement mechanisms to discourage defection.

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153. Barrett, *supra* note 110, at 295.

154. Indeed the Montreal Protocol has even had a substantial effect on climate change mitigation because ODSs also contribute to climate change and, hence, their phase-out has provided substantial climate change mitigation. Donald Kaniaru et al., *Strengthening the Montreal Protocol: Insurance Against Abrupt Climate Change*, 7 SUSTAINABLE DEV. L. & POL'Y 3, 3 (2007).

Fair: in that it must be perceived by the parties as being legitimate, reinforcing the individual and collective rationality of the agreement.[155]

To date, there has been significant legal scholarship on proposed alternatives to the Kyoto Protocol. However, some of the most common proposals can be listed as follows:

(1) Broader participation by industrial and developed nations is needed to address the global commons problem effectively and efficiently. Such proposals include measures such as "growth targets"[156] or creating an annex for fast-growing developing countries like China, India and Brazil.[157] Moreover, industrialized countries can also create a similar fund to that created under the Montreal Protocol in order to lower the cost to developing countries through direct and in-kind transfers. In this way, the offer of side payments can be a strategic choice in that the transfer of money and technology can help ensure that countries that would have lost by participating, can now reap the benefits of participation.

(2) Include a more comprehensive and fully integrated global emission trading scheme that would allow businesses instead of governments to decide for themselves how to spend money on cutting emissions by setting a variable carbon price.[158] In the alternative to a trading scheme, a viable carbon taxing system would likely provide the same amount of flexibility. Any foreseeable agreement on this raging debate would likely include both measures.[159]

(3) Include measures and mechanisms in the Kyoto Protocol to prevent trade leakage. Indeed, it was the trade restrictions, along with the

155. *See* Barrett, *supra* note 11, at xii-xiv.

156. Olmstead & Stavins, *supra* note 99, at 35.

157. *See generally* Halvorssen, *supra* note 101, at 248.

158. *See* Fiona Harvey, *UN carbon tax advocacy opens old wounds*, FIN. TIMES, Nov. 28, 2007. The targets and timetables approach of the Montreal Protocol served to put producers and the relevant industries on notice that alternative technology was going to have to be developed in light of eventual cuts, or even complete phase-outs. In this way, the parties gave private business the go-ahead to start investing in alternatives to CFCs. The resulting incentive then became for producers to be the first to produce and market CFC alternatives to be sold around the world. Indeed, once substitutes became available, developing nations were more inclined to use such technology over obsolete CFC technology. An example of how this process worked is illustrated by Dupont's announcement one year prior to the Montreal Protocol that it believed it could produce an alternative within five years, but the regulatory environment had not given them enough incentive to justify the required investment. By late 1988, Dupont and several other companies had created alternative chemicals. Currently there are a growing number of companies that view climate change regulation as inevitable, and some are even starting to propose that the US ratify the Kyoto Protocol to create conditions of investment certainty. In addition, many companies are now taking the position that the Kyoto Protocol could offer market opportunities and are pressing the US to reconsider its position. *See generally* Thomas, *supra* note 3, at 810 (noting that the targets and timetables approach adopted by the Montreal Protocol had the additional benefit of sending signals to CFC producing businesses that investments in alternatives would be profitable).

159. *See* Editorial, *Groundhog Day*, FIN. TIMES, Nov. 278, 2007.

compensation mechanisms to developing countries for incremental costs that led to a much broader participation among the developing world in the Montreal Protocol. While such a provision would undoubtedly be harder to administer under Kyoto, a "hybrid" version could be created to ensure adequate administration and enforcement. Trade restrictions do two things: (1) punish those that do not cooperate, and (2) correct for losses in "competitiveness" of the countries that do participate. Also, trade restrictions encourage participation, and with higher participation, the detrimental concerns of competitiveness are lower.

(4) Kyoto should facilitate more technology transfer and joint research and development (R&D) on a global scale.[160] The Montreal Protocol encourages the sharing of R&D between participants and even between participants and non-participants.[161] In addition, improving the technological capacity of all countries encourages participation because the cost of participation is lowered if a country is given a leg-up in the form of cleaner technology before joining an agreement that obliges it to undertake significant emissions reductions.

(5) Improve compliance and enforcement mechanisms to encourage compliance from the industrialized countries. Here, it might be proactive to include the ability to adjust compliance mechanism without party ratification, as is required for an amendment.

The Parties to the Kyoto Protocol met in Bali between December 3 to December 14 of 2007 to discuss a successor to the Kyoto Protocol.[162] Politics did, and will continue, to inevitably play a large role in the future of climate change mitigation. However, to have a significant and lasting impact on GHG emissions, the successor to the Kyoto Protocol must include adequate incentives to encourage broad participation, deepen cooperation, and encourage widespread compliance. The fate of the earth's fragile climate is at stake, and with the Kyoto Protocol's relatively lackluster impact on mitigating climate change, politics needs to give way to efficient, efficacious, and lasting solutions that can turn the corner in a somewhat stalled climate change regime.

160. For a complete discussion of what type of research and development measures should be incorporated into the Kyoto Protocol, and what role such measures could play, *see* Barrett, *supra* note 11, at 391-98.

161. Montreal Protocol, *supra* note 49, art. 9; *see also* Barrett, *supra* note 11, at 309-10, 393-94 (noting that an indication of the lack of effectiveness behind Kyoto is that in many of the most pro-Kyoto countries, government funded energy R&D actually decreased). Indeed a reverse relationship exists too: creating more of an incentive for Kyoto participation through effective compliance will undoubtedly speed up R&D for alternative technology.

162. *See* Fiona Harvey and John Aglionby, *Bali near deal to save forests*, FIN. TIMES, Dec. 12, 2007.