Assessing Climate Agreement Principles: The Tension Between Early Equivalent Actions and Variable Costs

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INTRODUCTION

The December 2009 Conference of the Parties ("COP") to the United Nations Framework Convention on Climate Change ("UNFCCC" or "Framework Convention")[1] in Copenhagen, Denmark marked a moment of truth for collective efforts to limit the greenhouse gas ("GHG") emissions that lead to global climate change.[2] In 2001, the United States made clear that it would not participate in further negotiations on the implementation of the Kyoto Protocol to the UNFCCC, citing the costs of complying with the agreement as a reason for its rejection of the protocol.[3] Despite this setback, other parties to the UNFCCC and the Kyoto Protocol continued efforts to reduce GHG emissions and to design a new international agreement that will address global climate change more effectively.[4] Indeed, in the years since the Kyoto Protocol was negotiated, the architecture for the next agreement has received great attention, with particular focus on how to induce the largest GHG emitters—especially the United States—to commit to

1. United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107 [hereinafter UNFCCC], *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf.

2. The Copenhagen climate change conference took place after this Note was completed. The final outcome of the conference was mixed. There was unprecedented direct head of state engagement in the talks, but the meeting did not produce a formal legal successor to the Kyoto Protocol. It did produce an accord noted by the final decision of the Conference of Parties, to which Annex I parties can subsequently add commitments for interim emissions reductions. Climate negotiations to produce a formal successor agreement will continue in the coming years. *See* International Institute for Sustainable Development, *Summary of the Copenhagen Climate Change Conference: 7–19 December 2009*, 12 EARTH NEGOTIATIONS BULL., Dec. 22, 2009, at 1–2, 27–29, *available at* http://www.iisd.ca/download/pdf/enb12459e.pdf; *see also* Andrew C. Revkin & John M. Broder, *A Grudging Accord in Climate Talks*, N.Y. TIMES, Dec. 20, 2009, at A1.

3. *See* Edmund L. Andrews, *Bush Angers Europe by Eroding Pact on Warming*, N.Y. TIMES, Apr. 1, 2001, at A3. For a discussion of the political machinations surrounding the American withdrawal from the Kyoto Protocol and the Bush administration's move away from binding actions to address climate change, see RON SUSKIND, THE PRICE OF LOYALTY 121–22 (2004).

4. *See generally* Kyle W. Danish, *An Overview of the International Regime Addressing Climate Change*, 7 SUSTAINABLE DEV. L. & POL'Y 10 (2007).

meaningful emissions limits.[5] The questions for ongoing climate negotiations in the wake of the Copenhagen meeting are whether and to what extent they will effectively include significant emitters.

In December 2007, environmental and foreign affairs officials from all over the world gathered in Bali, Indonesia for the UNFCCC's thirteenth Conference of the Parties ("COP 13")—the regular meeting of countries that have signed the Convention—to develop a roadmap for future climate change agreements.[6] The Bali Action Plan ("BAP"), adopted as a decision of the parties at the end of COP 13, and subsequent negotiating documents call for developed countries to take immediate actions to mitigate climate change and for each party's efforts to be "comparable" to those of the other parties.[7] The Plan suggests that two core principles of the current international framework for addressing climate change will carry forward. The first principle is early action: some parties, as a result of their level of economic development, should take early steps to reduce emissions while allowing developing countries to delay action.[8] The second principle is equivalent action: similarly

5. For an excellent collection of these proposals, see ARCHITECTURES FOR AGREEMENT: ADDRESSING GLOBAL CLIMATE CHANGE IN THE POST-KYOTO WORLD (Joseph E. Aldy & Robert N. Stavins eds., 2007) [hereinafter ARCHITECTURES FOR AGREEMENT], which is the outgrowth of The Harvard Project on International Climate Agreements. The Project continues to publish working papers and reviews of new proposals, and its website is indispensible. The Harvard Project on International Climate Agreements, http://belfercenter.ksg.harvard.edu/project/56/harvard_project_on_international_climate_agreements.html (last visited Jan. 23, 2010). For a general discussion of why this question is important, see SCOTT BARRETT, WHY COOPERATE?: THE INCENTIVE TO SUPPLY GLOBAL PUBLIC GOODS 85–102 (2007) [hereinafter BARRETT, WHY COOPERATE?].

6. International Institute for Sustainable Development, *Summary of the Thirteenth Conference of Parties to the UN Framework Convention on Climate Change and Third Meeting of Parties to the Kyoto Protocol: 3–15 December 2007*, EARTH NEGOTIATIONS BULL., Dec. 18, 2007, at 1 [hereinafter *Summary of the Thirteenth Conference*], *available at* http://www.iisd.ca/download/pdf/enb12354e.pdf. *See also* Raymond Clémençon, *The Bali Road Map: A First Step on the Difficult Journey to a Post-Kyoto Protocol Agreement*, 17 J. ENV'T & DEV. 70, 70–71 (2008).

7. UNFCCC Conference of the Parties, Bali, Indon., Dec. 3–15, 2007, *Decision 1/CP.13: Bali Action Plan, in Report on Conference of the Parties on its Thirteenth Session: Addendum*, ¶1(a)(i), U.N. Doc. FCCC/CP/2007/6/Add.1* (Mar. 14, 2008) [hereinafter Bali Action Plan], *available at* http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3; UNFCCC Secretariat, Ad Hoc Working Group on Long Term Cooperative Action Under the Convention, *Ideas and Proposals on the Elements Contained in Paragraph 1 of the Bali Action Plan: Submissions from Parties*, pts. I and II, FCCC/AWGLCA/2009/MISC.4 (Part I) and FCCC/AWGLCA/2009/MISC.4 (Part II) (May 19, 2009), *available at* http://unfccc.int/resource/docs/2009/awglca6/eng/misc04p01.pdf *and* http://unfccc.int/resource/docs/2009/awglca6/eng/misc04p02.pdf.

8. Robert N. Stavins, *Can an Effective Global Climate Treaty Be Based on Sound Science,*

situated parties should take on similar commitments out of fairness to other parties.[9]

This Note explores the inherent tension between the principles of early action and equivalent action on one hand, and the variable costs and benefits of addressing climate change on the other hand. Part I maintains that the dual principles of early and equivalent action have become entrenched in the current international framework for addressing climate change. Part II discusses how these principles are incorporated into the design of an agreement. Part III posits that these principles have the potential to skew parties' incentives to participate in an agreement because of the variable costs of climate change. Part IV assesses the Kyoto Protocol and argues that it failed to balance these principles successfully against the variable costs of climate change. The Note concludes that the mechanism for managing this tension is a useful indicator of a future emission agreement's potential success. It suggests that a successful agreement should allow short-term flexibility while measuring and verifying those actions in a way that provides long-term certainty for emissions reductions.

I. EARLY AND EQUIVALENT ACTION FOR CERTAIN PARTIES: THE UNITED NATIONS FRAMEWORK CONVENTION AND THE KYOTO PROTOCOL

The structure of the Framework Convention and the subsequent Kyoto Protocol reflect the principles of early action by developed countries and the establishment of an equivalent action baseline. As explained further below, the Framework Convention created the basic architecture of distinguishing between certain parties on the basis of economic development, and suggested that developed countries have a greater initial responsibility to reduce emissions. The Kyoto Protocol to the Framework Convention formalized the notion of equivalent action.

Rational Economics, and Pragmatic Politics? 8 (Resources for the Future, Discussion Paper 04-28, 2004) [hereinafter Stavins, *Sound Science, Rational Economics, and Pragmatic Politics*], *available at* http://www.rff.org/documents/RFF-DP-04-28.pdf.

9. Jake Schmidt et al., Presentation at Future Actions Dialogue Tokyo, Japan, Developed Country Further Emissions Reductions: What is "Comparable Effort"? (Feb. 12, 2008).

A. The Current International Architecture

1. The Framework Convention

The Framework Convention represents the first collective effort to address climate change through an internationally binding agreement. Accordingly, it has played an important role in establishing the principles that underlie subsequent agreements.[10] The UNFCCC creates (as its name would suggest) a framework for continued assessment and discussion of the climate change problem, laying out a goal for addressing global climate change and a process for assessing the problem and developing further agreements.[11] Signatories to the Framework Convention meet to discuss ongoing issues at Conferences of the Parties ("COP").[12] As necessary, Parties can develop more specific commitments through new additions to the Framework Convention ("Protocols" in UNFCC parlance), which require separate signing and ratification.[13]

Three specific elements of the UNFCCC have played an important role in defining the extent to which it and any future protocols will limit emissions, and how the Parties will be expected to make those reductions. First, Article 2 of the Framework Convention aims to "stabiliz[e] . . . greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[14] Second, the

10. Multilateral negotiations between more than 150 nations began in 1990 and were completed in 1992, when the UNFCCC was opened for signatures at the Earth Summit in Rio de Janeiro, Brazil. *See* PEW CENTER ON GLOBAL CLIMATE CHANGE, CLIMATE CHANGE 101: INTERNATIONAL ACTION 3 (2009), *available at* http://pewclimate.org/docUploads/Climate101-Intl-Jan09.pdf. For further background on the UNFCCC and the negotiating process, *see* INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT, A BRIEF INTRODUCTION TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, *available at* http://www.iisd.ca/process/climate_atm-fcccintro.html (last visited Jan. 23, 2010). As of 2007, 191 nations and the European Community had joined the Convention, forming the body of Parties to the Convention. U.N. Framework Convention on Climate Change Secretariat, *Uniting on Climate: A Guide to the Climate Convention and its Kyoto Protocol* 12 (2007) [hereinafter *Uniting on Climate*], *available at* http://unfccc.int/resource/docs/publications/unitingonclimate_eng.pdf.

11. *Uniting on Climate*, *supra* note 10, at 12.

12. *Summary of the Thirteenth Conference*, *supra* note 6, at 1.

13. *See* UNFCCC, *supra* note 1, at art. 2.

14. *Id.* It should be noted that "dangerous anthropogenic interference" is undefined, leading to an ongoing debate about the exact goal of the Convention. *See* SCOTT BARRETT, ENVIRONMENT AND STATECRAFT 368–69 (2003).

Framework Convention recognizes "common but differentiated responsibilities and respective capabilities" of different nations.[15] To that end, it divides the parties into different groups according to the state of their economic development. The Framework Convention classifies developed countries as "Annex I" and "Annex II" countries, and treats developing countries separately.[16] Finally, Article 2 states that stabilization of GHG concentrations should be achieved in a way that allows "economic development to proceed in a sustainable manner."[17]

2. Developing Binding Emissions Targets: The Kyoto Protocol

In 1997, the Kyoto Protocol was adopted at the third COP in Kyoto, Japan.[18] The most important element of the Kyoto Protocol is specific emissions limits for developed countries. The Protocol established binding emissions reductions for Annex I parties and defined those emissions limits as nearly equivalent percentage reductions from a fixed baseline.[19] It did not, however, include emissions targets for Annex II parties, including developing countries emerging as major emitters (e.g., China and India).[20] The Protocol was also silent on what emissions reductions would be required after 2012 and which countries would be required to reduce emissions after the first commitment period.[21]

Commitments for Annex I parties were specified individually and established as an annual average target for a "commitment period" from 2008 to 2012.[22] The Protocol set a binding target for Annex I parties collectively to reduce GHG emissions to five percent below 1990 levels by 2012,[23] and listed emissions targets for thirty-eight countries and for the fifteen members of the European Union.[24] Table 1 provides examples of these targets. Through the similarity

15. UNFCCC, *supra* note 1, at art. 3.
16. Danish, *supra* note 4, at 10–11.
17. UNFCCC, *supra* note 1, at art. 2.
18. *Uniting on Climate*, *supra* note 10, at 12.
19. Danish, *supra* note 4, at 11.
20. *Id.* at 11, 15.
21. *Uniting on Climate*, *supra* note 10, at 37.
22. *Id.* at 27. Specific details of how the Protocol and the emissions targets would be implemented were negotiated after Kyoto.
23. Danish, *supra* note 4, at 11–12. Parties have a choice of either a 1990 or 1995 baseline for HFCs, PFCs, and SF_6. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 12, 1997, U.N. Doc. FCCC/CP/197/L.7/Add.1, art. 3, *reprinted in* 37 I.L.M. 22 (1998) [hereinafter Kyoto Protocol].
24. *Uniting on Climate*, *supra* note 10, at 27.

of these targets, the Protocol implicitly endorsed and formalized the notion of equivalency of actions.[25]

Table 1: Kyoto Protocol Targets for Selected Countries: Emissions Levels in 2012 as compared to 1990 Emissions Levels[26]	
Australia	+8%
Canada	-6%
European Community	-8%
Japan	-6%
Russia	No change
United States	-7%

Despite its binding targets, it is widely accepted that the Protocol has not succeeded in achieving meaningful global reductions in GHG emissions.[27] Indeed, global CO_2 emissions alone are projected to *increase* by forty-six percent over 1990 levels in 2010.[28]

25. Australia's emissions reduction target, which seems like an outlier when compared to other developed country targets, reflects a calculation based on the "Australia clause" that allowed certain parties to calculate their Annex B targets based in part on emissions expectations from land-use changes. Because Australia is one of the few developed countries with significant net emissions gains from land-use changes, this increased its Kyoto baseline significantly. *See* Clive Hamilton & Lins Vellen, *Land-use Change in Australia and the Kyoto Protocol*, 2 ENVTL. SCI. & POL'Y 145, 145–146 (1999).

26. Kyoto Protocol, *supra* note 23, Annex B.

27. Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1, 4–5 (2007) [hereinafter Sunstein, *Of Montreal and Kyoto*]. Indeed, the Montreal Protocol on Substances that Deplete the Ozone Layer, a treaty that is not even aimed at addressing climate change, may do more to reduce GHG emissions from 2005 to 2012 than the Kyoto Protocol. *See* G.J.M. Velders et al., *The Importance of the Montreal Protocol in Protecting Climate*, 104 PROC. NAT'L ACAD. SCI. 4814, 4818 (2007) (discussing how the Montreal Protocol's restrictions on emissions of chlorofluorocarbons ("CFCs"), which deplete the ozone layer but are also potent GHGs, has had a noticeable impact on reducing GHG concentrations).

28. *See* ENERGY INFORMATION AGENCY, DEP'T OF ENERGY, EMISSIONS OF GREENHOUSE

Many parties are projected to miss their assigned emissions targets. For example, Canada has said it will miss its target of six percent reduction below 1990 levels, with its emissions thirty percent above its Kyoto Protocol target level as of 2007.[29] Japan will need to purchase significant offsets through the Clean Development Mechanism and other trading provisions of the Protocol to meet its target.[30] Europe, on the other hand, has had ongoing emissions reduction progress, and is projected to meet its Protocol targets.[31]

B. Beyond 2012: The Continuation of Equivalency

The Kyoto Protocol is silent on what will be required of its Parties after 2012.[32] In 2005 in Montreal, Parties to both the Kyoto Protocol and the UNFCCC launched a process to develop a successor agreement to the Kyoto Protocol and to start an informal dialogue to address long-term cooperative action under the UNFCCC, allowing all parties, including the United States, to begin contemplating a broader agreement.[33] Following the meeting in Montreal, the Parties agreed to negotiate a framework at COP 13 in Bali, Indonesia in 2007 and to finalize an agreement in Copenhagen, Denmark in 2009.[34]

Decision 1 of the Final Report of COP 13 established the Bali Action Plan, which creates a substantive framework for future climate change negotiations.[35] The language of the BAP was subject to extensive debate, as all parties recognized that the form

GASES IN THE UNITED STATES 2007 7 (2008) (providing calculations).

29. Richard Black, *Canada Sets Reduced Climate Goal*, BBC, Apr. 27, 2007, *available at* http://news.bbc.co.uk/2/hi/science/nature/6600585.stm.

30. Yasuko Kameyama, *Evaluation and Future of the Kyoto Protocol: Japan's Perspective*, 5 INT'L REV. FOR ENVTL. STRATEGIES 71, 73–75 (2004). The Clean Development Mechanism ("CDM") is one of a number of flexible mechanisms for implementation created in the Protocol. The CDM identifies emissions reduction projects in developing countries which are then paid for by Annex 1 parties, allowing them to offset their internal emissions reductions. Danish, *supra note* 4, at 13–14.

31. European Environmental Agency, *Greenhouse Gas Emission Trends and Projections in Europe 2008*, at 6–7, EEA REPORT NO. 5/2008 (2008), *available at* http://www.eea.europa.eu/publications/eea_report_2008_5/at_download/file.

32. *Uniting on Climate*, *supra* note 10, at 37.

33. PEW CENTER ON GLOBAL CLIMATE CHANGE, THIRTEENTH SESSION OF THE CONFERENCE OF THE PARTIES TO THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE AND THIRD SESSION OF THE MEETING OF THE PARTIES TO THE KYOTO PROTOCOL 2–3 (2007), *available at* http://www.pewclimate.org/docUploads/Pew%20Center_COP%2013%20Summary.pdf.

34. *Summary of the Thirteenth Conference*, *supra* note 6, at 15.

35. Clémençon, *supra* note 6, at 72.

of the BAP would greatly influence any subsequent document.[36] Paragraph 1 of the BAP sets forth the objectives for an agreement, including separate approaches for climate change mitigation efforts by developed and developing countries and the continuation of equivalency of action.[37] Specifically, Paragraph 1(b)(i) calls for: "Measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives, *by all developed country Parties*, while ensuring the *comparability of efforts* among them, taking into account differences in their national circumstances."[38] The language of "comparability" was included in the official negotiating texts for the Copenhagen climate talks, where it has been the subject of continued discussion.[39] The comparability language is relatively vague and could lead to different types of agreement and condoned action.[40] Nevertheless, the inclusion of such language, alongside the specification of early action by developed countries, suggests an adherence to the consensus principles developed before Copenhagen. The challenge, then, is to understand how the incorporation of these principles affects the incentives to participate in any future binding agreement.

II. INCORPORATING EARLY AND EQUIVALENT ACTION: FRAMEWORKS AND METRICS

Assuming that the principles of early and equivalent action will remain a feature of international climate agreements, a salient issue is how to define the equivalence of developed nations' actions in addition to measuring and verifying developing countries' actions. There are two aspects of agreement design that address

36. *See id.* at 73–77 (describing the difficult and sometimes contentious nature of the Bali negotiations). *See also* Lavanya Rajamani, *From Berlin to Bali and Beyond: Killing Kyoto Softly*, 57 INT'L & COMP. L.Q. 909, 914–15 (discussing the legal impact within the climate regime of the decisions taken at Bali).

37. The BAP moves away from Annex I and Annex II distinctions to more general "developed" and "developing" language. *Summary of the Thirteenth Conference*, *supra* note 6, at 19.

38. Bali Action Plan, *supra* note 7, ¶1(b)(i) (emphasis added).

39. International Institute for Sustainable Development, *Summary of the Bonn Climate Change Talks: 1–12 June, 2009*, EARTH NEGOTIATIONS BULL., June 15, 2009, at 1, *available at* http://www.iisd.ca/download/pdf/enb12421e.pdf.

40. *See* Scott Barrett, *Climate Treaties and the Imperative of Enforcement*, 24 OXFORD REV. ECON. POL'Y 239, 250 (2008).

the equivalency issue. The first is how the actions called for by the agreement are defined in relation to each other. The second is how those actions are measured.

A. Deciding How to Do It: Defining Actions

The actions required of parties are determined by the agreement's framework—the overall architecture of the agreement that defines the expectations of parties.[41] Because different actions carry different costs for parties, the range of actions targeted in and required by an agreement can have a dramatic impact on how the agreement is perceived.[42] Proposed frameworks can be grouped into three categories: top-down international targets; coordinated domestic policies across different economic sectors; and hybrid approaches.[43]

The first of the three categories covers proposed frameworks that are designed around top-down quantified emissions reductions.[44] Proposals in this category create a single emissions target for each country to meet over a specified time-period, and leave the methods of meeting these targets to each individual country.[45] These proposals extend the overall design of the Kyoto Protocol, in which a multi-lateral emissions reduction target ("cap") is chosen and allocated among the countries that agree to the cap.[46] One option for quantifiable emissions targets is a full extension of the Protocol's cap, with continued reductions from a fixed baseline (usually continuing the 1990 base year).[47] A common alternative is to specify reductions from projected "business-as-usual" emissions instead of a historical baseline.[48] Other approaches include

41. *See* Joseph E. Aldy & Robert N. Stavins, *Introduction: International Policy Architecture for Global Climate Change*, *in* ARCHITECTURES FOR AGREEMENT, *supra* note 5, at 1 [hereinafter Aldy & Stavins, *Introduction: International Policy Architecture*].

42. Barrett, *Climate Treaties and the Imperative of Enforcement*, *supra* note 40, at 252–53.

43. These three categories are adapted from Aldy and Stavin's summary. Aldy & Stavins, *Introduction: International Policy Architecture*, *supra* note 41, at 16.

44. Daniel Bodansky provides an overview of proposals that implement this design. *See* DANIEL BODANSKY, INTERNATIONAL CLIMATE EFFORTS BEYOND 2012: A SURVEY OF APPROACHES 9 (2004) [hereinafter BODANSKY, INTERNATIONAL CLIMATE EFFORTS BEYOND 2012], *available at* http://www.pewclimate.org/docUploads/2012%20new.pdf. One example of these proposals worth noting is found in Jeffrey Frankel, *Formulas for Quantitative Emission Targets*, *in* ARCHITECTURES FOR AGREEMENT, *supra* note 5, at 31.

45. Aldy & Stavins, *Introduction: International Policy Architecture*, *supra* note 41, at 17.

46. BODANSKY, INTERNATIONAL CLIMATE EFFORTS BEYOND 2012, *supra* note 44, at 9.

47. Frankel, *supra* note 44, at 33.

48. *Id.* A "business-as-usual" baseline is a projection of expected emissions growth in the

quantified emissions allowances reflecting "per capita entitlements"—the equal right of each person to emit a certain amount of GHGs—and targets based on each country's comparative responsibility for historic emissions.[49] Finally, variations include more complex formulations that take account of countries' relative wealth.[50]

The second and third categories are related and do not revolve around a universal, top-down, emissions cap. These categories address specific sources of GHG emissions from both individual sectors of the economy and from smaller clusters of nations. Proposals that focus on coordinated or interrelated domestic actions start from a "bottom-up" approach, which examines individual sources of emissions from different economic sectors or, in some cases, national, economy-wide emissions targets.[51] Proposed sectoral frameworks create separate agreements for emissions reductions, management of different sectors of the economy, and, potentially, for different gases.[52] Agreements can be tailored to the countries whose production is relevant to a given sector and to the nature of the sector.[53] For example, a sectoral framework might involve one agreement on technology standards for the aluminum sector amongst the twelve countries that account for the vast majority of aluminum production,[54] and another agreement linking emissions permit markets from the electrical generation sector.[55]

Proposals designed around hybrid approaches also build on coordinated sector-by-sector agreements, but seek to place those agreements in the context of a universal effort to address climate change.[56] These approaches attempt to combine the flexibility of sectoral agreements into a broader agreement that creates a

absence of any regulations or limitations.

49. *Id.*

50. *See id.* at 43–45.

51. Aldy & Stavins, *Introduction: International Policy Architecture*, *supra* note 41, at 22–23; BODANSKY, INTERNATIONAL CLIMATE EFFORTS BEYOND 2012, *supra* note 44, at 9.

52. *See* Scott Barrett, *A Portfolio System of Climate Treaties* 6–7 (Harvard Project on Int'l Climate Agreements, Discussion Paper 08-13, 2008).

53. *Id.*

54. *See* Barrett, *Climate Treaties and the Imperative of Enforcement*, *supra* note 40, at 253.

55. *See* DANIEL BODANSKY, INTERNATIONAL SECTORAL AGREEMENTS IN A POST-2012 CLIMATE FRAMEWORK 3 (2007), *available at* http://www.pewclimate.org/docUploads/International%20Sectoral%20Aggreements%20in%20a%20Post-2012%20Climate%20Framework.pdf.

56. *Id.*

unified approach to reducing emissions.[57] The important feature of these proposals is that the separate agreements are linked as part of an overall strategy to address emissions reduction.[58]

B. Deciding How to Measure It: Metrics Choice

The choice of framework is shaped by how performance metrics are incorporated into the proposed agreement frameworks.[59] There are two primary issues when considering measurement of defined actions: first, which metrics to use to evaluate action; and second, when the measuring occurs—either ex-ante, to shape future promises, or ex-post, to validate actions taken.[60] The two issues are interrelated. Many of the most useful metrics require significant data and calculation, and thus are better suited to ex-post evaluation, while other metrics must be developed early because climate agreements tend to rely on concrete, ex-ante measurements of committed actions.[61]

The options available for types of performance metrics can be split into two categories: measurements of actions and measurements of end results.[62] Measurements of actions include percentage reductions from a fixed base-year and costs of prior actions.[63] The emissions reduction targets in the Kyoto Protocol are an example of measurement of action—the Protocol lays out specific reduction targets below an emissions level from a fixed point in time. This approach continues to appear in climate change mitigation proposals[64] because it provides a relatively easy way to define a commitment that does not rely on significant ex-

57. *See* DANIEL BODANSKY & ELLIOT DIRINGER, TOWARDS AN INTEGRATED MULTI-TRACK CLIMATE FRAMEWORK 1 (2007), *available at* http://www.pewclimate.org/docUploads/Multi-Track-Report.pdf.

58. *See* David Victor, *Fragmented Carbon Markets and Reluctant Nations: Implications for the Design of Effective Architectures*, *in* ARCHITECTURES FOR AGREEMENT, *supra* note 5, at 133–36 [hereinafter Victor, *Fragmented Carbon Markets*].

59. *See* Schmidt et al., *supra* note 9.

60. *See* Carolyn Fischer & Richard Morgenstern, *Metrics for Evaluating Policy Commitments in a Fragmented World: The Challenges of Equity and Integrity* 1–3 (Harvard Project on Int'l Climate Agreements, Discussion Paper 08-17, 2008), *available at* http://belfercenter.ksg.harvard.edu/files/MorgensternWeb2.pdf.

61. *See id.* at 3–5.

62. *See* MICHEL DEN ELZEN ET AL., NETHERLANDS ENVIRONMENTAL ASSESSMENT AGENCY, EXPLORING COMPARABLE POST-2012 REDUCTION EFFORTS FOR ANNEX I COUNTRIES 24 (2008).

63. *Id.* at 25.

64. *See, e.g.*, BODANSKY, INTERNATIONAL CLIMATE EFFORTS BEYOND 2012, *supra* note 44, at 36.

ante data collection or coordination, and can be easily compared and referenced.[65]

Reduction from a fixed point in time encounters two problems. First, choosing a fixed point eliminates consideration of past efforts and ignores predictable future trends.[66] This means that past mitigation efforts are potentially ignored and future emissions trends—either predictable exogenous reductions, which can arise from expected economic contraction, or different rates of increasing emissions, often due to differences in expected economic growth—are not taken into consideration.[67] Second, the choice of a fixed point in time ignores differences in national circumstances that may significantly alter the costs of mitigation across different countries.[68] For example, this method of measurement ignores differences in access to renewable energy, which could reduce the costs of emissions mitigation for countries with a relative abundance of such resources.[69]

Equal reduction from a baseline ameliorates the problem of accounting for future emissions trajectories because a baseline explicitly accounts for this issue, but this also does not account for underlying mitigation potential.[70] Additionally, because it requires agreements on modeling emissions trajectories, reliance on this approach is far more complicated during ex-ante negotiations.[71]

The final alternative for measuring equivalency is for all parties to agree to take actions up to a certain cost—either equal cost per amount of CO_2 reduced or equal total effort as a percentage of gross domestic product in any given year.[72] Measuring costs is more reflective of national circumstances, but requires high levels of data

65. Fischer & Morgenstern, *supra* note 60, at 8–9.

66. *See* Schmidt et al., *supra* note 9.

67. The critical detail to note here is that emissions growth and economic growth are closely intertwined. If one country is expected to have a significant economic contraction or transition, while others are expected to continue growing, it is reasonable to expect that the contracting country's emissions going forward will be reduced, making the emissions target for that country easier to meet than for the growing country. Similarly, if one country is expected to grow more than another, their expected emissions trajectories will be different, with the faster growing country expecting to have greater emissions growth. This, in turn, means it will cost more for the faster growing country to comply with its targets. *See* Stavins, *Sound Science, Rational Economics, and Pragmatic Politics*, *supra* note 8, at 5–8.

68. *See* Schmidt et al., *supra* note 9.

69. DEN ELZEN ET AL., *supra* note 62, at 27, tbl.2.2.

70. *Id.* at 29; *see also* Schmidt et al., *supra* note 9.

71. *See* Schmidt et al., *supra* note 9. *See also* Fischer & Morgenstern, *supra* note 60, at 8–9.

72. Schmidt et al., *supra* note 9.

and agreement on a fair cost level, raising the same issues of ex-ante negotiations.[73]

The alternative approach to measuring action is to measure the end result of mitigation efforts. End-point indicators include per-capita emissions at a future point in time, efficiency levels in a sector at a future point, economy-wide GHG intensity at a future point (the amount of emissions per unit of GDP), or some combination thereof.[74] Equal per-capita emissions are a common goal for developing countries, because they tend to have much lower emissions per capita and thus, presumably, would have room to grow in relation to developed countries.[75] Measuring per-capita emissions is flawed, however, because it does not always account for the cost of emissions reductions for developed countries and is not an effective way to aid developing countries in their development process.[76] Efficiency metrics are more nuanced and allow for closer analysis, but are extremely data intensive, and, in some cases, are difficult to translate into economy-wide emissions reductions.[77] Specifically, they require collecting data across a wide variety of sectors and translating efficiency in a sector into emissions reductions.[78] Because of the data requirements, efficiency metrics also face ex-ante negotiation problems.[79]

C. Design Features in Light of the Incentives to Participate in an Agreement

The range of possibilities for measuring equivalency of action depends on how the definitions of actions and metrics are integrated. Top-down frameworks are most conducive to ex-ante measurement of equivalency in which each party is given a target for reduction based on the overall goal of the agreement.[80] Bottom-up approaches lend themselves to ex-post assessments of

73. *See id.*

74. *Id.*

75. *See* BODANSKY, INTERNATIONAL CLIMATE EFFORTS BEYOND 2012, *supra* note 44, at 13–14.

76. *See generally* Eric A. Posner & Cass R. Sunstein, *Should Greenhouse Gas Permits be Allocated on a Per Capita Basis?*, 97 CAL. L. REV. 51 (2009) (arguing that other types of development assistance might meet the specific needs of a given developing country, instead of wealth transfers based on emissions reductions).

77. *See* Schmidt et al., *supra* note 9.

78. Fischer & Morgenstern, *supra* note 60, at 12–14.

79. *See id.* at 2.

80. *See* Schmidt et al., *supra* note 9.

equivalency because of the difficulty of measuring the impact of the actions prospectively.[81] The question common to both approaches is how the chosen design reflects the complex nature of the incentives to address climate change. Part III of this Note discusses the inherent tension between the variable costs and benefits created by addressing climate change and the notion of equivalency of action.

III. THE CHALLENGE OF CLIMATE CHANGE'S VARIABLE COSTS

The purpose of an international environmental agreement "is to restructure incentives" of the parties to the agreement as they relate to the behavior the agreement seeks to address.[82] Examining how a treaty creates and imposes costs should therefore be considered in light of the incentives to participate. This Part examines why incentives are important, how the costs imposed by compliance with a treaty relate to the incentives to participate in that treaty, and the tension between specific elements of addressing global climate change and the principle of equivalency of action.

A. Why Look at Incentives

The purpose of looking at the role of incentives in international environmental agreements is to understand why countries join those agreements and why they adhere to them.[83] International agreements like the Kyoto Protocol and its potential successor are subject to the unique principles of international law.[84] International law emerges from a horizontal structure of theoretically equal national actors; because nations are not subordinate to any supra-national entity or organization, they are only subject to agreed upon limits.[85] While much of the study of international law examines how international agreements constrain national behavior, the voluntary nature of international agreements invites a threshold question of how a state's self-interest

81. *See id.*

82. *See* BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 14, at 355.

83. *See* Scott Barrett, *An Economic Theory of International Environmental Law*, *in* OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 231, 232–34 (Daniel Bodansky et al. eds., 2007).

84. *Id.*

85. JACK L. GOLDSMITH & ERIC A. POSNER, THE LIMITS OF INTERNATIONAL LAW 13 (2005).

guides commitment to international agreements.[86]

The question of a state's self-interest is further shaped by the nature of international environmental problems and, in particular, the nature of the climate change problem. As discussed in Part I of this Note, climate change is a collective action problem.[87] Because the climate is a public good, reducing the concentration of GHGs in the atmosphere requires an aggregate effort.[88] For any individual country, it does not pay to reduce emissions while other countries continue to emit GHGs because there will be little benefit from unilateral reductions.[89] There is, however, a significant advantage to mutual constraint. If all parties agree to reduce emissions, then all countries benefit from the avoided costs of climate change.[90]

One view suggests that the critical step to address the issue of cooperation on a problem like climate change is to develop an effective treaty that establishes norms for compliance.[91] This view arguably ignores that parties do not always adhere to an agreement.[92] Instead, it is useful to recognize that the purpose of international environmental agreements is to address how countries manage and consume public goods.[93] Participation in international environmental agreements can thus be understood through the value a treaty gives to an individual country, offset by the costs of compliance.[94] Specifically, whether a country will agree

86. Jonathan B. Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 Yale L.J. 677, 743–44 (1999).

87. *See generally* BARRETT, WHY COOPERATE?, *supra* note 5, at 89–91. For the purposes of review, the earth's climate is a public good; meaning that people and nations cannot be excluded from accessing it (it is non-excludable) and one person's access to the climate does not exclude another's access (it is non-rival). *See id.* at 1.

88. *See id.* at 101.

89. *See generally* TODD SANDLER, GLOBAL COLLECTIVE ACTION 224 (2004). There may be some unilateral payoffs from reducing energy consumption through conservation and other means that, in turn, reduce emissions, but the cost-effective nature of these reductions does not account for the required reduction in emissions to address climate change.

90. Barrett, *An Economic Theory of International Environmental Law, supra* note 83, at 237. It is worth noting that reducing emissions requires all parties to affirmatively agree to significant changes in behavior, which means that a treaty, with explicit expectations laid out, is the dominant form of agreement. *Id.* at 235–36.

91. ABRAM CHAYES & ANTONIA HANDLER CHAYES, THE NEW SOVEREIGNTY: COMPLIANCE WITH INTERNATIONAL REGULATORY AGREEMENTS 9–10 (1995).

92. Barrett, *An Economic Theory of International Environmental Law, supra* note 83, at 250.

93. *See generally* BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 14, at 355.

94. *See* Barrett, *An Economic Theory of International Environmental Law*, *supra* note 83, at 234–35.

to a treaty depends on the payoff provided by the treaty to that country and the costs of defection from the treaty.[95]

There are limits to the applicability of a cost-benefit approach to assessing climate mitigation actions. Most importantly, this approach is based largely on the assumption that nations can quantify and understand the costs and benefits from a particular line of action.[96] In the context of climate change, the potential costs of inaction depend significantly on assumptions about the range and probability of various negative outcomes as well as assumptions about the costs of compliance.[97] Despite the challenge of assessing the benefits of action—the sum of the costs of doing nothing—much of the analysis in this Note rests on *perception* of costs and benefits. Though nations and negotiators may not know the exact value of action or inaction, they do make judgments and weigh the merits of alternative approaches, suggesting that they consider some normative valuation.[98] Examining how an agreement is crafted will reveal how its terms alter the perception of costs and benefits.[99]

B. Burden-Sharing and Incentives to Participate in an Agreement

1. The Role of Costs in Shaping Incentives

A treaty must take account of the costs of the good being provided, the benefits of providing the good, and the distribution of those costs and benefits.[100] In particular, the distribution of the burden of fulfilling a treaty's obligations determines, among other things, the costs of compliance with the treaty, and the incentive to meet the treaty's goals.[101]

95. For extensive discussion of the different kinds of payoffs from international agreements, see *id.* at 237–41, 248.

96. Lisa Heinzerling & Frank Ackerman, *Law and Economics for a Warming World*, 1 HARV. L. & POL'Y REV. 331, 348–49 (2007); *see also* Jody Freeman & Andrew Guzman, *Climate Change & U.S. Interests*, 109 COLUM. L. REV. 1531 (2009).

97. Heinzerling & Ackerman, *supra* note 96.

98. *See* Barrett, *An Economic Theory of International Environmental Law*, *supra* note 83, at 231, 233, 241 (discussing how international law can restructure incentives for participation in protection of the environment).

99. *See* Cass R. Sunstein, *On Fairy Tales*, 1 HARV. L. & POL'Y REV. 371, 373 (2007) (discussing how a cost-benefit approach can be useful, even if its limitations are apparent to an observer assessing policy options).

100. *See* BARRETT, WHY COOPERATE?, *supra* note 5, at 102–04.

101. *See infra* section III.C.

A public good should be provided when the sum of the benefits to the participating countries is greater than the cost of providing the good.[102] This basic notion leads to several conclusions. First, the effectiveness of environmental agreements depends on the level of participation in the agreement.[103] A successful treaty attracts enough participants such that the sum of the benefits to each country for providing the good exceeds the overall cost of providing the good.[104] A simple example demonstrates how goods may be provided based on perceptions of value: if the cost of providing a public good is *C*, and ten countries enter the agreement to provide the good, and each country values the benefit at $B_1 \ldots B_{10}$, the good will be provided only when:

$$B_1 + B_2 \ldots + B_{10} > C.$$[105]

If the participating nations collectively perceive *C* to be greater than the sum of the parties' benefits, then they likely will not enter into an agreement to provide the good.[106] This creates a situation where a critical number of parties may be necessary at the outset to provide a good.

This basic understanding of burden-sharing only tells half of the story: whether the collective benefit is greater than the collective cost and how a given country can tilt the balance of that equation. The other half of the story is determining whether an individual country will participate in an agreement. That depends in part on the country's net benefits from cooperation—the value of its costs (C_1)[107] subtracted from its benefits (B_1) where:

$$B_1 - C_1 > 0.$$[108]

First and foremost, this depends on whether a country can be deterred from free-riding.[109] For any individual country, if all other countries cooperate to provide the good, it will be cheaper not to cooperate and to free-ride on the provision of the good by the

102. *See* BARRETT, WHY COOPERATE?, *supra* note 5, at 106–07.

103. Barrett, *An Economic Theory of International Environmental Law*, *supra* note 83, at 241–43.

104. BARRETT, WHY COOPERATE?, *supra* note 5, at 106–07.

105. *Id.*

106. *Id.*

107. This equation is based on aggregated national costs of compliance. There are separate issues of determining sub-national costs of compliance and how they might impact the decision to participate in an agreement.

108. Barrett, *An Economic Theory of International Environmental Law*, *supra* note 83, at 241–42. *See also* SANDLER, *supra* note 89, at 79–80.

109. Barrett, *An Economic Theory of International Environmental Law*, *supra* note 83, at 251.

other countries unless the payoff from cooperating is increased when all countries cooperate.[110] It also depends, however, on how the agreement defines *C* for any given party, assuming that party can be deterred from free-riding.

The challenge for an international agreement is to change the relationship between *B* and *C* for any individual country in addition to assembling enough countries such that the sum of *B*s exceeds *C*. Agreements can be designed to affect both sides of the equation. They can enforce cooperation by imposing costs for non-participation and lowering the value of *B* for the free-rider country.[111] They can also shift the value of *C*, the costs of compliance.[112] The value of *C* will reflect the required actions as defined by the terms of the agreement. The value of *C* can therefore be adjusted through negotiated solutions—the terms of the agreement can be defined in ways that increase or lower costs for an individual party.[113] Alternatively, if the value of *C* is high for a number of countries and other countries have greater values of *B*, then the countries that derive greater benefits can pay the countries with lower *B* values side payments within an international agreement in order to alter the incentives to cooperate.[114] The threshold issue, however, is how the agreement's terms impose costs on parties. Assessing the next generation of agreements requires looking at each of three pieces: the number of parties participating, the method of deterring free-riding, and notably, the definition of actions or obligations and its relationship to costs.

2. The Determinants of the Cost of Compliance

While significant attention has been given to the subject of how treaty design might change incentives to cooperate by ensuring inclusion of critical parties, less attention has been given to the question of how treaty design and distribution of obligations impacts the costs of compliance with the agreement. Indeed, attention to the issue of costs of compliance has been primarily focused on what kinds of climate policies are most efficient and

110. BARRETT, ENVIRONMENT & STATECRAFT, *supra* note 14, at 261–91.

111. *Id.*

112. BARRETT, WHY COOPERATE?, *supra* note 5, at 106–11.

113. This idea is the logical conclusion of Barrett's extensive discussion of burden-sharing as an issue in solving collective action problems. *See generally id.*

114. BARRETT, ENVIRONMENT & STATECRAFT, *supra* note 14, at 335–51.

cost the least for all parties.[115] While this is certainly a critical issue in developing a response to climate change, as a threshold question, how action is defined and measured in an agreement necessarily has a significant impact on the incentives to comply with that agreement.

The incentives to participate in an agreement as they relate to the costs of compliance depend on how well the institutions designed by an agreement reflect the wide variations in the costs and benefits of compliance. As discussed in Part III.C, climate change affects parties differently, delivering benefits to some while imposing varying levels of costs on others.[116] Even developmentally similar countries may have different capacities to reduce GHG emissions depending on a variety of national circumstances.[117] Accordingly, the issue is the degree to which an agreement reflects these variations through its terms and metrics. In particular, it depends on the complexity and depth of the institutions set up to address climate change and whether they reflect and account for differences in national conditions.

C. The Variability of the Climate Change Problem

The problem of climate change is beset by an internal inconsistency: the challenge of limiting emissions is global and requires broad participation while the benefits of participation depend on an individualized calculation.[118] The differences are magnified by the timeline and goals for actions.

1. Emissions as a Collective Action Problem

At its heart, climate change is a global collective action problem because reducing the future concentration of GHGs requires the aggregate effort of countries to reduce now.[119] In its fourth

115. *See, e.g.*, Joseph E. Aldy & Robert N. Stavins, *Designing the Post-Kyoto Climate Regime: Lessons from the Harvard Project on International Climate Agreements* 9 (Harvard Project on Int'l Climate Agreements, 2008) [hereinafter Aldy & Stavins, *Designing the Post-Kyoto Climate Regime*].

116. *See infra* Part III.C.2.

117. Schmidt et al., *supra* note 9.

118. BARRETT, WHY COOPERATE?, *supra* note 5, at 106–07. *See also* David Pearce, *The Social Cost of Carbon*, *in* CLIMATE CHANGE POLICY 99–133 (Dieter Helm ed., 2005). The inverse of these costs is the benefits from reductions of emissions. *Id.*

119. BARRETT, WHY COOPERATE?, *supra* note 5, at 6. *See also* Cass R. Sunstein, *The World vs. The United States and China? The Complex Climate Change Incentives of the Leading Greenhouse Gas Emitters*, 55 UCLA L. REV. 1675, 1676–77 (2008) [hereinafter Sunstein, *The World vs. The*

assessment report, the Intergovernmental Panel on Climate Change ("IPCC") concluded that global concentrations of GHGs—specifically carbon dioxide (CO_2, the most prevalent of the gases), methane, and nitrous oxide—have increased significantly since 1750 as a result of human activities.[120] Atmospheric concentration of carbon dioxide has increased from 280 parts per million ("ppm") before the industrial revolution to 385 ppm in 2008.[121]

The problem is particularly complex because the demand for energy—the source of eighty-three percent of global GHG emissions in 2006[122]—is expected to grow by forty-five percent by 2030.[123] As a result, projections based on current energy consumption and growth expectations suggest that energy-related CO_2 emissions will grow steadily from approximately twenty-eight billion metric tons of CO_2 equivalents ("CO_2e") to more than forty billion metric tons in 2030.[124] The collective nature of the problem does not mean that every nation in the world needs to participate in each element of climate change policy.[125] Indeed, the reality of climate change is that the top twenty emitters account for more than seventy-five percent of global emissions.[126] The core challenge is determining how to get the bulk of the world's largest emitters into an agreement that changes the path of their emissions trajectory.

United States and China?]; Dale Jamieson, *The Post-Kyoto Climate: A Gloomy Forecast*, 20 GEO. INT'L ENVTL. L. REV. 537, 544–45 (2008).

120. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT: SUMMARY FOR POLICYMAKERS 3–4 (2007) [hereinafter IPCC SPM] (noting that "warming of the climate system is unequivocal").

121. *See* PEW CENTER ON GLOBAL CLIMATE CHANGE, CLIMATE CHANGE 101: SCIENCE AND IMPACTS 3 (2009), *available at* http://pewclimate.org/docUploads/Climate101-Science-Jan09.pdf (discussing the CO_2 growth trend). *See also* PIETER TANS, NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION, TRENDS IN ATMOSPHERIC CARBON DIOXIDE—MAUNA LOA, *available at* http://www.esrl.noaa.gov/gmd/ccgg/trends/ (last visited Jan. 23, 2010).

122. INTERNATIONAL ENERGY AGENCY, CO_2 EMISSIONS FROM FUEL COMBUSTION HIGHLIGHTS: 2009 EDITION 8 (2009).

123. INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2008 38 (2008).

124. ENERGY INFORMATION AGENCY, DEP'T OF ENERGY, INTERNATIONAL ENERGY OUTLOOK 89 (2008).

125. *See* Victor, *Fragmented Carbon Markets*, *supra* note 58, at 136–37, 152–56 (discussing the conventional belief that universal participation is necessary and suggesting that a better approach looks at individual countries and adopts a "club approach" in which individual country's efforts are aggregated).

126. LARRY PARKER & JOHN BLODGETT, GREENHOUSE GAS EMISSIONS: PERSPECTIVES ON THE TOP 20 EMITTERS AND DEVELOPED VERSUS DEVELOPING NATIONS 17 (2007), *available at* www.fas.org/sgp/crs/misc/RL32721.pdf.

2. Uncertain and Variable Costs of Climate Change

While the problem of limiting GHG concentrations is universal, the incentives to take action vary across parties based on individual costs imposed by climate change. It is well established that climate change will create real and costly impacts throughout the world.[127] Increased GHG concentrations will lead to an increase in global temperatures.[128] A cumulative change in temperatures from 3°C to 5°C above pre-industrial levels would lead to significant and abrupt climate changes, including altered precipitation amounts, ocean salinity, wind patterns, and more extreme weather events such as droughts, heavy precipitation, heat waves, and intensified tropical cyclones.[129] As one author put it, with 5°C of warming, "an entirely new planet [would come] into being—one largely unrecognizable from the Earth we know today."[130] Collectively, these changes in the climate have the potential to dramatically impact the earth's environment and natural systems, and global human health and security.[131] Impacts include rising sea levels, flooding, and intensifying storms leading to loss of coastal property and potentially resulting in significant relocation of coastal cities and communities.[132]

These impacts, however, are and will be uneven. The costs of climate change will be most acute in the places where rising sea levels render parts of countries uninhabitable or where droughts or other changes in precipitation significantly reduce agricultural production and capacity.[133] Climate change is felt most in poor, low-lying countries and in island nations.[134] For these areas and

127. U.N. Sigma Xi Scientific Expert Group on Climate Change, *Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable* ix (2007) [hereinafter *Confronting Climate Change*], *available at* http://www.globalproblems-globalsolutions-files.org/unf_website/PDF/climate%20_change_avoid_unmanagable_manage_unavoidable.pdf.

128. IPCC SPM, *supra* note 120, at 2.

129. *Confronting Climate Change*, *supra* note 127, at xi; *see also* IPCC SPM, *supra* note 120, at 2.

130. MARK LYNAS, SIX DEGREES: OUR FUTURE ON A HOTTER PLANET 215 (2008).

131. *Id.* at 8–12.

132. *Id.* In a particularly jarring example, the island nation of the Maldives is actively exploring the possibility of purchasing land in Australia to relocate that country's entire population. Randeep Ramesh, *Paradise Almost Lost: Maldives Seek to Buy a New Homeland*, THE GUARDIAN (U.K.), Nov. 10, 2008, at 1.

133. *See Confronting Climate Change*, *supra* note 127, at 1.

134. *See id.* at 31. *See also*, Kurt M. Campbell & Christine Parthemore, *National Security and Climate Change in Perspective*, *in* CLIMATIC CATACLYSM: THE FOREIGN POLICY AND NATIONAL

areas close to them, the costs of climate change are high. In other cases climate change will produce some beneficial consequences such as the possibility of the opening of northern sea routes. The deterioration of arctic ice means that the Northern Passage will soon be open to shipping, providing a much shorter, and thus cheaper, shipping route between Asia and Europe and providing access to resources under the Arctic Ocean.[135] Additionally, while there will be negative agricultural impacts in some parts of the world, other high latitude regions will enjoy an increase in agricultural production.[136] Therefore, there are reduced incentives to address the impact of climate change for some parties that stand to reap gains from a warming climate (that is, before the warming imposes higher, long-term costs).

This variability in benefits from climate change is further complicated by the fact that the precise magnitude and distribution of anticipated impacts are uncertain.[137] Specifically, there is considerable uncertainty regarding the degree to which there are tipping points in the climate system, beyond which the effects of climate change will be much more severe.[138] Examples of potential tipping points include melting of the permafrost, recently observed for the first time,[139] and accelerated melting of the Greenland and West Antarctic Ice Sheet.[140] The IPCC's latest report projects sea levels to rise by 0.18–0.59 meters over the next century;[141] this does not include projections based on rapid changes in the rate at which ice melts.[142] Projections based on dynamic changes suggest that the sea level could rise between 0.5 and 1.4 meters by 2100.[143] Climate change could therefore be moderately costly, occurring only over a long period of time and for few countries, or it could be extremely

SECURITY IMPLICATIONS OF CLIMATE CHANGE 14–15 (Kurt M. Campbell ed., 2008).

135. *Confronting Climate Change*, *supra* note 127, at 33. Indeed the first commercial transit of the Northwest Passage was completed in September 2009, though regular shipping via this route appears to be a ways off. *See* Artyom Liss, *Arctic Trail Blazers Make History*, BBC, Sept. 19, 2009, *available at* http://news.bbc.co.uk/2/hi/europe/8264345.stm.

136. *See Confronting Climate Change*, *supra* note 127, at 33.

137. BARRETT, ENVIRONMENT & STATECRAFT, *supra* note 14, at 364–65.

138. *Confronting Climate Change*, *supra* note 127, at 105–06.

139. Ian Sample, *Warming Hits 'Tipping Point'*, THE GUARDIAN (U.K.), Aug. 11, 2005, at 1.

140. *Confronting Climate Change*, *supra* note 127, at 19.

141. IPCC SPM, *supra* note 120, at 8.

142. *Id.* at 7, 19.

143. Richard A. Kerr, *Pushing the Scary Side of Global Warming*, 316 SCIENCE 1412, 1415 (2007).

costly for a larger number of nations in a shorter timeframe.[144]

3. Variable Costs of Action

The costs imposed by climate change are not equally distributed and neither are the costs of action. The inequity in costs of action arises because each country has a different marginal abatement cost ("MAC") curve for addressing climate change.[145] The MAC curve shows the cost for reducing each subsequent unit of emissions. While the first unit of emissions might be inexpensive to reduce due to potential for energy efficiency, subsequent units will be increasingly costly because further reductions require more expensive technology or capital-intensive infrastructure investment.[146]

The MAC depends on a number of factors, which include underlying energy resources in a given country, the age and convertibility of the country's energy infrastructure, and how the country uses its energy.[147] Countries that have substantial potential savings from energy efficiency and extensive renewable energy resources will have lower MAC curves while countries that are already efficient or are particularly fossil fuel dependent due to a lack of alternative energy resources or the prohibitive cost of changing the existing infrastructure will have higher MAC curves.[148]

D. Deciding What to Do: How Much to Reduce and When

Cost variability of climate change emerges when setting targets to mitigate climate change. Determining a goal for climate change requires choosing a GHG concentration stabilization level, which

144. Warwick J. McKibbin & Peter J. Wilcoxen, *The Role of Economics in Climate Change Policy*, 16 J. ECON. PERSP. 107, 115, 122 (2002).

145. *See generally* Schmidt et al., *supra* note 9 (defining the marginal abatement cost as the cost for reducing emissions a given unit, usually expressed in dollars per Giga-ton of CO_2 ($/GT CO_2); one giga-ton is equivalent to one billion tons, or two trillion pounds). For perspective on a giga-ton, a Nimitz-class aircraft carrier weighs approximately 100,000 tons. United States Navy Fact File, http://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=200&ct=4 (last visited Jan. 23, 2010).

146. See MCKINSEY & COMPANY, PATHWAYS TO A LOW-CARBON ECONOMY: VERSION 2 OF THE GREENHOUSE GAS ABATEMENT COST CURVE (2009), http://www.mckinsey.com/clientservice/ccsi/pathways_low_carbon_economy.asp for a full discussion of MAC; McKinsey & Company has produced extensive material on both an international MAC curve and MAC curves for individual countries.

147. Schmidt et al., *supra* note 9.

148. *Id.*

depends primarily on the rise in global temperatures that policy makers deem acceptable.[149] Some consensus has emerged: to avoid the risk of the worst consequences of climate change, warming should be limited to 2°C over pre-industrial levels, which the European Union adopted as its benchmark goal.[150] Assuming that 1.5°C to 2°C of warming above pre-industrial levels is a reasonable goal for mitigating the worst elements of climate change, global GHG concentrations will need to be kept between 350 ppm and 450 ppm of CO_2e.[151]

Determining exactly how much and by when emissions should be reduced to meet a given concentration target is difficult.[152] Given that global CO_2e levels have already reached 385 ppm, the goal of limiting temperature increases to 2°C suggests that global emissions will need to be reduced significantly over the next century. Specifically, a report by a group of climate scientists suggests that in order to achieve the goal of limiting GHG concentrations to 450 ppm, GHG emissions need to be not only leveled off but also significantly reduced over the coming century.[153] The process of planning for the leveling off and subsequent reduction of emissions entails creating an emissions path—a final target for emissions and a trajectory for reaching that target.[154] An emissions path will create benchmarks that can be distributed going forward.[155] The more difficult question is when the drop off towards zero-emissions should take place, as this has a significant impact on the cost of the agreement.[156]

There are a number of ways to develop an emissions path. The

149. BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 14, at 368.

150. Commission of the European Communities, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Towards a Comprehensive Climate Change Agreement in Copenhagen*, at 2, COM (2009) 39 final (Jan. 28, 2009) [hereinafter *Towards a Comprehensive Climate Change Agreement in Copenhagen*]. *See also Confronting Climate Change*, *supra* note 127, at xi (discussing additional scientific assessment of the 2°C goal).

151. *Confronting Climate Change*, *supra* note 127, at 44; *see also* James Hansen et al., *Target Atmospheric CO2: Where Should Humanity Aim?*, 2 OPEN ATMOSPHERIC SCI. J. 217, 228–29 (2008) (providing numbers for CO_2 equivalents, the concentration of all GHGs expressed as an equivalent of CO_2).

152. *See* Axel Michaelowa et al., *Issues and Options for the Post-2012 Climate Architecture: An Overview*, 5 INT'L ENVTL AGREEMENTS 5, 6–8 (2005) (discussing thoroughly the process and challenges of getting from a temperature goal to an emissions path).

153. *Confronting Climate Change*, *supra* note 127, at 44–45.

154. Michaelowa et al., *supra* note 152, at 6–8.

155. *Id.*

156. Stavins, *Sound Science, Rational Economics, and Pragmatic Politics*, *supra* note 8, at 8–9.

first is to look at the economics of reductions. An emissions path based on economic analysis will depend on how much cost to carry early in the process of emissions reduction and how much cost to defer to future generations.[157] One way to resolve the tradeoff is to consider the future costs of climate change and translate these costs into present economic value.[158] Much of the economic debate over climate change therefore revolves around the question of intertemporal discounting—the process of valuing future damages in current prices.[159] Choosing a low discount rate reflects a decision to translate future changes into current prices while affording little consideration to the benefit of future economic gains, which results in a high value placed on future costs.[160] An alternative to an emissions curve based primarily on cost is to shape an emissions path based on the precautionary principle of bearing high costs early to avoid the uncertainties of future climate change.[161]

Defining the desired emissions trajectory, however, depends significantly on a given country's perceived costs of climate change and its costs of mitigation. Countries that perceive low initial costs from climate change will be less willing to bear higher up-front costs for reducing emissions, unless the precautionary principle overtakes those costs concerns.[162] Similarly, countries that have

157. BARRETT, WHY COOPERATE?, *supra* note 5, at 95–97.

158. *Id.*

159. *See* Heinzerling & Ackerman, *supra* note 96, at 351–53 (discussing how present values of future impacts rests on the choice of discount rates, or the rate at which the value of a dollar today is expected to grow over time. If a high discount rate is used, damages far in the future will have low dollar values today, whereas if a low rate is used, they will have a high dollar value today.).

160. William D. Nordhaus, The Challenge of Global Warming: Economic Models and Environmental Policy 129 (July 24, 2007) (unpublished manuscript, on file with Yale University) (discussing the debate over discount rates that has played out most prominently in reaction to the conclusions reached by noted British economist Nicholas Stern, in his review for the British government. Stern recommends an immediate and significant effort to reduce emissions, based on the findings of very high costs and use of a low discount rate. On the other side of the debate, William Nordhaus, an environmental economist at Yale University, calls for low prices that rise over time to the end of the century, using a more widely accepted discount rate.); *see* BARRETT, WHY COOPERATE, *supra* note 5, at 96.

161. *See* John C. Dernbach, *Achieving Early and Substantial Greenhouse Gas Reductions Under a Post-Kyoto Agreement*, 20 GEO. INT'L ENVTL. L. REV. 573, 582–87 (2008) (discussing the precautionary principle and arguing that the high risks of emissions concentrations above 450 ppm require early action).

162. *See generally* Warwick J. McKibbin & Peter J. Wilcoxen, *Estimates of the Costs of Kyoto: Marrakesh Versus the McKibbin–Wilcoxen Blueprint*, 32 ENERGY POL'Y 467, 471 (2004) (noting that although developing countries' emissions are growing more rapidly than other countries' emissions, developing countries have not traditionally contributed to historic

higher MACs will be reluctant to commit to an agreement calling for significant early reductions as such an agreement will impose high initial costs on them relative to other countries.

E. The Conflict Between Variability and Equivalency

Variability in perceived benefits from action and in costs of mitigation has the potential to conflict with the underlying principles of climate agreements that developed countries must take early action and that the action should be comparable. First, the benefits that developed countries might be expected to receive are potentially negligible in comparison to the costs of taking action.[163] Second, the notion of comparable action sets up the possibility of significant disparity in costs of action depending on how the actions are defined.[164] Thus, when considering design choices for international agreements, the variability of the costs and benefits created by addressing climate change constrains the choice of approach and measurement options. For both top-down and bottom-up frameworks, baselines and actions must be defined to reflect the potential for significant disparity between preferred emissions trajectories. Otherwise, the agreement has the potential to skew the costs of compliance in ways that overwhelm the anticipated benefits from the agreement.

IV. RECONCILING EQUIVALENCY AND VARIABILITY

The seemingly contradictory incentives created by the tension between the variability of costs and benefits of addressing climate change and the principles of early and equivalent action provide a partial explanation for why the existing climate architecture has not succeeded in inducing meaningful emissions reductions. Specifically, both the UNFCCC and the Kyoto Protocol have left little room for accommodating variability of costs and benefits into the structure for defining actions for developed countries. The nature of this failure suggests that a different balance of defined actions and metrics would provide a better solution to incorporating early and equivalent action into an agreement while

emissions and thus will be less likely to be willing to bear up-front costs of a climate change agreement).

163. *See* WILLIAM D. NORDHAUS & JOSEPH BOYER, WARMING THE WORLD: ECONOMIC MODELS OF GLOBAL WARMING 161–62 (2000).

164. *See* Fischer & Morgenstern, *supra* note 60, at 8.

also managing the problem of variable incentives.

A. Variable Costs and the Current International Efforts: The Kyoto Protocol's Failed Burden Sharing Arrangement

The Protocol has been the subject of great debate and widespread criticism.[165] Some of these critiques are specific to the nature of the negotiations that led to the Kyoto Protocol. The Protocol was hastily negotiated, and many of the most difficult questions regarding responsibilities for meeting the Protocol's "5% below 1990 levels" target were delayed until later negotiations.[166] Additionally, it has been argued that the negotiators of the Kyoto Protocol were guilty of "analytical confusion," collapsing a number of distinct issues into one set of negotiations.[167] A central problem with the Protocol, and indeed the UNFCCC, is that the system it implemented did not adequately address the variability of different costs of climate change.

The UNFCCC provided a weak foundation for the international framework to address variable costs and benefits. The language defining the goal of stabilization leaves open critical questions regarding the proper level of stabilization of emissions and when to take actions to reach those levels, essentially deferring the question of what kind of reduction, and thus benefit, an agreement should achieve.[168] Additionally, the separation of parties formalizes the principle that developed countries need to act first, but creates a bifurcated approach to addressing climate change that has the potential to shift the burden to developed countries.[169] Finally, the commitment to economic sustainability ostensibly provides a potential safety valve to prevent undue costs to parties, yet developed countries have not had recourse to this protection in practice.

165. Many of the articles and papers cited in this Note start from the premise that the Kyoto Protocol was a flawed agreement. *See, e.g.*, Jagdish N. Bhagwati, Op-Ed., *A Global Warming Fund Could Succeed Where Kyoto Failed*, FIN. TIMES (LONDON), Aug. 16, 2006, at 13.

166. DAVID G. VICTOR, THE COLLAPSE OF THE KYOTO PROTOCOL AND THE STRUGGLE TO SLOW GLOBAL WARMING 26 (2001) [hereinafter VICTOR, THE COLLAPSE OF THE KYOTO PROTOCOL].

167. Bhagwati, *supra* note 165. Professor Bhagwati notes that there is an important distinction between the stock and flow of GHG—the stock being existing GHG concentrations from historical emissions and the flow being ongoing GHG emissions. He notes that these are best treated separately. *Id.*

168. BARRETT, ENVIRONMENT AND STATECRAFT, *supra* note 14, at 368–69.

169. Aldy & Stavins, *Introduction: International Policy Architecture*, *supra* note 41, at 12.

The Kyoto Protocol, built on the unstable foundation of the UNFCCC, is beset by critical shortcomings that limit its ability to address cost variability and indeed in some ways exacerbate the problem of variability. The failure to include developing country parties has been widely discussed, and was the stated reason for the United States' rejection of the Protocol.[170] This failure significantly reduces what the Protocol can accomplish by leaving many countries free to emit GHGs without any limit.[171] If one assumes that the design of the Kyoto Protocol is extended indefinitely, it places the burden of emissions reductions on the relatively small number of Annex I parties, while permitting other growing emitters to continue emitting GHGs as usual.[172] As the growing emissions from omitted parties may offset or exceed any reductions by the smaller group, the Protocol reduces the potential benefits of compliance.[173] Specifically, because there was no expectation of emissions cuts by developing countries, emissions cuts by Annex I parties necessarily had a negligible impact on overall global emissions levels.[174] The short timeline of the Kyoto Protocol's commitment period means that this design imposes high costs of early reductions on the Parties with binding emissions limits without producing either short-term or long-term benefits from meaningful global emissions reductions.

The limited benefits of compliance with the Protocol are particularly salient because the emissions targets devised in the Protocol are largely arbitrary and exacerbate abatement cost variability. The base year, 1990, was chosen because it conferred advantages on certain Parties by making it easier for them to comply—it was not grounded in climate science or effective policymaking, rather the specific details of the cap and the targets

170. Sunstein, *Of Montreal and Kyoto*, *supra* note 27, at 27–28.

171. Aldy & Stavins, *Designing the Post-Kyoto Climate Regime: Lessons from the Harvard Project on International Climate Agreements*, *supra* note 115, at 4.

172. NORDHAUS & BOYER, *supra* note 163, at 148. The assumption that Kyoto would be extended indefinitely is a flawed assumption that undermines Nordhaus and Boyer's conclusions about the costs of the Kyoto Protocol. If in any of the subsequent commitment periods, China, India, or any of the other non-Annex I countries were included, then the model no longer holds. However, because the Kyoto Protocol fails to suggest when other parties might be included or even how to decide, it does not resolve how the burden is to be distributed in the future. *See* Barbara Buchner & Carlo Carraro, *Modeling Climate Policy: Perspectives on Future Negotiations*, 27 J. POL'Y MODELING 711, 726–27 (2005).

173. NORDHAUS & BOYER, *supra* note 163, at 167.

174. McKibbin & Wilcoxen, *supra* note 144, at 125.

designed to meet it were primarily political choices.[175] Because the Protocol based its targets on a fixed year, it failed to take into account how emissions would change over time in relation to that year; for countries with higher expected economic growth after 1990, a fixed reduction from 1990 levels is particularly costly because the target fails to take any subsequent changes in emissions expectations into account.[176] In 1997, the magnitude of a five to seven percent reduction from 1990 emissions levels already varied widely based on a variety of exogenous national factors. For example, both the United Kingdom and Germany had stable or slightly reduced emissions levels in 1997 because of the switch from coal to natural gas in the United Kingdom and reunification, and the accompanying industrial consolidation, in Germany.[177] For both countries, then, compliance with the Kyoto Protocol required national policies that imposed limited or relatively gradual emissions reductions between 1997 and 2012.[178] Because of emissions growth resulting from economic growth, the United States would have had to cut emissions by twenty-seven percent to comply with its Protocol obligations.[179]

The result, then, is that the Kyoto Protocol failed to address the participation incentives of critical GHG emitters, especially the United States.[180] Within the allocation of emissions among the Annex I parties, the Protocol makes it particularly expensive for the

175. Richard E. Benedick, *Morals and Myths: A Commentary on Global Climate Policy*, WZB-MITTEILUNGEN, HEFT 109, Sept. 2005, 16. *See also* VICTOR, THE COLLAPSE OF THE KYOTO PROTOCOL, *supra* note 166, at 26.

176. *See* DEN ELZEN ET AL., *supra* note 62, at 25–26. The choice of a baseline year, instead of recognition of a "business-as-usual" emissions trajectory means that countries with flat or declining emissions growth between 1990 and 2008 (the start of the first commitment period) would have one level of reduction, while countries with high expected emissions growth would have significantly greater reductions. *See also* Thomas C. Schelling, *What Makes Greenhouse Sense?*, 81 FOREIGN AFFAIRS 2 (May/June 2002) (noting that the United States had emissions that had already grown significantly from 1990 levels in 1997, making a seven percent reduction from 1990 levels by 2012 very difficult to manage).

177. McKibbin & Wilcoxen, *supra* note 144, at 127.

178. *See generally* Axel Michaelowa, *Germany: A Pioneer on Earthen Feet*, 3 CLIMATE POL'Y 31 (2003); *see also* Brian Wheeler, *The Politics of Power*, BBC, Apr. 22, 2004, *available at* http://news.bbc.co.uk/2/hi/uk_news/politics/3581637.stm.

179. *See* ENERGY INFORMATION AGENCY, *supra* note 28, at 7 (calculating twenty-seven percent figure). *See also* Schelling, *supra* note 176, at 2. As a point of comparison, France would have had to cut its emissions by ten percent from its business-as-usual projection. *See* Joseph Szarka, *From Inadvertent to Reluctant Pioneer?: Climate Strategies and Policy Style in France*, 5 CLIMATE POL'Y 627, 628 (2006).

180. Sunstein, *The World vs. The United States and China?*, *supra* note 119, at 1676–77.

United States to comply with its seven percent reduction target because of expected emissions growth and uncertainty over options for implementation of the agreement.[181] By some estimates this would have accounted for more than half of the total global costs of Protocol compliance and amounted to a heavily skewed cost-sharing structure.[182] While the United States would have had to pay significantly to comply with the Protocol's requirement, Russia and other former Soviet-bloc countries were left in a position to profit from the limits because their actual emissions were lower than the targets set in 1997, a well-known fact at the time.[183] Compliance with the Protocol would have imposed high costs on the United States because of its reliance on fossil fuels—especially coal—for a significant percentage of electricity generation; these costs are disproportionate to the possible benefits from the Protocol's limited emissions reductions.[184] This disparity—between the high compliance costs and arguably minimal benefits that the Protocol would have provided—played a significant role in shaping the perception of the costs and benefits of addressing climate change and thus cannot be ignored.[185]

The mismanagement of costs and benefits in the Kyoto Protocol

181. Under the most restrictive assumptions of how the Kyoto Protocol's flexibility mechanisms would be implemented, the cost of compliance could have reached $325 billion or nearly two percent of GDP. *See* NORDHAUS & BOYER, *supra* note 163, at 148, 161. A critical issue in determining the cost of compliance with the Kyoto Protocol was the uncertainty over how to comply with the Protocol's emissions limits. As a result, cost estimates at the time ranged from compliance costing almost nothing to Nordhaus and Boyer's estimate of $325 Billion. *See* CONGRESSIONAL BUDGET OFFICE, THE ECONOMICS OF CLIMATE CHANGE: A PRIMER 48 (2003).

182. Eric A. Posner & Cass R. Sunstein, *Climate Change Justice*, 98 GEO. L.J. 1565, 1577–80 (2008). For further discussion on cost-sharing, see Nordhaus, *supra* note 160, at 99–101.

183. Benedick, *supra* note 175, at 16.

184. *See* Sunstein, *The World vs. The United States and China?*, *supra* note 119, at 1681. These models do not necessarily tell the entire story; indeed they potentially exclude many of the co-benefits of addressing climate change, they may undervalue the risks posed by climate change, and they may ignore some costs of climate change. For a discussion of how models might undervalue risk, *see* Martin L. Weitzman, *Structural Uncertainty and the Value of Statistical Life in the Economics of Catastrophic Climate Change* (AEI-Brookings Joint Center for Regulatory Studies, Working Paper No. 07-11, 2007); for a discussion of co-benefits from addressing climate change, *see* Brian K. Migone, *The National Security Dividend of Global Carbon Mitigation* (AEI-Brookings Joint Center for Regulatory Studies, Working Paper No. 07-18, 2007) (discussing the possibility of a "national security dividend" from addressing climate change) *and* Michael R. Bloomberg & Rohit T. Aggarwala, *Think Locally, Act Globally: How Curbing Global Warming Emissions Can Improve Local Public Health*, 35 AM. J. PREVENTIVE MED. 414 (2008).

185. Sunstein, *Of Montreal and Kyoto*, *supra* note 27, at 33.

is particularly galling given that a number of projections show that limiting emissions need not be tremendously costly to the United States and that the United States stands to benefit significantly from global emissions reductions.[186] A cost estimate prepared by the Congressional Budget Office ("CBO") for compliance with proposed domestic GHG emissions legislation shows that domestic emissions regimes would not necessarily create high compliance costs.[187] Furthermore, studies that show that the United States has limited exposure to the negative effects of climate change probably underreport the actual costs that will be realized for at least two reasons.[188] First, the studies have limitations in their modeling of prospective costs.[189] Second, a variety of spillover effects, such as reduced trade with countries that are heavily affected or costs of managing international crises exacerbated by climate change, are often not accounted for in traditional climate economic models.[190]

The reality that emissions reductions are economically feasible and would probably benefit the United States further suggests that the Protocol incorporated the principles of early and comparable action in ways that undermined its long-term viability. Its formulation of early action for developed countries significantly reduced actual benefits from action by these countries. It also defined those actions in ways that made compliance particularly costly for the United States. Going forward, an agreement will need to incorporate these principles in a way that effectively addresses the United States' participation incentives.

B. The Next Agreement: Choosing a Design that Accommodates

186. *See* MCKINSEY & COMPANY, *supra* note 146 (showing that much of the actions to reduce GHG emissions would actually save costs through, for example, energy savings); *see also* Freeman & Guzman, *supra* note 96.

187. The CBO estimate of the cap-and-trade provisions of the American Clean Energy and Security Act of 2009 (H.R. 2454) found that an emissions trading regime would cost $22 billion in 2020 (in 2010 dollars). This estimate does not take into account any savings from the energy efficiency or other elements of the bill. *See* CONGRESSIONAL BUDGET OFFICE, THE ESTIMATED COSTS TO HOUSEHOLDS FROM THE CAP-AND-TRADE PROVISIONS OF H.R. 2454 2 (2009), *available at* http://www.cbo.gov/ftpdocs/103xx/doc10327/06-19-CapAndTradeCosts.pdf. Another study shows that significant GHG emissions reductions can be achieved at no cost, with the savings from limiting energy use offsetting the costs of reductions. *See* MCKINSEY & COMPANY, *supra* note 146.

188. For a very good in-depth discussion of the potential costs of climate change in the United States and the limits of economic modeling in assessing these costs, see Freeman & Guzman, *supra* note 96.

189. *Id.*

190. *Id.*

Variability

The Protocol's failure to address variability shows that the wrong framework and combination of metrics can significantly skew participation incentives by driving up the costs of compliance, thus forcing an agreement to provide even greater benefits. Specifically, the Protocol chose a metric for measuring action that exacerbated the challenge of variability. To keep the principles of early and comparable action from inhibiting effective action, the successor to the Kyoto Protocol should abandon the Protocol's rigid system for measuring early action in favor of allowing for flexibility in approaches while still providing a long-term framework for measuring and assessing action. The Protocol's failures in light of the tension between variability and early and equivalent action suggest that, going forward, a future agreement's viability will rest in part on how well it incorporates two design features to address variability: a long-term emission reduction target and short-term flexibility in which countries are required to commit to what and when.

First, to establish greater certainty in the benefits to be gained from adhering to a climate agreement, a successor agreement will need to adjust how the Kyoto Protocol implements a long-term, top-down goal for emissions reductions. The advantage of top-down, economy-wide targets is that they help promote climatic certainty because the targets and actions are easily measured and verified.[191] A long-term fixed target creates a level of certainty that allows for easier calculation of the benefits of participation for parties that enter and adhere to an agreement.[192] A verifiable commitment that is part of an overall agreement that meaningfully reduces emissions would ideally produce sufficient benefits to make an individual country's compliance worthwhile.[193] While some of the proposals for a successor agreement maintain the Kyoto Protocol's negotiated, ad-hoc commitment periods, other proposals suggest creating a long-term emissions trajectory and short-term interim targets. Specifically, an all-or-nothing

191. *See* Fischer & Morgenstern, *supra* note 60, at 13–14.

192. This is drawn from Barrett's analysis of tipping treaties, suggesting that once enough parties meaningfully commit to a treaty, the benefits from participation combine to make the treaty beneficial for all. *See* Barrett, *An Economic Theory of International Environmental Law*, *supra* note 83, at 241–43.

193. *Id.*

commitment may create a situation in which some mitigation actions are economically rational given the expected costs of climate change yet the economy-wide cap and accompanying framework for reduction might be prohibitively costly.[194] An agreement must continue to incorporate an emission-reduction target, but will also need to transform that target to extend over a longer period of time, both in order to help with measurement and to provide certainty of benefits.

Second, the future framework needs to create short-term flexibility in a way that eases the requirements for specific reductions for each party over a short time-period. This suggests that proposals for future frameworks that allow for interim agreements and coordinated actions between sub-groups of nations may provide a way to encourage early action without linking the success of the entire architecture for agreement to short-term actions by specific parties.[195] These more flexible proposals have developed in part as an outgrowth of the argument that the process of coming to an agreement under the UNFCCC is so burdensome that it prevents progress on other agreements that might start effectively addressing climate change.[196] Stanford Law Professor David Victor argues that a universal participation requirement is overemphasized and that a number of successful international regimes, including the international trade and monetary regimes, have emerged without initial universal participation.[197] Instead, the successes of those regimes suggest that working towards agreements on specific issues amongst fewer parties will produce more effective results than a watered-down agreement that achieves universal coordination.[198]

There are a number of ways that long-term targets and short-term flexibility can be incorporated. The most obvious option is to shift an international agreement to a hybrid model that sets a long-term target and creates a forum for short-term negotiations. For example, instead of a fixed emissions-reduction target from a

194. Barrett, *Climate Treaties and the Imperative of Enforcement*, *supra* note 40, at 252–53.

195. Barrett, *A Portfolio System of Climate Treaties*, *supra* note 52, at 2–3.

196. Aldy & Stavins, *Introduction: International Policy Architecture*, *supra* note 41, at 20, 23. This does leave open the important question of what happens if targets are not adhered to or when countries choose to free-ride. The answer will depend on enforcement and the valuation of benefits, which have been widely studied, though without necessarily reaching a satisfying conclusion. *See generally* ARCHITECTURES FOR AGREEMENT, *supra* note 5.

197. Victor, *Fragmented Carbon Markets*, *supra* note 58, at 136.

198. *Id.*

baseline in a four- or five-year period, an agreement could establish a global emissions trajectory that lays out collective emissions-reductions targets for the medium- and long-term and leaves countries more room to determine how and when they will limit emissions within that overall framework. Both the European Union's recent proposal for negotiations in Copenhagen and an article written by the United States' lead climate negotiator, before he was appointed to that position, suggest that this approach is under consideration, though many details need to be resolved.[199] Other options include maintaining a top-down approach but incorporating a cost safety-valve that would limit obligations that prove too expensive.[200] Finally, a future agreement can improve monitoring and assessment to provide information that allows for periodic adjustment.[201] In all cases, however, an approach that contains an explicit cost-awareness mechanism is essential to reconciling the incentive problems created by the principle of equivalent action.[202]

CONCLUSION

The existing international architecture for addressing global

199. *See Towards a Comprehensive Climate Change Agreement in Copenhagen*, *supra* note 150, at 4–5 (calling for long-term targets and interim assessment of those targets and their distribution); Todd Stern & William Antholis, *A Changing Climate: The Road Ahead for the United States*, 31 WASH. Q. 175, 184–85 (2007–2008) (arguing for a multi-prong approach that incorporates the possibility of separate sectoral agreements). It should be noted that as this Note was being completed, there were signs of tension over this kind of proposal between the European nations and the United States, with the Europeans expressing displeasure over the U.S. wanting to abandon the Kyoto framework. *See* David Adam, *US Planning to Weaken Copenhagen Climate Deal, Europe Warns*, THE GUARDIAN (U.K.), Sept. 15, 2009, *available at* http://www.guardian.co.uk/environment/2009/sep/15/europe-us-copenhagen.

200. *See* Frankel, *supra* note 44, at 52–53.

201. Joseph E. Aldy, Presentation at Third Atlantic Workshop on Energy and Environmental Economics, A Toxa, Spain: Designing a Bretton Woods Institution to Address Climate Change (July 4, 2008).

202. An added benefit of flexibility is that it may address an additional inherent difficulty facing a climate agreement: the United States Senate. While there has been much attention devoted to the challenge of getting the votes of sixty Senators to approve domestic climate legislation, there has been less discussion of the need for sixty-six votes to approve a new treaty. While that will be a difficult challenge no matter what, an agreement that would allow the U.S. to present the results of its domestic legislative or regulatory efforts for verification and negotiation may have a better chance of approval than an agreement that imposes a different emissions cap or reduction time-line. For a discussion of the challenges relating to passing an Article II treaty, *see* Hannah Chang, *International Executive Agreements on Climate Change*, 35 COLUM. J. ENVTL L. (forthcoming 2010).

climate change has evolved in a way that creates an inherent tension between the principles of early and equivalent action for developed country parties to climate agreements and the variability of the costs and benefits of addressing climate change. The Kyoto Protocol exacerbated this tension by failing to create long-term certainty while calling for expensive short-term actions. The express recognition of the principles for early and comparable action in the Bali Action Plan suggests that future climate agreements risk repeating these mistakes unless the incorporation of these principles takes into account the inherent variability of the problem of global climate change. Accounting for variability requires establishing long-term goals for emissions reductions that enhance the certainty of benefits from taking action while putting in place short-term mechanisms for flexible action to allow individual parties some control over the shape of their emissions trajectories.