SYMPOSIUM SCHOLAR

In its inaugural Symposium Scholar Essay Competition, the Law Review solicited entries from graduate students on the topic of liability for global warming. The following piece was selected as the winner and was presented at the Symposium.

UNRAVELING THE GLOBAL WARMING REGIME COMPLEX: COMPETITIVE ENTROPY IN THE REGULATION OF THE GLOBAL PUBLIC GOOD

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With the earth's temperature on the rise, ecosystems are faltering, economies are suffering, and human health is deteriorating. The global community has accepted its responsibility for global warming and the immediate need to reduce the anthropogenic greenhouse gas (GHG) emissions to prevent further global warming. As a means to reduce their greenhouse footprints, many national and state governments have pinned their hopes on GHG emissions trading regimes. Such regimes, however, seek to reduce GHG emissions through differing liability rules and mechanisms. This Article analyzes these rules and mechanisms in the context of regulating the global public good of climate stability. It concludes that the network of partially overlapping GHG emissions trading regimes, often with differing rules, forms a global warming regime complex and gives rise to interregime competition and forum shopping. While beneficial to some trading entities, ultimately, these outcomes may undermine the Kyoto Protocol and climate protection. Recognizing the inherent difficulty in preventing a proliferation of competitive regimes, this Article calls for the creation of a clean development fund as a means to maximize compliance despite strategic behavior facilitated by the regime complex.

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INTRODUCTION

2005 was the earth's hottest year on record,[1] and 2006 was the hottest in the continental United States.[2] Scientists across the globe have reached a consensus that global warming is occurring at a rapid pace.[3] Indeed, "[e]leven of the last twelve years (1995-2006) rank among the twelve warmest years in the instrumental record of global surface temperature (since 1850)."[4] Absent prompt reductions in greenhouse gas (GHG) emissions—the leading contributor to global warming—global temperatures may rise as much as 6.4°C by the end of the century.[5] If significant reductions of GHG emissions are not achieved over the next ten years, global warming may be irreversible.[6] Even a 3°C degree rise in global average temperature would devastate the global environment, place human survival in grave danger, and risk the collapse of the world economy.

Recognizing that global warming presents a serious risk to the survival and health of the planet, policymakers worldwide have called for the reduction of GHG emissions and have embraced emissions trading programs to achieve this reduction. The international community has banded together to create the Kyoto Protocol, a regulatory regime designed to stabilize the escalating atmospheric concentrations of GHGs.

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[1] *First Half of 2006 Warmest on Record in U.S.*, MSNBC.COM, July 18, 2006, http://www.msnbc.msn.com/id/13860976.

[2] Marc Kaufman, *Climate Experts Worry as 2006 Is Hottest Year on Record in U.S.*, WASH. POST, Jan. 10, 2007, at A1.

[3] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], WORKING GROUP I, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 5 (2007) [hereinafter IPCC, CLIMATE CHANGE 2007], *available at* http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_SPM.pdf. ("Warming of the climate system is unequivocal . . . .").

[4] *Id.* at 5; *see also* IPCC, WORKING GROUP I, CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS 2 (X. Dai et al. eds., 2001) [hereinafter IPCC, SCIENTIFIC BASIS] ("[I]t is very likely that the 1990s was the warmest decade . . . in the instrumental record, since 1861." (footnote omitted)); William H. Sorrell, Commentary, *Stepping in To Curb Pollution When U.S. Government Won't: N.J. Joins 7 States, N.Y. City in Suit Seeking Reduced CO_2 Emissions*, N.J. L.J., Oct. 4, 2004, at 23 ("The five hottest years have all occurred since 1997 and the 10 hottest since 1990.").

[5] IPCC, CLIMATE CHANGE 2007, *supra* note 3, at 13 tbl.SPM.3; *see also* S. Pacala & R. Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, SCIENCE, Aug. 13, 2004, at 968 (detailing possible options that can curb global warming over the next fifty years).

[6] *See, e.g.*, AL GORE, AN INCONVENIENT TRUTH: THE PLANETARY EMERGENCY OF GLOBAL WARMING AND WHAT WE CAN DO ABOUT IT (2006) (describing the devastating, irreparable effects of global warming).

Drawing upon successful national and regional experiments with pollution cap-and-trade programs,[7] the Kyoto Protocol and other international and regional emissions trading regimes have emerged in the hopes of achieving similar success. Although achieving emissions reductions sufficient to slow the current global warming trend will not come without sacrifice, the burden borne by countries need not be as onerous as one might initially think. Emissions trading—the ability to offset excess emissions in one area for emissions reductions achieved elsewhere at lower cost—presents the possibility of stabilizing global GHG emissions with a minimal societal cost.

These trading regimes come together to form part of the global warming regime complex—a network of overlapping regimes with different rules and parties—designed to achieve the common goal of reducing atmospheric concentrations of GHGs.[8] Within this regime complex, the Kyoto Protocol is the largest and most comprehensive regime establishing emissions-reduction targets for the international community. Other regimes within the complex may be designed to implement the emissions-reduction targets established by the Protocol or may operate independently from the Protocol and its rules. Each regime within the complex employs different procedural regulations to define and credit emissions trades, enforcement mechanisms to encourage compliance, and liability rules in the event a country does not meet its emissions-reduction targets under the regime.

The global warming regime complex, while sharing features with the United States' cooperative federalist system of governance, has some unique features that cause regime differences to result not in positive experimentalism, but in destabilizing entropy. The regime complex, like the federalist system, has a superregime, the Kyoto Protocol, which establishes generally applicable rules and emissions limits, and elemental regimes, which are designed to implement the gen-

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[7] A cap-and-trade system establishes a cap of total emissions of a pollutant within a particular sector and assigns individual quotas—based upon emissions units and totaling the cap—to companies. Firms that reduce their pollutant emissions below their individual caps may sell their surplus quotas to firms emitting above their individual caps. *See* Richard B. Stewart et al., *Designing an International Greenhouse Gas Emissions Trading System*, 15 NAT. RESOURCES & ENV'T 160, 160-61 (2001). An emissions-reduction trading system awards credits to firms emitting a pollutant below levels set by regulation. These credits may then be sold to other firms emitting above the regulated limit. *Id.* at 161.

[8] *See generally* Kal Raustiala & David G. Victor, *The Regime Complex for Plant Genetic Resources*, 58 INT'L ORG. 277 (2004) (outlining a theory of the regime complex).

erally applicable rules of the Protocol.[9] The regime complex departs from typical federalism in three significant respects: first, elemental regimes within a regime complex may link together to jointly regulate transactions; second, the regime complex and international law generally lack rules to resolve conflicts across regimes; and third, interregime competition relates to the validation and security of traded emissions, which can be moved to another regime at low cost. These differences between the regime complex and the federalist system have important consequences for a regime complex, especially one regulating a global public good. This Article concludes that interregime competition within a regime complex regulating a global public good can have entropic effects on the regime complex and its goals.

This Article analyzes how interregime competition arises within the global warming regime complex and what entropic effects such competition might have on the complex. It focuses on differences in liability rules across regimes to explain the phenomenon of competitive entropy.[10] In the emissions trading context, liability rules allocate responsibility among trading entities to ensure that emissions targets are achieved. This Article identifies the different trading liability rules and mechanisms of the Kyoto Protocol, the European Union Emissions Trading Scheme, and the United Kingdom Trading Scheme, and analyzes how the differing rules and mechanisms interact and result in competitive entropy.

After concluding that interregime competition within the global warming regime complex increases the rate of both intentional and accidental noncompliance under the Kyoto Protocol, this Article proposes a way out of the regime complex morass. Regime complexes

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[9] An elemental regime can be nested within the regime complex or operate parallel to it. *See generally* INSTITUTIONAL DESIGNS FOR A COMPLEX WORLD (Vinod K. Aggarwal ed., 1998) (exploring nesting as an institutional reconciliation mechanism). Currently, all multilateral GHG emissions trading regimes are at least partially nested within the Kyoto Protocol regime complex. Although no multilateral trading regime has emerged to operate in parallel to the Kyoto Protocol framework, parallel trading regimes have been discussed, and other nontrading parallel regimes have been created. The impact of elemental regimes operating in parallel to the Protocol—such as the Asia-Pacific Partnership on Clean Development and Climate, Renewables Process, International Partnership for the Hydrogen Economy, Carbon Sequestration Leadership Forum, Energy Efficiency Partnership, and Methane to Markets Initiative—is, therefore, outside the scope of this Article.

[10] In this Article, "liability" refers to the risk borne for a failed emissions trade or project; it does not refer to liability in a legal sense, though legal liability questions may arise as a result of the allocation of these risks.

reduce trading transparency, make monitoring of country compliance more difficult, and create questions of which rules apply to a transaction. When regime complexes regulate a public good, these regime effects enable shirking and create the likelihood of greater intentional and accidental noncompliance. Such noncompliance is inherent within the global warming regime complex and necessitates a liability mechanism that allows countries found noncompliant under the Protocol to achieve eleventh-hour compliance with the Protocol's emissions targets. Given the precarious political alliance keeping the Protocol intact, this Article argues for the creation of a Clean Development Fund, in conjunction with a largely harmonized regime complex, to permit countries to fund emissions-reducing projects when they would otherwise be in noncompliance under the Protocol.

Part I of this Article proceeds with a discussion of the potential implications of global warming on the environment, human health, and the economy. Part II then analyzes the Kyoto Protocol and some of the major elemental regimes within the global warming regime complex, discussing the liability rules employed by the different regimes. Part III develops the notion of competitive entropy, analyzing how different liability rules within the regime complex serve to undermine the goals of the complex. Finally, Part IV concludes with a proposal to incorporate a Clean Development Fund into the Kyoto Protocol to maximize country compliance with Protocol emissions targets and to reduce global warming.

I. THE WARMING GLOBE

There is a global scientific consensus that anthropogenic emissions of GHGs are warming the earth and causing environmental damage.[11] According to the Intergovernmental Panel on Climate

[11] *See, e.g.*, Massachussets v. EPA, 127 S. Ct. 1438, 1455 (2007) ("The harms associated with climate change are serious and well recognized."); David A. Grossman, *Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENVTL. L. 1, 10 (2003) ("[D]espite the uncertainties that remain in climate science, the overwhelming scientific consensus . . . is that anthropogenic global warming is occurring and that increased carbon dioxide concentrations are one of its major causes."); Matthew F. Pawa & Benjamin A. Krass, *Global Warming as a Public Nuisance:* Connecticut v. American Electric Power, 16 FORDHAM ENVTL. L. REV. 407, 415 (2005) ("There is now a clear scientific consensus that global warming has begun and that most of the current global warming is caused by emissions of greenhouse gases, primarily carbon dioxide from fossil fuel combustion."); James R. Drabick, Note, *"Private" Public Nuisance and Climate Change: Working Within, and Around, the Special Injury Rule*, 16 FORDHAM ENVTL. L. REV. 503, 511 (2005) (noting consensus among the scientific community that the

Change (IPCC), over the last century, the global average temperature has risen approximately 1°F,[12] and the global relative sea level has risen 0.1 to 0.2 meters.[13] While these figures may not seem particularly alarming, even small changes in the global average temperature can have a significant impact on existing ecosystems. For instance, a two-degree rise in global temperature will cause coral reefs to become bleached and die.[14] Fish populations dependent on coral reefs for

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burning of fossil fuels and other anthropogenic activities are the primary causes of global warming); *see also* Donald M. Goldberg & Martin Wagner, Petitioning for Adverse Impacts of Global Warming in the Inter-American Human Rights System (2002), *available at* http://www.ciel.org/Publications/Petitioning_GlobalWarming_IAHR.pdf ("It is beyond dispute that human activities are causing global warming, as even the U.S. government now admits."). Indeed, "IPCC's conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations accurately reflects the current thinking of the scientific community on this issue." COMM. ON THE SCI. OF CLIMATE CHANGE, NAT'L RESEARCH COUNCIL, CLIMATE CHANGE SCIENCE: AN ANALYSIS OF SOME KEY QUESTIONS 3 (2001). Remarkably, even the lead defendant in *Connecticut v. American Electric Power* has noted "[t]here is not a lot of debate in the scientific community that rising concentrations of greenhouse gases are occurring and will lead to climactic changes." Melita Marie Garza, *Reducing Pollution: Proposals Pushed to Tax Carbon Dioxide Emissions*, CHI. TRIB., Mar. 28, 2004, at C1 (quoting Dale Heydlauff, Senior Vice President for Government and Environmental Affairs, American Electric Power).

Much of the debate about global warming was the result of a study that found that some areas of the Arctic were not warming. Peter T. Doran et al., *Antarctic Climate Cooling and Terrestrial Ecosystem Response*, 415 NATURE 517 (2002). The lead author of the study has publicly condemned the distortion of the study's findings for use as propaganda that global warming is not occurring. *See* Peter Doran, Op-Ed., *Cold, Hard Facts*, N.Y. TIMES, July 27, 2006, at A25 ("I would like to remove my name from the list of scientists who dispute global warming. I know my coauthors would as well.").

[12] The global average temperature in 1899-1901 was 13.88°C (56.98°F), and in 1999-2001 it was 14.44°C (57.99°F). Lester R. Brown, Earth Policy Inst., Global Temperature Rising (2002), http://www.earth-policy.org/Indicators/indicator8.htm.

[13] IPCC, SCIENTIFIC BASIS, *supra* note 4, at 4; Mark Clayton, *In Hot Pursuit of Polluters*, CHRISTIAN SCI. MONITOR, Aug. 19, 2004, at 15 ("The global sea level has risen 4 to 8 inches over the past century."); *see also* IPCC, CLIMATE CHANGE 2007, *supra* note 3, at 13 tbl.SPM-3 (projecting future sea level rise relative to 1980-1999 levels). The relative sea level incorporates all anthropogenic and natural causes of land elevation, including tectonic uplifting and land subsidence. *See* NAT'L ASSESSMENT SYNTHESIS TEAM, U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS ON THE UNITED STATES: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE 80-81 (2000), *available at* http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm.

[14] Michael Perry, *Global Warming Devastates World's Coral Reefs*, GLOBAL SITUATION REP., Nov. 26, 1998, http://www.gsreport.com/articles/art000023.html; *see also* Leonard Post, *Power Companies Feel the Heat: Eight States and NYC Sue Power Companies over Global Warming*, NAT'L L.J., Aug. 2, 2004, at 4 (2004) (highlighting a lawsuit against power companies for causing global warming and, with it, the death of coral reefs). To put the situation in perspective, it is estimated that the global average temperature

survival will dwindle or become extinct, and the global marine food chain will be sent into chaos.[15] For human beings, this change portends significant losses to fisheries and economic upheaval for fishing communities across the globe, among other deleterious impacts.[16]

The damage to ecosystems, economies, and human health from global warming does not happen only when the global temperature reaches a threshold level; rather, such damages are incurred whenever the average temperature rises.[17] If the global temperature continues to increase, we can expect even more serious problems to emerge than the bleaching of coral reefs and the devastation of worldwide fish populations. Some of the other significant global and regional environmental harms include rise in sea levels,[18] coastal erosion and loss of coastal wetlands,[19] shifts in plant and animal migration and reproduction patterns,[20] desertification, increased number and intensity of

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during the Ice Age was 5°C to 7°C colder than current temperatures. *Global Climate Change: Hearings Before the S. Comm. on Environment and Public Works*, 105th Cong. 120 (1997) (statement of Stephen H. Schneider, Professor, Department of Biological Sciences, Stanford University), *available at* http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=105_senate_hearings&docid=f:46585.pdf; *see also* JOHN HOUGHTON, GLOBAL WARMING: THE COMPLETE BRIEFING 95 (2d ed. 1997) (explaining that there is only a "5 or 6°C change in global average temperature which occurs between the middle of an ice age and the warm period in between ice ages").

[15] *See* ROBERT W. BUDDEMEIER ET AL., PEW CTR. ON GLOBAL CLIMATE CHANGE, CORAL REEFS & GLOBAL CLIMATE CHANGE: POTENTIAL CONTRIBUTIONS OF CLIMATE CHANGE TO STRESSES ON CORAL REEF ECOSYSTEMS 1-2, 15-17 (2004).

[16] THE CORAL REEF ALLIANCE, CORAL REEFS & GLOBAL CLIMATE CHANGE: RISING TIDES, TEMPERATURES AND COSTS TO REEF COMMUNITIES (2003), *available at* http://www.icran.org/pdf/reefs-climatechange.pdf.

[17] *See, e.g.*, A.T. Strathdee et al., *Climatic Severity and the Response to Temperature Elevation of Arctic Aphids*, 1 GLOBAL CHANGE BIOLOGY 23 (1995) (studying the effect of temperature rise on aphid populations at different sites and concluding that the effect of warming temperatures is greater at colder sites).

[18] IPCC, SCIENTIFIC BASIS, *supra* note 4, at 16 (noting that the relative sea level may rise three feet by the end of the century). With global sea level rise, small island developing states face significant and unique problems due to their inability to adapt to a rising sea level by relocating. *See* U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE [UNFCCC], CLIMATE CHANGE: SMALL ISLAND DEVELOPING STATES (2005) (discussing the potential impacts of climate change on small island developing states).

[19] *See* Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran), Valencia, Spain, Nov. 18-26, 2002, *Climate Change and Wetlands: Impacts, Adaptation and Mitigation*, Ramsar COP8 DOC. 11, *available at* http://www.ramsar.org/cop8/cop8_doc_11_e.pdf; IPCC, WORKING GROUP II, CLIMATE CHANGE 2001: IMPACTS, ADAPTATION & VULNERABILITY 34 (James J. McCarthy et al. eds., 2001) [hereinafter IPCC, IMPACTS].

[20] IPCC, IMPACTS, *supra* note 19, at 3 (noting altitudinal and poleward shifts in animal migration patterns). Additionally, the journal *Nature* has reported that current GHG emissions levels are likely to result in the extinction of fifteen to thirty-seven per-

wildfires,[21] reduced access to water,[22] more intense and abrupt catastrophic weather-related events,[23] varied and reduced agricultural yields,[24] and melting of Arctic ice and permafrost,[25] not to mention

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cent of terrestrial species by 2050. Chris Thomas et al., *Extinction Risk from Climate Change*, 427 NATURE 145, 145 (2004); *see also* World Wildlife Fund, Asia-Pacific Partnership Sets World Up for Massive Global Warming (Jan. 12, 2006), http://www.panda.org/news_facts/newsroom/news/index.cfm?uNewsID=56020 (noting the *Nature* study and urging the United States and Australia to ratify the Kyoto Protocol).

[21] *See* Robert Lee Hotz, *Wildfire Increase Linked to Climate*, L.A. TIMES, July 7, 2006, at A1 ("[T]he average fire season has grown more than two months longer, while fires have become more frequent, longer-burning and harder to extinguish. They destroy 6.5 times more land than in the 1970s."); Press Release, Scripps Inst. of Oceanography, Warming Climate Plays Large Role in Western U.S. Wildfires, Scripps-Led Study Shows (July 6, 2006), http://scrippsnews.ucsd.edu/article_detail.cfm?article_num=739 (describing a new study linking global warming with the dramatic increase of wildfires). Wildfires account for more than $1 billion in federal firefighting expenses annually, plus immeasurable property damages. Hotz, *supra*.

[22] *See* INT'L CLIMATE CHANGE TASK FORCE, MEETING THE CLIMATE CHALLENGE: RECOMMENDATIONS OF THE INTERNATIONAL CLIMATE CHANGE TASK FORCE 3 (2005) (expressing concern about the water shortages that would result from climate change).

[23] *See* DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 596 (2d ed. 2002) (noting that global warming affects droughts, floods, and heat waves); INT'L SCI. STEERING COMM., AVOIDING DANGEROUS CLIMATE CHANGE 12-15 (2005) (including "dangerous weather events" in a discussion of the adverse impacts of climate change"); Pawa & Krass, *supra* note 11, at 424 (describing harmful consequences of the wildfires and intense precipitation caused by global warming); *see also* Press Release, Scripps Institution of Oceanography, Global Warming Can Trigger Extreme Ocean, Climate Changes, Scripps-Led Study Reveals (Jan. 4, 2006), http://scrippsnews.ucsd.edu/article_detail.cfm?article_num=708 (linking global warming to "drastic climatological, biological and other important changes around the world"). Additionally, global warming has been linked to abrupt and severe climatic changes. COMM. ON ABRUPT CLIMATE CHANGE, NAT'L RESEARCH COUNCIL, ABRUPT CLIMATE CHANGE: INEVITABLE SURPRISES 107-17 (2002); *see also* RICHARD A. POSNER, CATASTROPHE: RISK AND RESPONSE 163 (2004) ("[A]brupt global warming is more likely to be catastrophic than gradual global warming because it would deny or curtail opportunities for adaptive responses, such as switching to heat-resistant agriculture or relocating population away from coastal regions.").

[24] Although agricultural production levels globally may remain stable, local adaptability may vary greatly, resulting in significantly reduced output in certain localities. *See* HUNTER ET AL., *supra* note 23, at 596 (noting that agricultural productivity may decrease in poor localities from climate change).

[25] Goldberg & Wagner, *supra* note 11, at 3-4. The melting of Arctic permafrost has destabilized areas of the Arctic, forcing some coastal communities in Alaska to relocate. *See* SUSAN JOY HASSOL, IMPACTS OF A WARMING ARCTIC: ARCTIC CLIMATE IMPACT ASSESSMENT 19 (2004), *available at* http://amap.no/acia; Grossman, *supra* note 11, at 15-16. The expense resulting from the relocations of just two coastal communities, Kivalina and Shishmaref, are expected to exceed fifteen million dollars. DEBORAH L. WILLIAMS, ALASKA CONSERVATION SOLUTIONS, GLOBAL WARMING IN ALASKA: THE GREATEST THREAT 20 (2006), http://www.alaskaconservationsolutions.com/acs/images/stories/docs/PowerPointTraining.pdf. These warming concerns have caused

economic deterioration[26] and adverse impacts on human health.[27]

Scientists and policymakers agree that global warming is the most pressing environmental concern facing the globe today.[28] This determination has been made even though science has yet to understand fully the myriad ways in which global warming affects our daily lives, ecology, and economy; moreover, scientists may have significantly underestimated the potential environmental damage from

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the Alyeska Pipeline Service Company to install additional supports for the Trans-Alaska Pipeline. Timothy Egan, *Alaska, No Longer So Frigid, Starts to Crack, Burn and Sag*, N.Y. TIMES, June 16, 2002, at A1. In some areas of Alaska, the permafrost has warmed to within 1°C of thawing. Ned Rozell, *Interior Alaska and Siberia Permafrost Thawing Together*, ALASKA SCI. F., Jan. 3, 2001, http://www.gi.alaska.edu/ScienceForum/ASF15/1523.html.

[26] William D. Nordhaus, *Reflections on the Economics of Climate Change*, 7 J. ECON. PERSP. 11, 16-17 (1993) (noting that a 2.5°C to 3.0°C increase in global temperature will cause the global aggregate of gross national products to decrease approximately 1% to 2%).

[27] These health impacts include increased instances of asthma, Pawa & Krass, *supra* note 11, at 423, heat-stroke and death, and increased outbreaks of insect and water-borne diseases that thrive in warmer temperatures, *see* Jonathan A. Patz et al., *Impact of Regional Climate Change on Human Health*, 438 NATURE 310 (2005) (reviewing studies of projected health risks associated with future climate change); WORLD HEALTH ORG. [WHO], CLIMATE CHANGE AND HUMAN HEALTH: RISKS AND RESPONSES: SUMMARY 7 (2003) (reporting that 2.4% of worldwide diarrhea cases are caused by global warming).

Throughout Europe, the impact of global warming on human health has been even more dramatic than in the United States, as approximately 35,000 individuals perished due to the August 2003 continent-wide heat wave. *See* Shaoni Bhattacharya, *European Heatwave Caused 35,000 Deaths*, NEW SCIENTIST, Oct. 10, 2003, http://www.newscientist.com/article.ns?id=dn4259. With 90% certainty, more than half of the heat wave suffered by Europe in 2003 was attributable to anthropogenic GHG emissions. Peter A. Stott et al., *Human Contribution to the European Heatwave of 2003*, 432 NATURE 610, 612-13 (2004). Yet, if GHG emissions are not reduced, by 2040, on average every other summer will be warmer than 2003. *Id.* at 613.

Globally, it is estimated that 150,000 deaths are related to global warming every year. Patz et al., *supra*, at 313; *see also* Juliet Eilperin, *Climate Shift Tied to 150,000 Fatalities*, WASH. POST, Nov. 17, 2005, at A20 (noting that according to the WHO, the earth's warming climate contributes to more than 150,000 deaths and five million illnesses each year).

[28] *See, e.g.*, Massachussets v. EPA, 127 S. Ct. 1438, 1446 (2007) ("Calling global warming 'the most pressing environmental challenge of our time,' a group of States, local governments, and private organizations, alleged . . . that the Environmental Protection Agency . . . has abdicated its responsibility under the Clean Air Act to regulate the emissions of four greenhouse gases, including carbon dioxide." (footnotes omitted)); Patrick Parenteau, *Anything Industry Wants: Environmental Policy Under Bush II*, 14 DUKE ENVTL. L. & POL'Y F. 363, 365 (2004).

global warming.[29] Indeed, science may have touched only the tip of the iceberg when it comes to understanding the impacts of global warming. It may not be until the iceberg melts that we learn the true extent and nature of the dangers posed by global warming. The recognized dangers it presents, as well as the global agreement to embrace precaution when faced with scientific uncertainty as to other potential dangers from global warming,[30] call for regulatory responses that are effective in reducing anthropogenic GHG emissions. The next Part discusses the international recognition that global warming must be slowed and details the emissions trading regime complex created by the international community in hopes of stabilizing the global climate.[31]

II. THE KYOTO PROTOCOL: MOTHER OF THE GHG TRADING REGIME COMPLEX

In 1992, the international scientific community concluded that global warming was a serious threat to the well being of the earth and its inhabitants and enacted the United Nations Framework Convention on Climate Change (UNFCCC).[32] The Convention, which has been ratified by 189 countries and the European Community,[33] set 1990 GHG emissions levels as targets for the parties to achieve voluntarily by 2000.[34] Despite wide international approval and ratification, the UNFCCC has largely failed to achieve its established emissions targets.[35]

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[29] Peter Alsop, *Flower Power*, CALIFORNIA, Sept./Oct. 2006, at 34, 37 (quoting Berkeley scientist John Harte as saying "we're underestimating the magnitude of future warming"), *available at* http://www.alumni.berkeley.edu/calmag/200609/harte.asp.

[30] U.N. Conference on Env't & Dev., Rio de Janeiro, Braz., June 3-14, 1992, *Adoption of Agreements on Environment and Development: The Rio Declaration on Environment and Development*, princ. 15, U.N. Doc. A/CONF.151/5/Rev.1 (June 13, 1992).

[31] *See* UNFCCC, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE: THE FIRST TEN YEARS 10-13 (2004) [hereinafter UNFCCC, THE FIRST TEN YEARS], *available at* http://unfccc.int/resource/docs/publications/first_ten_years_en.pdf.

[32] U.N. Framework Convention on Climate Change, May 9, 1992 [hereinafter UNFCCC Treaty], *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf.

[33] UNFCCC, Status of Ratification (Nov. 22, 2006), http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php.

[34] UNFCCC Treaty, *supra* note 32, art. 4.2(b).

[35] Kofi A. Annan, *Message of the Secretary-General of the United Nations: Mr. Kofi A. Annan on the 10th Anniversary of the Entry into Force of the United Nations Framework Convention on Climate Change* (Mar. 21, 2004), *in* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 2 (noting that atmospheric concentrations of CO_2 have increased 5% since 1990). *See generally* MATTHEW BRAMLEY, PEMBINA INST., THE CASE FOR KYOTO: THE FAIL-

Recognizing the ineffectiveness of the UNFCCC as written, the first conference of the parties to the UNFCCC adopted the Berlin Mandate in 1995, which amended the UNFCCC to require parties to enter into negotiations to establish quantitative targets and timelines for emissions reductions.[36] In December 1997, these negotiations bore fruit in the Kyoto Protocol,[37] which ultimately established a GHG emissions trading regime in an attempt to minimize the societal burden of reducing anthropogenic GHG emissions. Since the Kyoto Protocol, a number of other international and regional GHG emissions control programs have emerged to support or challenge the Protocol. This Part analyzes the mechanisms employed by the Kyoto Protocol to

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URE OF VOLUNTARY CORPORATE ACTION (2002), *available at* http://www.pembina.org/pdf/publications/vcr_publication_101702.pdf (analyzing the failure of the voluntary emissions-reduction programs to reduce emissions in Canada and globally); Mary Anne Sullivan, *Voluntary Plans Will Not Cut Greenhouse Gas Emissions in the Electricity Sector*, 6 SUSTAINABLE DEV. L. & POL'Y 47 (2006).

Emissions from the fourteen Annex I parties with economies in transition (EITs) decreased 39.6% (45.2% including land use, land-use change, and forestry considerations (LULUCF)) between 1990 and 2003. UNFCCC, Subsidiary Body for Implementation [SBI], *National Greenhouse Gas Inventory for the Period Inventory Data for the Period 1990-2003 and Status of Reporting*, ¶ 13, U.N. Doc. FCCC/SBI/2005/17 (Oct. 12, 2005) [hereinafter UNFCCC, *National Greenhouse Gas Inventory*], *available at* http://unfccc.int/resource/docs/2005/sbi/eng/17.pdf; *see infra* note 43 (explaining what Annex I, Annex II, and non-Annex I parties are). Over the same period, the aggregate emissions of all Annex I parties, including emissions reductions from the EIT countries, decreased by 5.9% (6.5% including LULUCF) over the same period. *Id.* Although UNFCCC did not have some relevant data, its calculations include extrapolations of other data received to present an estimation of total aggregate emissions, including emissions from nonreporting countries. *Id.* at fig.2.

Changes in land use affect the ability of the natural environment to act as "carbon sinks." *See* IPCC, SPECIAL REPORT: LAND USE, LAND-USE CHANGE, AND FORESTRY 3-4 (Robert T. Watson et al. eds., 2000). Destruction of carbon sinks such as forests through land-use conversion releases carbon dioxide into the air, while the creation of more wooded area increases the carbon-absorptive capacity of the environment and reduces total emissions. *Id.* Although some difficulties are presented in calculating the CO_2 emissions changes resulting from changes in land use, the United Nations has requested that countries report such emissions changes in recent years; the United States has been one of the largest sources of emissions resulting from the conversion of carbon sinks. *See* UNFCCC, *National Greenhouse Gas Inventory*, *supra*, at tbl.11 (listing "[n]et anthropogenic CO_2 emissions and removals from land use, land-use change, and forestry" from 1997-2003 for various countries, including the United States).

[36] UNFCCC Conference of the Parties, Berlin, F.R.G., Mar. 28-Apr. 7, 1995, *Report of the Conference of the Parties on Its First Session: Addendum: Part Two: Action Taken By the Conference of the Parties at Its First Session*, at 4-6, U.N. Doc. FCCC/CP/1995/7/Add.14 (June 6, 1995), *available at* http://unfccc.int/cop4/resource/docs/cop1/07a01.pdf.

[37] Kyoto Protocol to the U.N. Framework Convention on Climate Change, Dec. 10, 1997 [hereinafter Kyoto Protocol], *available at* http://unfccc.int/resource/docs/convkp/kpeng.pdf.

reduce the cost of compliance and some of the newly created trading regimes, identifying significant differences in the rules of liability used by the different elemental regimes of the GHG trading regime complex.[38]

A. *The Kyoto Protocol Comes into Force*

The Kyoto Protocol was adopted in 1997 to transform the principles articulated by the UNFCCC into an enforceable international regime. It went into effect on February 16, 2005.[39] The Protocol establishes enforceable emissions-reduction targets,[40] liability for

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[38] For a discussion of the various liability rules proposed for the Kyoto Protocol, see UNFCCC, Subsidiary Body for Scientific & Technological Advice [SBSTA] & SBI, *Mechanisms Pursuant to Articles 6, 12 and 17 of the Kyoto Protocol: Text for Further Negotiation on Principles, Modalities, Rules and Guidelines*, ¶ 357, U.N. Doc. FCCC/SB/2000/3, (May 11, 2000), *available at* http://unfccc.int/resource/docs/2000/sb/03.pdf.

[39] *See* Miguel Bustillo, *Kyoto Pact Takes Effect Without U.S.*, L.A. TIMES, Feb. 16, 2005, at A3 (noting that the Kyoto Protocol was taking effect with the ratification of 140 countries, but that the United States was not among them). The United States, as the single largest emitter of GHGs, released almost 7 billion tons of CO_2 equivalent into the atmosphere in 2003. UNFCCC, KEY GHG DATA 25 tbl.II-11 (2005). To put this figure into context, emissions of GHGs from all Annex I countries—including the United States—totaled 17.3 billion tons of CO_2 equivalent in 2003, *id.* at 14; the entire European Community emitted 4.2 billion tons of CO_2 equivalent in 2003, *id.* at tbl.II-11; and the aggregate GHG emissions from the developing world—122 non-Annex I parties—was 11.7 billion tons CO_2 equivalent in 1994. UNFCCC, KEY GHG DATA, *supra*, at 14; UNFCCC, *National Greenhouse Gas Inventory*, *supra* note 35, at 17 tbl.7; UNFCCC, SBI, *Sixth Compilation and Synthesis of Initial National Communications from Parties Not Included in Annex I to the Convention: Addendum: Inventories of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases*, ¶ 23, U.N. Doc. FCCC/SBI/2005/18/Add.2 (Oct. 25, 2005), *available at* http://unfccc.int/resource/docs/2005/sbi/eng/18a02.pdf.

[40] The Kyoto Protocol's compliance scheme involves facilitating compliance through a "multilateral consultative process," as endorsed by Article 16, and ensuring enforcement in instances of noncompliance, as authorized by Article 18. Kyoto Protocol, *supra* note 37, arts. 16, 18. To achieve these twin goals, a Compliance Committee was established in 2006, consisting of a Facilitative Branch and an Enforcement Branch. Press Release, UNFCCC, Groundbreaking Kyoto Protocol Compliance System Launched (Mar. 3, 2006), *available at* http://unfccc.int/resource/docs/2005/sbi/eng/18a02.pdf; *see also* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 86 box 8.2 (describing plans for the Compliance Committee before its implementation). The Protocol itself, however, does not impose financial penalties for failing to comply. *Cf.* Joshua Busby, *Climate Change and Collective Action: Troubles in the Transition to a Post-Oil Economy*, 2 ST. ANTHONY'S INT'L REV. 35, 44 (2006) (explaining that, because penalizing defectors is costly, enforcement "itself is a public goods problem"). Rather, it imposes a range of potential sanctions, including making noncompliant parties ineligible to participate in the Joint Implementation (JI) program or in emissions trading, *see infra* notes 47-48, during the next commitment period, as well as requiring such defaulting parties to reduce their emissions further to compensate for the earlier non-

noncompliant parties,[41] and an emissions trading regime to ease the burden of compliance for countries highly dependent on the use of fossil fuels and countries for which emissions reductions would be very costly or would require significant consumer sacrifice.[42]

The Protocol establishes binding emissions-reduction targets and commitment timelines for developed countries that have ratified it (Annex I parties).[43] To determine whether a country meets its target,

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compliance. *See* DONALD M. GOLDBERG ET AL., CTR. FOR INT'L ENVTL. LAW & EURONATURA, BUILDING A COMPLIANCE REGIME UNDER THE KYOTO PROTOCOL 21-26, 29-33 (1998), *available at* http://ciel.org/Publications/buildingacomplianceregimeunderKP.pdf. The effectiveness of this enforcement mechanism is a matter of significant dispute.

[41] Kyoto Protocol, *supra* note 37, art. 17.

[42] IPCC's Third Assessment Report, published in 2001, concluded that the measures taken to reduce GHGs to the levels prescribed by the UNFCCC would reduce developed countries' GDPs between 0.1% and 2.0% by 2010. *See* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 20.

[43] Annex I parties are developed countries, while Annex II parties, which by definition are also Annex I parties, are highly developed countries. Non-Annex I parties are developing countries. Under the Protocol, Annex I parties must reduce their GHG emissions to, on average, 5% below their 1990 emissions levels by 2012. UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 84-85. If the United States ratifies the Protocol, it will be required to cut its emissions by 7%. *Id.* at 84. However, the United States has proclaimed its intention not to ratify the Protocol. *See Political Interference with Science: Global Warming, Part II: Hearing Before the H. Comm. on Oversight and Government Reform*, 110th Cong. (2007) (statement of James L. Connaughton, Chairman, White House Council on Environmental Quality), *available at* http://oversight.house.gov/documents/20070319130732-64027.pdf; Stuart Eizenstat, *Stick With Kyoto: A Sound Start on Global Warming*, FOREIGN AFF., May/June 1998, at 119, 121, *available at* http://www.foreignaffairs.org/19980501faresponse1395/stuart-eizenstat/stick-with-kyoto-a-sound-start-on-global-warming.html (explaining that the United States would not ratify the Protocol unless developing countries also participate).

The Protocol does not establish binding emissions-reduction targets for non-Annex I parties (developing countries). This differential treatment was a matter of significant dispute and was one of the reasons articulated by the United States for its decision to not ratify the Protocol. Negotiations are currently underway to establish emissions-reduction targets for the second commitment period under the Protocol. As with the first commitment period, the imposition of binding emissions-reduction targets for non-Annex I parties is currently a point of contention. *See* S. Res. 98, 105th Cong. (1997) (enacted) (noting that the United States would not ratify any emissions-reduction agreement unless binding emissions targets were imposed on developing countries as well). *See generally* Frank Jotzo, *Developing Countries and the Future of the Kyoto Protocol* (Australian Nat'l Univ., Econ. & Env't Network Working Paper No. EEN0406, 2004), *available at* http://een.anu.edu.au/download_files/een0406.pdf.

The International Energy Agency (IEA) has predicted that energy-related carbon emissions will increase by 70% over current levels by 2030, with increases coming largely from developing countries. IEA, WORLD ENERGY OUTLOOK 2002 30-31 (2001), *available at* http://www.iea.org/textbase/nppdf/free/2000/weo2002.pdf. It is expected, therefore, that non-Annex I countries will soon emit GHGs at levels necessitating regulation. Whether parties to the Protocol will be able to include binding emis-

the Protocol allocates to each Annex I party a fixed number of assigned amount units (AAUs), which represent the right to emit a fixed amount of GHGs.[44] Though the Protocol limits the ability of Annex I parties to emit more GHGs than the number of AAUs they possess, Annex I parties can acquire additional AAUs.[45] The Protocol permits the sale of surplus AAUs throughout the five-year commitment period to parties needing additional AAUs to ensure compliance, but does not determine whether a party is in compliance with its emissions-reduction obligations until the end of the commitment period.

This timing differential enables a party to sell surplus AAUs early in the commitment period, yet emit GHGs in excess of its AAUs throughout the remainder of the period. This "overselling" can occur accidentally or intentionally.[46] If the amount of overselling is significant, it can undermine the effectiveness of the Protocol in achieving the global GHG emissions reductions necessary to slow global warming. Due to these concerns, a number of liability rules and mechanisms have developed to ascribe responsibility to parties to ensure that GHG emissions reductions are met in the event of overselling.

The Protocol establishes three programs—Article 17 trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI)[47]—the objectives of which are to help ease the burden of Annex I parties in meeting their GHG emissions-reduction targets and to infuse much needed investment into developing countries' economies.[48]

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sions targets for non-Annex I parties in future commitment periods remains to be seen. The recent Nairobi negotiations did not resolve the issue, but did focus on whether developing nations, such as China and India, should agree to mandatory emissions targets under the Protocol. *See* Dean Scott, *Post-2012 Emissions Limits, Adaptation To Be Focuses of U.N. Climate Conference*, Daily Env't Rep. (BNA) No. 213, at A-11 (Nov. 3, 2006).

[44] Kyoto Protocol, *supra* note 37, art. 3.7.

[45] *Id.* art. 17.

[46] DONALD M. GOLDBERG ET AL., CTR. FOR INT'L ENVTL. L. & EURONATURA, RESPONSIBILITY FOR NON-COMPLIANCE UNDER THE KYOTO PROTOCOL'S MECHANISMS FOR COOPERATIVE IMPLEMENTATION 15 (1998), *available at* http://www.ciel.org/Publications/ResponsibilityforNCundertheKP.pdf.

[47] Kyoto Protocol, *supra* note 37, arts. 6, 12, 17. While the JI and CDM programs are not technically emissions trading programs, they contribute to the GHG emissions trading regime complex and are therefore analyzed as part of the regime complex.

[48] An analysis by the European Commission has established that utilization of the JI and CDM trading programs will cut the cost of compliance with the Protocol nearly in half in 2010. *See* Joseph A. Kruger & William A. Pizer, *Greenhouse Gas Trading in Europe: The New Grand Experiment*, ENVIRONMENT, Oct. 2004, at 8, 17; Jonathan Baert Wiener, *Policy Design for International Greenhouse Gas Control*, *in* CLIMATE CHANGE ECONOMICS AND POLICY 205, 208 (Michael A. Toman ed., 2001).

Each program under the Protocol applies a different liability rule to ensure party compliance with the Protocol. Article 17, which permits Annex I parties to sell surplus AAUs to other Annex I parties, applies a seller-liability rule. The CDM, which permits Annex I parties to earn "certified emissions reductions" (CERs) by investing in emissions-reducing projects in non-Annex I parties, uses a buyer-liability rule. Finally, JI, a program that permits Annex I parties to earn "emissions reduction units" (ERUs) for investing in emissions-reducing projects in other Annex I parties, uses a traffic-light liability rule, which applies either a seller- or a buyer-liability rule, depending on the circumstances.

While the level of compliance with the Protocol will determine its ultimate success,[49] the design of the Protocol's programs and their liability rules will be critical to compliance. The next subsections review the design of the three trading programs, with a focus on the liability rules and mechanisms used to ensure party compliance with the emissions targets set by the Protocol in the event that a program, trade, or project does not yield the expected emissions reductions.

1. Article 17 Trading

Article 17 of the Kyoto Protocol permits Annex I parties to sell surplus AAUs to other Annex I parties in need of those AAUs to comply with the Protocol's binding emissions targets. Countries purchasing AAUs pay another country to reduce its GHG emissions in exchange for the right to emit more GHGs than their original targets would have permitted. Countries purchasing AAUs from a selling country, therefore, rely on those AAUs in determining their compliance with their Protocol targets.

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[49] UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 85 ("The Kyoto Protocol will only be effective if the parties comply with their commitments, have the means to verify compliance and also use reliable emissions data."). While it has one of the most developed compliance regimes in international law, the regime is designed to facilitate compliance through nonpunitive means and without financial penalty. *Id.* at 85-86 & box 8.2. However, as a penalty for failing to comply with the implementation schedule of the Kyoto Protocol, parties may become ineligible to trade, UNFCC Conference of the Parties, Marrakesh, Morocco, Oct. 29-Nov. 10, 2001, *Report of the Conference of the Parties on Its Seventh Session: Addendum: Part Two: Action Taken by the Conference of the Parties: Volume III*, at 76, U.N. Doc. FCCC/CP/2001/13/Add.3 (Jan. 21, 2002) [hereinafter Marrakesh Accords Volume III], or to engage in projects under JI, Kyoto Protocol, *supra* note 37, art. 6.1(c); *see also* GOLDBERG, *supra* note 40, at 30 n.62. Parties also may be ineligible to participate in such programs because of procedural default (e.g., not filing emissions inventory reports) during the commitment period. *Id.* at 75-76.

The Article 17 trading program fosters emissions reductions in the Annex I parties with the lowest marginal abatement cost. It is generally cheaper to implement emissions-reducing technologies in new power plants or cars than it is to retrofit existing power plants and cars with new technologies. Annex I parties with the lowest marginal abatement costs, then, are typically countries less reliant on carbon-based, fossil fuel technologies, such as economies in transition (EITs), which have fewer costs sunk into power that plants rely on older technology.[50] Trading, therefore, is expected to occur between highly developed countries with higher marginal abatement costs and EITs. EITs, however, have unique features that encourage overselling of allowances.

After the fall of the former Soviet Union in 1991, most EITs suffered severe economic downturn. This downturn means that EITs emit fewer GHGs today than they did in 1990. Since emissions targets were established based upon emissions levels in 1990, these EITs have what is termed "hot air"—surplus emissions allowances resulting from economic underdevelopment.[51] EITs, therefore, have a very valuable commodity—surplus AAUs—which they may sell for pure profit, since they would not have used them anyway.[52]

The economic downturn suffered by EITs presents something of a Catch-22 for the Protocol framework. As a result of the downturn, EITs are able to achieve surplus AAUs at no economic cost and at little or no social cost, but EITs also need significant infusions of capital to restore their economies. EITs, therefore, will likely seek to sell all their "hot air" to maximize their financial gain. This is rational, utility-maximizing behavior. The problem arises, however, because Article 17 trading of AAUs is essentially a "pig in a poke."[53] EITs have lim-

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[50] Highly developed countries are expected to have higher marginal abatement costs, not only because they have greater sunk costs in older technology, but also because they often have environmental protections that reduce emissions to a greater extent than those in EITs.

[51] *See* CHRIS ROLFE & LINDA NOWLAN, W. COAST ENVTL. LAW, NEGOTIATING THE CLIMATE AWAY: REPORT CARD ON ENVIRONMENTAL INTEGRITY OF OECD NATIONS' CLIMATE SUMMIT NEGOTIATION POSITIONS 16 (2000), *available at* http://www.wcel/org/wcelpub/2000/13244.pdf (explaining the "hot air" loophole).

[52] Since the amount of "hot air" available for sale through tradable AAUs depends upon emissions inventories, EITs have an incentive to underreport current emissions, or to overreport the amount of "hot air" they possess. Given that EITs often lack the systems and capacity to undertake highly accurate GHG emissions inventories, there is ample room for underreporting of GHG emissions and overreporting of "hot air."

[53] Werner Güth et al., "Buying a Pig in a Poke": An Experimental Study of Unconditional Veto Power (2005) (unpublished manuscript), *available at* https://people.econ.mpg.de/

ited technical capacity to calculate their GHG emissions and determine their compliance status during the commitment period. Their GHG emissions inventories may be inaccurate and misleading. Further, EITs may not be able to predict adequately either their future growth patterns that may result in higher levels of GHG emissions or climatic events affecting their GHG emissions. These uncertainties make the sale of every last surplus AAU during the commitment period an unwise strategy to ensure compliance with the Protocol's aggregate emissions-reduction targets at the end of the commitment period. Despite these uncertainties, EITs have significant financial incentives to sell every surplus AAU during the commitment period. An additional problem is that, aside from concerns of transparency and the resultant accidental overselling, EITs may be willing to risk penalties under the Protocol to maximize short-term financial gain by intentionally overselling their AAUs. When overselling occurs under Article 17, liability rules become crucial to determine which party has the responsibility for ensuring emissions-reduction targets are achieved. The Protocol imposes a seller-liability rule to ascribe liability in the event of overselling and a commitment period reserve to minimize overselling.

a. *Seller Liability*

After significant debate and a number of proposals of different liability rules, the parties to the Protocol adopted a seller-liability rule for Article 17 trading with the Marrakesh Accords of 2001.[54] Seller liability ascribes liability for overselling AAUs to the selling party and therefore puts the onus on it to avoid overselling.[55] To the extent the selling party emitted more GHGs than it was permitted to by its remaining, unsold AAUs, the seller party is noncompliant. The seller must therefore achieve the necessary emissions reductions or obtain sufficient allowances during the commitment period to bring it into compliance and avoid possible sanctions under the Protocol.

A seller-liability rule offers a number of benefits. Adopting such a rule eases the administrative burden of trading. If AAUs are guaranteed to the purchaser, all AAUs are equal. Accordingly, a single global

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~levati/YesNoGame.pdf (concluding that, in a "pig in a poke" bargaining game where transactions involve limited transparency, players seek to act unfairly).

[54] Marrakesh Accords Volume III, *supra* note 49, at 76.

[55] Obtaining AAUs, ERUs, or CERs adjusts a party's assigned emissions allowance; it does not affect the emissions reported. Kyoto Protocol, *supra* note 37, art. 3.10-.12.

price will emerge for AAUs and the likelihood of seller noncompliance has no impact on the market price of the AAUs. Investor risk is eliminated, resulting in a higher AAU price than under liability rules that impose risks on purchasers. Under such a framework, the universal price reduces transaction costs and provides the structure for a robust trading market.[56] From a policy perspective, because seller countries have surplus allowances, they are less desperate than buyers to achieve their emissions targets, and are in greater control of their ability to meet those targets. This practical reality favors a liability rule that will hold sellers responsible for ensuring emissions targets are met.

Seller liability, however, also has drawbacks. Most net seller countries are EITs with weak legal regimes and less bargaining power than net buyer countries.[57] They also may not be sufficiently capable of conducting an accurate GHG emissions inventory or determining whether an additional trade will make them noncompliant. A seller-liability framework also raises questions of fairness, since net seller parties—usually EITs—would have met their targets had they not traded their AAUs. Yet, by trading, these parties become noncompliant, while purchasing parties remain compliant even though their purchases did not actually reduce emissions and they did not reduce their own emissions sufficiently to meet their original emissions targets under the Protocol. For this reason, one could argue that a seller-liability framework is unfair because it might prohibit seller parties from reengaging the trading regime while permitting the buyer party to continue engaging in trades with noncompliant parties.

The risk of trades involving oversold AAUs is endemic to a pure seller-liability regime. Buyers have the same incentives to engage in

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[56] OECD Env't Directorate & IEA, *An Assessment of Liability Rules for International GHG Emissions Trading*, at 21, OECD Doc. COM/ENV/EPOC/IEA/SLT(2000)6 (2000) (*prepared by* Richard Baron) [hereinafter OECD, *Liability Assessment*].

[57] *See, e.g.*, KEVIN BAUMERT & JONATHAN PERSHING, PEW CTR. ON GLOBAL CLIMATE CHANGE, CLIMATE DATA: INSIGHTS AND OBSERVATIONS 19 (2004), *available at* http://www.pewclimate.org/docUploads/Climate%20Data%20new.pdf. Indeed, there is the potential for party-firm trades as well as party-party trades that involve a number of concessions, only one of which involves trading AAUs. *See* OECD Env't Directorate & IEA, *Market Power and Market Access in International GHG Emissions Trading*, at 9, OECD Doc. COM/ENV/EPOC/IEA/SLT(2000)5 (2000) (*prepared by* Richard Baron). However, if dominant buyers develop monopsony power, the lower AAU price that results would make the purchase of AAUs worthwhile for more parties and firms, thereby counteracting the monopsony effect. *Id.* at 7-8. While concerns about monopoly pricing exist, they should be counteracted largely by the elasticity of demand for AAUs in a weak international regime. *Id.* at 7.

trades with parties that have oversold their AAUs—risky trades because the sellers may not achieve compliance by the end of the commitment period—as they do to engage in trades with those that have not oversold, since all AAUs are guaranteed and fetch the same price on the market.[58] Sellers have incentives to oversell under a seller-liability framework because they can garner the global price of AAUs for each excessive trade irrespective of their compliance status. For this reason, David Victor has likened seller liability to an "autoimmune disorder" that enables the regime to become infected by perverse incentives and game playing.[59]

The incentive to oversell in a seller-liability trading regime is tempered only by the effectiveness of the enforcement mechanisms of the regime.[60] As a result, "the sanction for non-compliance, e.g. the penalty, must be stronger than the potential gain from having oversold AAUs."[61] The enforcement regime in the Kyoto Protocol, however, lacks the ability to impose financial or other penalties that might remedy the global injury caused by noncompliance or substantially affect a decision to intentionally oversell. The only substantial sanction that may be imposed under the Protocol prohibits noncompliant parties from trading in future commitment periods. This sanction, however, is little motivation for EITs that are in need of immediate infusions of cash and that are unconcerned about their ability to sell AAUs in future commitment periods.[62] Indeed, even the most dramatic sanction for overselling, expulsion from the Protocol, does little to prevent the problem, since EITs could oversell their AAUs and then simply withdraw from the treaty before sanctions are applied.[63]

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[58] One danger of overselling is that it minimizes the need to implement emissions-reducing technologies or modify consumption patterns and can lead to a degradation of the environment. OECD, *Liability Assessment*, *supra* note 56, at 21-22.

[59] DAVID G. VICTOR, THE COLLAPSE OF THE KYOTO PROTOCOL AND THE STRUGGLE TO SLOW GLOBAL WARMING 18 (2001).

[60] *See generally* OECD, *Liability Assessment*, *supra* note 56, at 10-12.

[61] *Id.* at 21; *see also* Erik Haites, *Harmonisation Between National and International Tradeable Permit Schemes*, *in* GREENHOUSE GAS EMISSIONS TRADING AND PROJECT-BASED MECHANISMS 105, 109-10 (OECD ed., 2004) [hereinafter GHG EMISSIONS TRADING].

[62] This concern is especially pertinent to EITs because their emissions targets likely will be adjusted for future commitment periods to reflect their current emissions levels, eliminating their ability to sell "hot air." EITs may still have lower marginal abatement costs and, therefore, still be net seller parties in future commitment periods, but their monopoly over surplus AAUs will be diminished once the supply of "hot air" is removed from the trading pool.

[63] VICTOR, *supra* note 59, at 70.

Although a significant dispute exists over the best liability rule in a GHG emissions trading regime, most analysts agree that a pure seller-liability rule, in combination with a weak enforcement regime, will result in overselling under the Kyoto Protocol.[64] As a result, additional mechanisms are necessary to ensure the global public good of climate stability given the seller-liability rule and the weak enforcement mechanisms of the Protocol. The Protocol's parties have attempted to minimize the possibility of overselling created by a guaranteed, uniform AAU price under a seller-liability rule by establishing a supplemental liability mechanism—the commitment period reserve.

b. *Commitment Period Reserve: Surplus Trading and Annual Retirement*

The Protocol's parties have recognized that supplemental liability mechanisms are required under a seller-liability framework and have adopted a commitment period reserve (CPR) to minimize the incentives to oversell in a system with a seller-liability rule. The CPR requires each Annex I party to hold permanently a share of its total assigned emissions allowances as not tradable. A party subject to the CPR mechanism must refrain from trading the lesser of ten percent of its initial AAU allocation for the commitment period and five times the party's latest verified emissions inventory.[65]

The "five times the latest emissions inventory" calculation is applied to limit a party's sales to emissions surpluses. When a party is limited to trading only surplus emissions, overselling is not feasible. To ensure a fungible trading market for AAUs throughout the commitment period under this calculation, however, parties must reduce their emissions early in the commitment period so that the surplus demonstrated in the first emissions inventory is reflected throughout the commitment period. If a party does not achieve a surplus in the early emissions inventories, the party cannot trade AAUs under this calculation. The "five times the latest emissions inventory" calculation therefore rewards immediate, technology-based emissions reductions

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[64] "[S]anctioning authority is rarely granted by treaty, rarely used when granted, and likely to be ineffective when used." ABRAM CHAYES & ANTONIA CHAYES, THE NEW SOVEREIGNTY: COMPLIANCE WITH INTERNATIONAL REGULATORY AGREEMENTS 32-33 (1995).

[65] UNFCCC Conference of the Parties, Marrakesh, Morocco, Oct. 29-Nov. 10, 2001, *Report of the Conference of the Parties on Its Seventh Session: Addendum: Part Two: Action Taken by the Conference of the Parties: Volume II*, at 54, U.N. Doc. FCCC/CP/2001/13/Add.2 (Jan. 21, 2002); *see also* OECD, *Liability Assessment*, *supra* note 56, at 14.

over land-use changes and other projects that yield emissions reductions in the long term, but not in the short term.

Although the surplus trading scheme under this calculation is designed to prevent overselling, it is not entirely effective. Time lags between emissions inventories allow parties to rely on the last emissions inventory, which may demonstrate a surplus, in a future year or years when they oversell their allowances. Further, the surplus trading framework does not prevent a party from achieving a surplus of AAUs in the first inventory, overselling in the second inventory, achieving a surplus of AAUs in the third inventory, and overselling in the fourth or even fifth inventory. Because the Protocol determines the amount of tradable allowances based upon annual inventories, parties may be able to oversell on a cyclical basis, with the cycle ending in large amounts of oversold AAUs.[66] While the surplus trading scheme attempts to avoid the liability issues raised by overselling, it does not do so entirely, and the seller-liability rule applies to oversold allowances.

When the "ten percent of total AAUs" calculation is used to determine a party's CPR, however, a different liability rule applies. Under this calculation, a party can oversell up to ten percent of its total allowances if it emits enough GHGs to equal or exceed its emissions target and still sells its allowances. The party can oversell its ten percent in the first year, the final year, or throughout the course of the commitment period. Some have argued for the application of seller liability when trades do not involve reserve allowances and buyer liability when trades fall within the CPR.[67] Trading within the CPR entails speculation as to whether the selling party will ultimately achieve compliance. A shifting (or traffic-light) liability rule has been proposed[68] to prevent speculators from reaping windfalls from their risky

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[66] CIEL proposes a CPR scheme that establishes surpluses on an annual basis, but adjusted based on cumulative emissions. *See* CTR. FOR INT'L ENVTL. LAW, HYBRID LIABILITY REVISITED: BRIDGING THE DIVIDE BETWEEN SELLER AND BUYER LIABILITY 4-5 (2000), *available at* http://www.ciel.org/publications/HybridLiabilityCop6.pdf.

[67] *See, e.g.*, *id.* at 6-8.

[68] This is a modified version of the traffic-light liability scheme designed to address the issues of time lag related to emissions inventories and the domino effect of a pure buyer-liability system. CTR. FOR INT'L ENVTL. LAW, *supra* note 66, at 4. The system does not truly address the time-lag issue, however, because if the verified emissions inventory provides the basis for a CPR determination, a party can use the time delay before the next emissions-inventory verification to oversell AAUs. *See* Peter Bohm, *Improving Cost-Effectiveness and Facilitating Participation of Developing Countries in International Emissions Trading* 19 (Les séminaires de l'Iddri No. 5, 2003) (on file with author).

purchases through a seller-liability rule that guarantees trades to buyers.[69]

Although the CPR has been lauded as the preferred supplement to a seller-liability rule to limit overselling,[70] it is not a panacea. Certainly, limiting the number of tradable allowances will limit the extent of overselling.[71] The CPR also forces buying Protocol parties to diversify their supply of AAUs if they need to buy a large number of AAUs on the market, since sellers may not be able to sell allowances from their CPRs. In addition, the CPR limits the ability of a party to rely on emissions reductions expected to occur as a result of earlier investments (e.g., in reforestation or afforestation projects) that have delayed GHG-reducing effects.[72] That is, if parties do not have precertified, guaranteed emissions reductions from reforestation projects, which can take five years before emissions reductions actually occur, they will be unable to use those emissions-reduction projects to create surplus allowances for sale elsewhere. The CPR, therefore, reduces the potential market of tradable allowances by limiting the ability of parties to achieve surplus emissions through CDM or JI projects.

It is uncertain whether trades of allowances from the CPR will be permitted or what liability rule will be applied to trades within the CPR, but the prevailing belief is that seller liability applies to all AAU trades. Under such a system, identification of noncompliant parties is

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[69] For trades occurring within the CPR, the same policy arguments apply as those under a pure buyer-liability regime. *See* GOLDBERG ET AL., *supra* note 46, at 9-12.

[70] *See* Erik Haites & Fanny Missfeldt, *Limiting Overselling in International Emissions Trading II: Analysis of a Commitment Period Reserve at National and Global Level* (UNEP Collaborating Ctr. on Energy & Env't, Working Paper No. 11, 2002) [hereinafter Haites & Missfeldt, *Limiting Overselling II*]; Erik Haites & Fanny Missfeldt, *Limiting Overselling in International Emissions Trading I: Cost and Environmental Impacts of Alternative Proposals* (UNEP Collaborating Ctr. on Energy & Env't Working Paper No. 10, 2000) [hereinafter Haites & Missfeldt, *Limiting Overselling I*]. The Haites and Missfeldt research model, however, due to the need for simplicity, could not account for subtleties and combination effects of various proposals. *See* Haites & Missfeldt, *Limiting Overselling II*, *supra*, at 3-4. Nevertheless, the model provides core guidance for policymakers designing liability schemes.

[71] While reducing the number of tradable allowances may affect the liquidity of the market, *see* Sonja Peterson, *Monitoring, Accounting and Enforcement in Emissions Trading Regimes*, *in* GHG EMISSIONS TRADING, *supra* note 61, at 189, 200; OECD, *Liability Assessment*, *supra* note 56, at 32-33, Haites and Missfeldt's research suggests the impact on liquidity will be insignificant. *See* Erik Haites & Fanny Missfeldt, *Liquidity Implications of a Commitment Period Reserve at National and Global Levels*, 26 ENERGY ECON. 845 (2004).

[72] Bohm, *supra* note 68, at 19. Delayed reductions will reduce overall emissions in later years, enabling greater trading at that time, but in the years prior to the reductions' achievement, no such trading would be allowed.

largely irrelevant to trading, since buyer parties have the same incentive to purchase AAUs from noncompliant parties as they do from compliant parties.[73] Given the absence of a strong compliance mechanism,[74] a CPR was established under the Protocol to address the concerns of overselling raised by the seller-liability framework. While the CPR can go a long way toward ensuring compliance, as discussed in greater detail below, trading across elemental regimes within the regime complex reduces transparency and makes country compliance more difficult,[75] calling into question the ultimate ability of such a system to identify surplus trading or trades made within the CPR.

2. Clean Development Mechanism

The liability issues raised by Article 17 are mirrored in the CDM,[76] which allows Annex I parties to earn CERs when they invest in certified, emissions-reducing projects designed to reduce the GHG emissions of non-Annex I parties.[77] Established by Article 12 of the Kyoto Protocol, the CDM is designed to promote sustainable development in, and transfer of emissions-reducing technologies to, non-Annex I parties, while reducing compliance costs for Annex I parties.[78]

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[73] Political pressure may push traders to trade only with compliant parties. This pressure seems unlikely given the complexity of the regime and how removed the global citizenry is from such trades.

[74] *See* Busby, *supra* note 40, at 44.

[75] *See infra* Part III.B.

[76] Kyoto Protocol, *supra* note 37, art. 12. The CDM program originated from a Brazilian proposal to incorporate developing countries into the trading regime. *See* Jacob Werksman, *The Clean Development Mechanism: Unwrapping the "Kyoto Surprise"*, 7 REV. EUR. COMMUNITY & INT'L ENVTL. L. 147, 151 (1998).

[77] Kyoto Protocol, *supra* note 37, art. 12; *see also* KEVIN A. BAUMERT & ELENA PETKOVA, HOW WILL THE CLEAN DEVELOPMENT MECHANISM ENSURE TRANSPARENCY, PUBLIC ENGAGEMENT, AND ACCOUNTABILITY? 1 (World Resources Inst. Climate Notes, 2000), *available at* http://pdf.wri.org/pp-note.pdf (suggesting ways to "promote participation within the CDM"); Stewart et al., *supra* note 7, at 163, 202-05 (providing an overview of the CDM program).

[78] Kyoto Protocol, *supra* note 37, art. 12.2 ("The purpose of the [CDM] shall be to assist parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3."). Accordingly, the CDM requires that CDM projects ensure "real, measurable, and long-term benefits related to the mitigation of climate change" and promote "sustainable development." *Id.* art. 12.2, .5(b); *see also* U.N. Ad Hoc Working Group on CDM, *The Clean Development Mechanism: Building International Public-Private Partnerships Under the Kyoto Protocol: Technical, Financial and Institutional Issues*, U.N. Doc. UNCTAD/GDS/GFSB/Misc.7 (2000) (*prepared by* Richard Stewart); Stewart et al., *supra* note 7, at 204-05 (discussing different models of CDM

The CDM program is still being formalized, but ensuring that the CDM properly addresses liability issues will be critical to its success. The Protocol is silent on the issue of liability for failed CDM projects, even though the global stakes for such projects could run into the billions.[79] This Article seeks to untangle the two core liability questions arising in the CDM context: (1) whether to certify emissions reductions from CDM projects upon investment or only following actual emissions reductions, and (2) what liability rule to apply in the event that a project does not achieve expected emissions reductions.[80]

a. *Ex Ante v. Ex Post Certification*

The first liability issue relates to whether CERs should be certified before emissions are reduced (ex ante certification) or based upon actual emissions-reduction performance after the project is opera-

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project development and investment). The CDM does not require "financial additionality" as required for projects occurring under JI. Axel P. Gosseries, *The Legal Architecture of Joint Implementation: What Do We Learn from the Pilot Phase?*, 7 N.Y.U. ENVTL. L.J. 49, 78 (1999). This is an odd outcome considering that most overseas deployment assistance (ODA) flows from Annex I parties to non-Annex I parties rather than between and among Annex I parties. A simple shift in resources from ODA to CDM investments can therefore result in significant CERs.

[79] Richard Sandor, *How I See It: The CDM: Opportunities and Challenges*, ENVTL. FIN., Apr. 2000, at 15, 15. In addition, there is often uncertainty when the ability of CDM projects to generate credits and the value of those credits are uncertain. *See* OECD Env't Directorate & IEA, *Taking Stock of Progress Under the Clean Development Mechanism*, at 34, OECD Doc. COM/ENV/EPOC/IEA/SLT(2004)4/FINAL (June 15, 2004) (*prepared by* Jane Ellis et al.).

[80] While other liability issues are of significant concern for the CDM, trading, and JI regimes—including the liability of third-party certifying bodies, independent monitors, financing entities, and parties—these issues are beyond the scope of this Article, which seeks to identify the dangers of overlapping emissions trading regimes with varying liability rules.

For instance, while anyone might propose a CDM project that could satisfy the CDM Executive Board, *see* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 86, questions of financing are a bit trickier. Commentators have identified multiple ways in which CDM projects might be financed. The three most likely are (1) host country identification and financing, with subsequent CER sales to Annex I parties; (2) open market negotiation, whereby private and/or government entities enter into bilateral contracts for CDM projects; and (3) portfolio investments akin to a mutual fund model, whereby CDM project investment brokers analyze and recommend a portfolio of CDM projects for investors. *See* Stewart et al., *supra* note 7, at 204-05 (evaluating the pros and cons of each model). Each financing method raises different liability issues for parties, firms, and third parties. *Id.*

Similarly, this Article does not discuss the liability questions raised when a party hosting a CDM or JI project has understated its "hot air," thereby affecting the ability of an investment to meet the CDM or JI additionality requirement.

tional (ex post certification). The determination of when to certify CERs has a significant effect upon the liability rule ultimately applied and therefore is important to resolving questions of liability.

In an ex ante certification system, a project is first proposed, and then baseline emissions levels are determined. The project is then analyzed for expected emissions reductions, which are certified as CERs. Afterward, the project is monitored for performance. Under a seller-liability framework, the CERs awarded at the project proposal stage are guaranteed and investor risk is minimized; however, emissions reductions are not ensured. A project certified to achieve a certain level of emissions reductions may not actually achieve those expected reductions. Under a seller-liability framework, the non-Annex I party must ensure the expected emissions reductions are achieved even if the project does not meet these expectations. Because non-Annex I parties have no substantive commitments under the Protocol, it seems improbable that they can be held accountable for a failed CDM project. As a result, a seller-liability framework is unlikely to ensure that emissions are actually reduced and thereby minimize environmental risk.

In contrast, a buyer-liability rule in an ex ante certification system is likely to overcome this problem. Again, in an ex ante certification system, the project is certified to achieve a certain level of expected emissions reductions. The Annex I party finances the project, which is monitored over time. At some predefined time during or after the project, the project is evaluated for its actual ability to reduce emissions. If the project yields the expected emissions reductions, the Annex I party receives the expected number of CERs. If it yields fewer emissions reductions than expected, the number of certified CERs granted to the Annex I party is reduced accordingly. This system ensures that CERs are granted based on actual emissions reductions, not upon hypothetical predictions, which may prove to be misguided. A buyer-liability rule in an ex ante system, therefore, is really an ex post certification system.

This ex post certification system achieves improved environmental outcomes, but not without greater investor risk than an ex ante seller-liability system. Annex I parties investing in CDM projects have some information regarding the expected level of CERs they will achieve from their CDM projects due to the monitoring activities. The parties, however, cannot predict when forest fires or other natural phenomena might occur to wipe away the emissions-reducing benefits of the project. The buyers, therefore, bear the risk that they will invest in

a project that will yield no CERs despite their best efforts and for reasons outside their control. Some have called for CDM liability rules to be established by contract between the Annex I and non-Annex I parties.[81] Even so, remedies available to an Annex I party for a breach of contract by a non-Annex I party may be insufficient to compensate the Annex I party for its resulting noncompliance under the Protocol.

While both methods of certification have advantages and disadvantages, most commentators favor ex post certification because it largely avoids questions of liability.[82] An ex ante system is easier to administer, but is less likely to achieve preferred environmental outcomes. An ex post system, on the other hand, achieves better environmental performance, but imposes greater investor costs and uncertainty in the process. Currently, the Kyoto Protocol employs an ex ante certification system and is largely silent on the liability rules. This Article suggests the Kyoto Protocol should apply a buyer-liability rule to CDM projects, essentially converting them into ex post certifications.

b. *Buyer Liability*

The second liability question in the CDM context is what liability rule to use in the event a CDM project does not yield the CERs predicted before the parties undertake the project. As with JI projects, investments in non-Annex I countries are at great risk of not achieving the expected CERs. Indeed, the failure rate of CDM projects is likely to be higher than that of JI projects due to the lower management capacities of non-Annex I countries and their heightened vulnerability to climatic events and domestic regulatory change. Accordingly, liability rules may come into play more often in the CDM context than in the JI context. Some have suggested that differing reputational interests and strengths of domestic regimes between Annex I and non-Annex I parties counsel for a buyer-liability rule in the CDM context.[83] This Article argues that the principle of "common but differentiated

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[81] *See, e.g.*, Stewart et al., *supra* note 7, at 204 (explaining a market negotiation model to create contractual obligations between parties).

[82] *See* OECD, *Liability Assessment*, *supra* note 56, at 15 (noting the popularity of ex post certification). As discussed below, however, the responsibilities of parties to the Protocol may still raise significant liability questions in an ex post certification system. *See infra* Part IV.

[83] *See, e.g.*, SUZI KERR, ENFORCING COMPLIANCE: THE ALLOCATION OF LIABILITY IN INTERNATIONAL GHG EMISSIONS TRADING AND THE CLEAN DEVELOPMENT MECHANISM 9-10 (RFF Climate Issue Brief No. 15, 1998).

responsibilities" (CBDR) inherently imposes a buyer-liability regime in the CDM program.

As noted above, the Kyoto Protocol implements the UNFCCC, which establishes the concept of CBDR as the Convention's first guiding principle:

> The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.[84]

The CBDR principle is especially pertinent to the CDM, whereby Annex I and non-Annex I parties engage each other in emissions-reducing projects and Annex I parties earn CERs as a result of those projects. The CBDR principle calls on Annex I parties to transfer emissions-reducing technologies to non-Annex I parties and to meet binding emissions targets that are not applicable to non-Annex I parties. These two aspects of CBDR, as applied to the CDM, suggest that a buyer-liability rule should govern CDM projects.

Article 4.5 of the UNFCCC calls on Annex I parties to transfer emissions-reducing technologies to non-Annex I parties.[85] This invocation suggests Annex I parties may have to sacrifice to ensure the transfer. This sacrifice can take the form of increasing the potential for business competition as technology-importing countries develop

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[84] UNFCCC Treaty, *supra* note 32, art. 3.1. Given the UNFCCC's use of relative emissions reductions based upon prior emissions levels, determining binding emissions targets for non-Annex I nations might very well inhibit their economic development or otherwise be too speculative to have much meaning. *See* Paul Baer et al., *Equity and Greenhouse Gas Responsibility*, 289 SCIENCE 2287, 2287 (2000) (arguing that without a fair allocation scheme that will not impede their development, developing countries will not be able to restrict future emissions). This equity concern has caused some commentators to call for an equal right to the atmosphere and a system of global per capita emissions limitations. *Id.* While normatively this may be a superior allocation scheme, it has been rejected by the Kyoto Protocol and does not seem workable, given the current international political climate. For discussions of the CBDR principle, see generally Paul G. Harris, *Common but Differentiated Responsibility: The Kyoto Protocol and United States Policy*, 7 N.Y.U. ENVTL. L.J. 27 (1999); Jarrod Hepburn & Imran Ahmad, *The Principle of Common but Differentiated Responsibilities* (CISDL Legal Working Paper, 2005).

[85] UNFCCC Treaty, *supra* note 32, art. 4.5 ("The developed country Parties . . . shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other parties, particularly developing country parties, to enable them to implement the provisions of the Convention.").

their own environmentally sound technologies for export. Similarly, the UNFCCC calls on developed country parties to promote the development of endogenous emissions-reducing technologies within developing country parties.[86] This may also entail sacrifice on the part of developed countries as they could incur financial costs associated with promoting the use of technologies abroad. As CDM projects may include the transfer of emissions-reducing technologies, a buyer-liability rule is the only rule consistent with the language and implications of the UNFCCC and the CBDR principle for technology transfers. Such a rule places the ultimate responsibility for the effectiveness of the technology transfer in the hands of the developed country party.

The CBDR principle, however, extends beyond technology transfer agreements to all CDM projects and suggests a buyer-liability rule for them. The CBDR principle establishes that only Annex I parties have binding emissions targets under the Protocol; non-Annex I parties cannot be held liable.[87] In the CDM context, the CBDR principle suggests a buyer-liability rule when CERs are certified for a developed country party but the project does not yield the amount of emissions reductions certified. Since the Protocol has no mechanism for holding the non-Annex I party liable, buyer liability must be the default rule in the CDM program.

Buyer liability invalidates CERs earned or AAUs traded when CDM projects are ineffective or overselling of AAUs occurs.[88] This liability rule requires that all parties meet their emissions targets. While environmentally preferable to a seller-liability rule,[89] which permits parties

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[86] *Id.*

[87] Some have called for the use of contract law to impose liability on the non-Annex I party in the event of a reversal or CDM project failure. *See, e.g.*, OECD, *Liability Assessment*, *supra* note 56, at 15; Stewart et al., *supra* note 7, at 204. This Article suggests that while this is possible, it is unnecessary. Clarifying the existing framework, however, will provide all parties with a better understanding of their relative risks in any bargaining that might occur under a contract. But even if contract law is used to impose liability on the non-Annex I party for a failed CDM project, the Annex I party is still ultimately responsible under the Protocol. Certainly, a contract provision that requires a non-Annex I party to reforest a carbon sink in the event of a reversal or a forest fire would go a long way to ensure the predicted CERs are achieved. Ultimately, however, the only action an Annex I party might have against a non-Annex I party for a failed CDM project is a breach of contract action. Even if victorious, the Annex I party will be deemed noncompliant with its obligations under the Protocol if it relied upon achieving the predicted CERs to achieve compliance.

[88] For ease of discussion, the discussion pertaining to buyer liability will primarily relate to trading allowances.

[89] *See* CTR. FOR INT'L ENVTL. LAW, *supra* note 66, at 3 (noting that under a buyer-liability rule, both parties care about compliance).

to purchase oversold AAUs, a buyer-liability rule also has significant drawbacks. Buyer liability may create a domino effect, whereby if one seller becomes noncompliant, the oversold AAUs are invalid for use by any party buying those AAUs from the noncompliant seller.[90] If the buyer country cannot achieve compliance without those oversold AAUs, it becomes noncompliant as a result of the seller country's noncompliance. This pattern can repeat itself with each subsequent buyer, resulting in a chain of noncompliance.[91]

Another potential drawback of a buyer-liability rule is that when CERs and AAUs are not guaranteed to a buyer, the price of the CERs and AAUs becomes dependent on the ability of the host country to either ensure that the CDM project will achieve the expected emissions reductions or comply with its own emissions targets (if it has any).[92] As David Victor explains, "governments nearing default on their emission permit stocks would earn lower prices than those where management has been more prudent."[93] While this price effect is expected to reduce the incentive of parties to oversell, it also means that buyer parties must have a significant amount of information regarding the relative risks of noncompliance in different seller or project host countries. These transaction costs can be very high and can affect the liquidity of the system.

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[90] *See* VICTOR, *supra* note 59, at 71 (assessing the transaction costs that accompany buyer liability).

[91] OECD, *Liability Assessment*, *supra* note 56, at 23 & app. 1.

[92] *Id.* at 12-13; VICTOR, *supra* note 59, at 69 (noting that a buyer-liability rule uses market mechanisms to spur project reliability within the CDM); Timothy N. Cason, *Buyer Liability and Voluntary Inspections in International Greenhouse Gas Emissions Trading: A Laboratory Study*, 25 ENVTL. & RESOURCE ECON. 101, 102 (2003) (describing the purpose and benefits of a buyer-liability rule); Henrik Malvik & Hege Westskog, *The Kyoto Mechanisms and the Quest for Compliance: Unresolved Issues and Potential Pitfalls* 13 (CICERO Working Paper 2001:3, 2001). Haites and Missfeldt suggest that a buyer-liability rule would result in full compliance, but would also result in 20% higher costs than a voluntary full compliance scenario (as compared to a much lower expected increase under a commitment period reserve scheme). *See* Haites & Missfeldt, *Limiting Overselling II*, *supra* note 70, at 34-40. These costs were in part determined, however, based upon the model's formulation, which annualized the buying party's compliance. The model therefore assumed that compliance could only be achieved through the use of CERs and ERUs in all but the last year of the commitment period, since period AAUs do not become valid until a seller party demonstrates compliance. *Id.* at 60. This model, however, does not consider a buyer party's total compliance at the end of the commitment period under a pure trading scenario, so the true costs of a buyer-liability scheme for Article 17 trading is unclear.

[93] VICTOR, *supra* note 59, at 72.

Whether a buyer-liability regime is ultimately preferable in contexts other than the CDM is a matter of significant dispute. Although this Article ultimately adopts the framework of seller liability used by the Kyoto Protocol under Article 17, it does not pass judgment on the buyer-liability framework as a concept, nor as applied in the CDM context. Rather, the purpose of this discussion is to highlight the significant effect a liability rule may have on country compliance and the trading system as a whole. These effects become particularly significant, as discussed below, when linked trading regimes use different liability rules.

3. Joint Implementation

Similar in nature to the CDM, JI offers Annex I parties the opportunity to obtain ERUs by investing resources in another Annex I party for the purpose of achieving GHG emissions reductions.[94] JI projects generally involve the infusion of emissions-reducing technologies into existing or new power plants and factories. This scheme allows Annex I parties to enjoy the least costly means of reducing total GHG emissions while transferring emissions-reducing technologies abroad, consistent with the UNFCCC guiding principles.[95] In order to earn ERUs, an Annex I party must meet an additionality requirement—that is, it must achieve emissions reductions in addition to any reduction that would have occurred absent the project in a business-as-usual scenario.[96]

Additionality naturally requires that the emissions levels from a business-as-usual scenario be calculated. Once the baseline emissions are determined, the JI project is then evaluated for its ability to reduce emissions below the business-as-usual scenario. Additionality is particularly relevant to JI projects in EITs, where most JI projects are ex-

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[94] Kyoto Protocol, *supra* note 37, art. 6.

[95] UNFCCC Treaty, *supra* note 32, art. 3.3; *see* Roebijn Heintz, *Joint Implementation in Discussion*, *in* JOINT IMPLEMENTATION TO CURB CLIMATE CHANGE 181, 181 (Onno Kuik et al. eds., 1994) (highlighting JI's ability to allow countries to undertake cost-efficient measures to reduce global warming).

[96] Kyoto Protocol, *supra* note 37, art. 6.1(b); UNFCCC Treaty, *supra* note 32, art. 4.2(a). For an overview of JI, see Gosseries, *supra* note 78, at 49. This requirement does not necessarily exclude financially viable projects, as it is possible for there to be a financially viable project that faces administrative or other hurdles to implementation that cannnot be overcome without the intervention of the investing Annex I party. *See id.* at 71.

pected to occur.[97] For EITs, determining an accurate business-as-usual level of emissions may be difficult, given the existence of "hot air" in their emissions pattern and the lack of technical capacity to prepare accurate GHG emissions inventories. Further, the additionality requirement establishes an incentive for EITs to overreport their emissions, so JI projects will be more favorably received in their country.[98] The possibility of inaccurate emissions inventories raises the potential that JI projects will be authorized and ERUs awarded even though the projects do not actually meet the additionality requirement of the program.

To address these issues, the JI program provides two methods through which JI projects may be carried out. The first method, Track 1, applies to countries with reliable emissions accounting systems in place. Projects occurring under Track 1 of the JI program do not require international supervision.[99] Track 2, on the other hand, deals with JI projects involving countries without reliable emissions accounting systems.[100] Under Track 2, the Article 6 Supervisory Committee oversees the project to ensure that the ERUs are properly certified.[101]

While the availability of Track 2 alleviates some concerns regarding approval of JI projects between Annex II parties and EITs,[102] such

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[97] There are a number of reasons why EITs are the primary market for JI projects. EITs have fewer sunk costs in the energy sector and are less reliant on fossil fuel technologies. Therefore, they can incorporate emissions-reducing technologies at a lower cost than developed countries. *See supra* note 50. Further, the cost of exporting emissions-reducing technologies to EITs may be lower than exporting the same technologies to other parties since export to EITs is less likely to result in future competition in the export market for those technologies. *See* Env't Bus. Austl., Deep Cuts (in Greenhouse Gas Emissions) and Quantum Leaps (in Renewable and Sustainable Energy): Submission to the MRET Review Committee 5 (May 5, 2003), *available at* http://www.mretreview.gov.au/pubs/mret-submission88.pdf (noting that Australia faces export competition of renewable technologies from non-EIT European countries).

[98] While these incentives are counteracted slightly by the incentive to overreport the amount of "hot air" for purposes of trading emissions credits under Article 17, it is difficult to determine how these incentives will play out in terms of proper reporting among EITs.

[99] UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 88.

[100] Countries can also opt for such international supervision. Those that do so are evaluated under Track 2. *Id.*

[101] *Id.*

[102] Further, the experience that EITs had with JI projects in the years leading up to the Protocol's effective date should serve to lessen the likelihood of errant calculations. *See id.* at 89.

projects nevertheless raise an issue central to the concept of emissions trading: liability. The liability issue arises when JI projects do not yield the additional benefit predicted and expected by investors. This may be the result of improper emissions reporting or simply the failure of the technology transfer to reduce emissions. When such projects do not yield the expected emissions reductions, fewer ERUs are granted to emitting entities. Questions of liability therefore arise in determining who is responsible for ensuring that the expected emissions-reduction levels are properly attained and the overall emissions targets achieved. Unlike the CDM context, where only investing countries can be held liable for failure to comply with the Protocol, both parties involved in a JI project may be held liable under the Protocol.

Despite the significance of liability issues in the JI program, liability for failed JI projects is unclear under the Protocol.[103] Article 6.4 provides:

> If a question of implementation by a Party included in Annex I of the requirements referred to in this Article is identified in accordance with the relevant provisions of Article 8, transfers and acquisitions of [ERUs] may continue to be made after the question has been identified, provided that any such units may not be used by a Party to meet its commitments under Article 3 until any issue of compliance is resolved.[104]

This liability rule is different from that used in both the Article 17 trading framework and the CDM. The liability rule imposed in the JI program is traffic-light liability.[105]

Under the traffic-light liability scheme, ERUs obtained by an investing party are guaranteed if they are earned before a compliance problem is detected in the EIT project host country. This is known as a green-light trading scenario, and a seller-liability rule applies.[106]

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[103] Article 3 is designed to address liability under JI, but it does not distinguish liability mechanisms applied to ERUs earned through JI projects and AAUs traded under Article 17.

[104] Kyoto Protocol, *supra* note 37, art 6.4.

[105] *See* OECD, *Liability Assessment*, *supra* note 56, at 26;, OECD Env't Directorate, *International Emissions Trading Under the Kyoto Protocol*, at 23, OECD Doc. ENV/EPOC(99)18.FINAL (May 28, 1999) (*prepared by* Fiona Mullins) [hereinafter OECD, *International Emissions Trading*] (examining the possible hybrid liability approach for the JI program suggested by Article 6.4); Michael Grubb, *International Emissions Trading Under the Kyoto Protocol: Core Issues in Implementation*, 7 REV. EUR. COMMUNITY & INT'L ENVTL. L. 140, 141 (1998) (explaining the costs and benefits of a shared liability rule).

[106] VICTOR, *supra* note 59, at 141.

Once a compliance problem is detected in the host party, a yellow-light scenario develops.[107] ERUs obtained during the yellow-light scenario may not be used by the investing party until the host party achieves compliance.[108] Investing parties may still invest in JI projects during a yellow-light scenario, but they do so at the risk that the host party will end up noncompliant and that any ERUs earned from such a project will become worthless. In a yellow-light scenario, a buyer-liability rule applies.[109]

It is unclear how a traffic-light liability scheme dependent upon the timing of a party's compliance might be employed when compliance is assured only at the end of the commitment period. Such a system is highly complex, as yellow-light transactions are timing dependent and require ongoing monitoring of the state of compliance among potential project host countries.[110] A traffic-light liability rule is interesting from a systemic perspective as well, because it suggests that investing parties will have to incur the level of information costs associated with the buyer-liability rule, despite the existence of a seller-liability component. This aspect of the rule raises questions about investments, market confidence, and transaction costs.[111]

This cursory review of the Kyoto Protocol demonstrates three different potential liability frameworks, including seller, buyer, and traffic-light liability. Since Annex I parties might use JI, Article 17 trading, or CDM projects to meet their emissions targets and ensure compliance with the Protocol, liability rules may have a significant impact on which program or programs they choose to use. The next Section demonstrates that the issue of differentiated liability rules is even more complex. As cross-jurisdictional elemental trading regimes have emerged to implement the Protocol, differing liability rules have

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[107] OECD, *Liability Assessment*, *supra* note 56, at 26. For a discussion of what compliance issues might trigger a yellow or red light, see *id.* at 27-28; GOLDBERG ET AL., *supra* note 40, at 16.

[108] Kyoto Protocol, *supra* note 37, art. 6.4; *see also* GOLDBERG ET AL., *supra* note 40, at 16 (noting that buyers cannot redeem allowances during a "yellow-light" period).

[109] *See* OECD, *Liability Assessment*, *supra* note 56, at 15 ("[A] buyer may not use acquired ERUs if a compliance problem is identified under JI, suggesting a form of buyer liability."); GOLDBERG ET AL., *supra* note 46, at 2 (noting that trading during a "yellow-light" period entails more risk for buyers).

[110] This liability scheme is highly vulnerable to game playing by parties during the time lag between verifications of emissions inventories if ERUs or AAUs obtained during a green-light phase are instead treated under a buyer-liability rule. In such a situation, a party could take advantage of the verification time lag to oversell AAUs or induce JI investments. *See* CTR. FOR INT'L ENVTL. LAW, *supra* note 66, at 4, 6-8.

[111] *See* Haites & Missfeldt, *Limiting Overselling I*, *supra* note 70, at 65-66.

created opportunities for forum shopping and regime competition, with deleterious effects for global emissions reductions.

B. *Kyoto Gives Birth: The Rise of Elemental Regional Trading Regimes*

The mere possibility that the Protocol would become binding international law was enough to spark the creation of national and regional trading regimes designed to implement it.[112] A number of regional GHG emissions trading regimes nested within the Kyoto framework have emerged in recent years.[113] These elemental regimes are nested, either wholly or partially, within a hierarchy that places the Protocol at the top of the regulatory pyramid. Under a nested framework, the Protocol is, in principle, the overarching regulatory framework and, therefore, its rules should preempt conflicting regulations in a subregime.[114] Nested elemental regimes implementing the Protocol operate within the spaces it left unaddressed, but are generally consistent with the Protocol.

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[112] *See* Tom Tietenberg, *Tradable Permits in Principle and Practice*, 14 PENN ST. ENVTL. L. REV. 251, 251-52 (2006) (noting that the Kyoto Protocol has spawned other trading regimes, such as the European Union's cap-and-trade program for GHGs); *see also* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 92 (describing the European Union's cap-and-trade program and a series of domestic emissions trading regimes). Although a variety of national regimes have sprouted up to implement the Kyoto Protocol, including Canada, Denmark, Sweden, Australia, and Japan, an analysis of those regimes is beyond the scope of this Article. Several authors have analyzed the issues of interlinking purely domestic emissions trading regimes with the Kyoto Protocol. *See, e.g.*, OECD Env't Directorate & IEA, *Exploring Options for "Sectoral Crediting Mechanisms"*, OECD Doc. COM/ENV/EPOC/IEA/SLT(2005)1 (2005) (*prepared by* Martina Bosi & Jane Ellis) (discussing transectoral trade agreements); YONG GUN KIM & ERIK F. HAITES, KOREA ENVT. INST., GREENHOUSE GAS EMISSIONS TRADING SCHEMES: RECENT DEVELOPMENT AND POLICY RECOMMENDATIONS FOR KOREA 6-7 (2005).(same). However, any conflict between such national regimes and the Protocol would not affect a party's obligations under the Protocol and would not involve JI, CDM, or Article 17 trading, unless cross-country linkages are established. This Article leaves a fuller discussion of the impacts of linking domestic emissions trading regimes to the Protocol for another day.

[113] For purposes of this Article, the term "regional" refers to trading regimes with multiple sovereign entities that could be parties to the Kyoto Protocol. It therefore does not relate to regional programs located wholly within a single national jurisdiction, such as the Regional Greenhouse Gas Initiative, which was established to promote GHG trading among northeastern states in the United States.

[114] *See* Karen J. Alter & Sophie Meunier, *Nested and Overlapping Regimes in the Transatlantic Banana Trade Dispute*, 13 J. EUR. PUB. POL'Y 362, 363 (2006) ("When institutions are nested . . . conflicting policies of the subsumed regime constitute a violation of the more encompassing institution.").

While these nested elemental regimes are designed to ensure compliance with the Kyoto Protocol, each regime is designed with slight variations in the method of allocating emissions allowances, certifying emissions reductions, determining baseline emissions and eligibility of land-use offset projects, permitting banking of emissions-reduction credits into future commitment periods, and holding parties liable for noncompliance. The extent of the differences between these elemental regimes and the requirements of the Kyoto Protocol also vary by elemental regime. These differences, even when seemingly minor, may have profound impacts on the effectiveness of the regime complex as a whole. The next Parts analyze the similarities and differences between the two largest emissions trading schemes nested within the framework of the Kyoto Protocol: the European Union Emissions Trading Scheme and the United Kingdom Emissions Trading Scheme.

1. The European Union Emissions Trading Scheme as a Nested Elemental Regime

On January 1, 2005, in response to the Kyoto Protocol, the European Union Emissions Trading Scheme (EU ETS) went into effect, establishing a cap-and-trade program for GHG emissions within the EU.[115] The first phase of the EU ETS, lasting until 2007, is termed the "warm-up" phase and deals only with CO_2 emissions from the energy, pulp and paper, iron and steel, and minerals sectors.[116] The next phase, which runs from 2008 through 2012, coincides with the first commitment period of the Kyoto Protocol.[117] The scope of the EU ETS is expected to expand to cover more GHGs and industrial sectors during the next phase.[118]

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[115] *See* Kruger & Pizer, *supra* note 48, at 8.

[116] *Id.* at 8, 10; Peter Zapfel, The EU Emissions Trading Scheme, Presentation at the OECD Global Forum on Sustainable Development: Emissions Trading 5 (Mar. 18, 2003), *available at* http://www.oecd.org/dataoecd/9/39/2790139.pdf.

[117] *See* Kruger & Pizer, *supra* note 48, at 10.

[118] *See Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: Building a Global Carbon Market—Report Pursuant to Article 30 of Directive 2003/87/EC*, at 7, 11-12, COM (2006) 676 final (Nov. 13, 2006) [hereinafter *Commission Report, Building a Global Carbon Market*].

The EU ETS involves twenty-five countries and more than ten thousand sources of CO_2 pollution,[119] or roughly half of the EU's total CO_2 emissions.[120] The scope of emissions trading under the EU ETS is tremendous and the scheme's operation will establish an important precedent for future regional trading programs.[121] As with the Kyoto Protocol, concerns exist about whether member countries have sufficient institutional capacity and reliable information about GHG output levels to make the trading scheme viable.[122] Despite these practical concerns, the EU ETS has gone forward and is developing a robust CO_2 trading market. Whether the EU ETS will ultimately prove successful cannot be determined with any precision at this point, but the existence of the elemental regime within the larger GHG emissions trading regime complex raises important questions regarding the effects of rule differences between elemental regimes.[123]

The EU ETS is a nested regime that links its commitment timelines and emissions targets to those of the Kyoto Protocol.[124] It per-

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[119] *See Commission Report, National Allocation Plan Progress Table—8* (Mar. 2004), *available at* http://europa.eu.int/comm/environment/climat/pdf/nap_progress.pdf (totaling the number of installations detailed for each member country).

[120] *See* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 92 box 8.4.

[121] *See* Kruger & Pizer, *supra* note 48, at 15 tbl.1, for a discussion of the size of the EU ETS trading regime as compared to trading regimes within the United States.

[122] *See* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 92 box 8.4.

[123] This GHG emissions trading regime complex might also be considered part of an energy regime complex. *See* David G. Victor et al., The Global Energy Regime 35-37 (Jan. 16, 2006) (unpublished manuscript, on file with author).

[124] The EU ETS is a nested regime because it is subsumed by Kyoto, yet no bubble agreement exists for the EU with respect to the Kyoto Protocol under Article 4.1. A bubble agreement exists when parties to the Kyoto Protocol agree to fulfill jointly their obligations under the Protocol. *See* Kyoto Protocol, *supra* note 37, art. 4.1; OECD, *Liability Assessment*, *supra* note 56, at 14-15. Under such an agreement, if the parties fail "to achieve their total combined level of emissions reductions," each party remains "responsible for its own level of emissions set out in the agreement." Kyoto Protocol, *supra* note 37, art. 4.5. Under such bubble agreements, issuer liability applies to trades that cause the bubble to be noncompliant. *See* OECD, *Liability Assessment*, *supra* note 56, at 15.

Because no bubble agreement exists, each EU ETS member that is a signatory to the Kyoto Protocol has obligations under both the EU ETS and the Protocol and must decide which obligation to follow when the rules conflict and no clear resolution of the conflicting rules exists. This inherent nesting of EU ETS policies is sharply criticized by Alter and Meunier, *supra* note 114, at 378. *But see* Memorandum from Michael Oppenheimer & Annie Petsonk to Sophie Meunier, Linked Regimes To Solve the Timing Problem for Global Warming 5-6 (2006) (on file with author) (arguing that the possibility of nested agreements "can be a powerful force for encouraging the participation of sovereign nations in environmental protection regimes"). If a bubble agreement exists for a region, then the regional elemental trading regime would be

mits parties to link their intra-EU activities with the Kyoto Protocol CDM and JI programs, as well as with other non-EU trading schemes with other parties to the Protocol.[125] As such, any link the EU ETS might develop in the future would be fully nested within the framework of the Protocol. Similarly, ERUs and CERs obtained through the JI and CDM mechanisms of the Kyoto Protocol can be converted into EU allowances and traded with other allowances in that program.[126] This effort to recognize Kyoto ERUs, CERs, and AAUs as tradable commodities within the EU ETS and to ensure that intra-EU projects meet Kyoto standards will likely help member countries reduce their total compliance cost.[127]

While the EU ETS seeks to harmonize its policies with those of the Kyoto Protocol, it has neither fully synchronized its liability rules with the Protocol nor ensured that standard procedural requirements are applied within its member countries. For instance, while the EU ETS harmonizes its non-compliance penalties (e.g., monetary fines[128]), reporting and monitoring requirements, and rules for which entities may own allowances and trade,[129] it nevertheless allows country variability in how emissions surpluses are banked for use in future years or commitment periods to achieve compliance[130] and how emissions allowances are allocated.[131] This variability among different nested elemental regimes within a regime complex can have significant consequences.

The impact of differences among operational requirements pales, however, in comparison to the impact different liability rules might have. The EU ETS raises two major liability issues in the context of a trading regime complex. The first issue relates to whether the EU ETS system, as currently designed, can avoid the difficult liability is-

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analogous to a national trading system with external liability hooks for noncompliance. Such regimes are beyond the purview of this Article.

[125] *See* KIM & HAITES, *supra* note 112, at 17 tbl.2-2, 35.

[126] *See* Kruger & Pizer, *supra* note 48, at 12.

[127] *See* KIM & HAITES, *supra* note 112, at 53.

[128] *See* Kruger & Pizer, *supra* note 48, at 16 (describing the EU ETS's structure).

[129] Haites, *supra* note 61, at 111 n.25.

[130] *Id.* at 112.

[131] The EU ETS only requires that no more than ten percent of emissions allowances be auctioned, beginning on January 1, 2008. Council Directive 2003/87/EC, art. 10, 2003 O.J. l2751; PEW CTR. ON GLOBAL CLIMATE CHANGE, THE EUROPEAN UNION EMISSIONS TRADING SCHEME (EU-ETS): INSIGHTS AND OPPORTUNITIES 7, *available at* http://www.pewclimate.org/docUploads/EU%2DETS%20White%20Paper%2Epdf (last visited May 1, 2007).

sues raised by this Article through its ex post certification process. The second issue relates to what liability rule the EU ETS system imposes in the event liability issues arise in spite of the certification process.

The EU ETS assigns an annual allowance to member countries based on the countries' emissions targets under the Protocol. The EU ETS seeks to avoid the problem of allowance overselling by requiring member states each year to surrender, or retire, enough allowances to cover their verified CO_2 emissions.[132] This system of annual retirement is similar to the CPR established by the Kyoto Protocol. Surplus, allowances may be traded on an annual basis or banked for use toward achieving the EU ETS emissions target of the following year.[133] This system is an ex post certification and trading regime that is designed to limit emissions trading to actual reductions. Because such tradable allowances are based upon actual emissions reductions, their validity is guaranteed to the buyer.

The EU ETS annual retirement and surplus trading system prevents overselling in all but the final year of the commitment period, during which a country may sell surplus allowances while still emitting more GHGs than it was entitled to emit.[134] Indeed, a country can earn surplus allowances in the first year of an EU ETS phase, sell those surplus allowances in the second year, and then emit more than permissible. The country would not be able to sell allowances in the next year, but would still be in noncompliance with its overall emissions target. Additionally, the EU ETS system presumes that annual emissions of CO_2 may be verified accurately within sufficient time to permit a liquid trading market to develop on an annual basis. The Kyoto verification process has demonstrated this inventory and verification process is unlikely to occur so rapidly.[135] What this time lag means is

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[132] *See* Council Directive 2003/87/EC, *supra* note 131, art. 12.3; *Commission Report on EU Action Against Climate Change: EU Emissions Trading—An Open Scheme Promoting Global Innovation*, at 12 (Sept. 2005), *available at* http://ec.europa.eu/environment/climat/pdf/emission_trading2_en.pdf; PEW CTR. ON GLOBAL CLIMATE CHANGE, *supra* note 131, at 7.

[133] *Commission Report on EU Action Against Climate Change*, *supra* note 132, at 12.

[134] OECD, *Liability Assessment*, *supra* note 56, at 33-34.

[135] CTR. FOR INT'L ENVTL. LAW, *supra* note 66, at 4 (suggesting that it would take up to two years to perform annual emissions "inventories"). Even if such a process can occur within the timeframe, issues of market liquidity are significant concerns if the system is to conduct wholly ex post verification of emissions inventory reporting. Additionally, the limited trading market likely would result in a uniform CO_2 price significantly higher than the price of CO_2 allowances that may be obtained from other parties to the Kyoto Protocol.

that in future years, countries may be able to trade allowances that are not verified as surplus.[136] Accordingly, the EU ETS system, while addressing many concerns regarding overselling, must still ascribe liability in the event a country is not in compliance at the end of a year or at the end of the commitment period.

Despite the possibility of liability issues, the EU ETS does not explicitly establish a liability rule to be imposed in the event of overselling. Article 16.3 of the directive establishing the EU ETS reads:

> Member States shall ensure that any operator who does not surrender sufficient allowances . . . to cover its emissions during the preceding year shall be held liable for the payment of an excess emissions penalty. . . . Payment of the excess emissions penalty shall not release the operator from the obligation to surrender an amount of allowances equal to those excess emissions when surrendering allowances in relation to the following calendar year.[137]

This rule is silent as to how the EU ETS ascribes liability in the event of overselling. Most commentators, however, have concluded that the

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[136] The EU ETS permits futures trading, so it allows parties to speculate regarding the amount of surplus any particular country within the framework may achieve. Futures trading preceded the opening date of the EU ETS CO_2 market, and firms have been engaging in spot trading of CO_2 emissions allowances before emissions inventories were submitted for 2005. *See* Peterson, *supra* note 71, at 4. The EU ETS can handle the time lag issue either by pushing trades of unverified surplus into the futures market or by permitting such trades based upon the latest available verified emissions inventory. As expected, futures trading operates under a buyer-liability rule. One benefit of the surplus trading rule is that it creates incentives for countries to prepare their emissions inventories early. As a result, even if trading of unverified surplus occurs on the futures market, buyers have access to important information regarding the likelihood of a country's compliance, given the existence of annual verified inventories. While this information is largely irrelevant in a seller-liability framework, in the futures market it can be vitally important for investors.

[137] Council Directive 2003/87/EC, *supra* note 131, art. 16.3. The penalty for noncompliance is €40 per ton of excess CO_2 emitted into the atmosphere. *Id.* art. 16.4. In Phase II, the penalties increase to €100 per ton of excess CO_2. *Id.* art. 16.3. The EU ETS penalty, however, is sufficiently high to be effective and, since it does not release a member state from its obligation to achieve compliance, does not act as a price cap. *See* OECD Env't Directorate & IEA, *Linking Non-EU Domestic Emissions Trading Schemes with the EU Emissions Trading Scheme*, at 29, OECD Doc. COM/ENV/EPOC/IEA/STL(2004)6 (June 17, 2004) (*prepared by* William Blyth & Martina Bosi) [hereinafter OECD, *Linking*]; CTR. FOR CLEAN AIR POLICY, DESIGN OF A PRACTICAL APPROACH TO GREENHOUSE GAS EMISSIONS TRADING COMBINED WITH POLICIES AND MEASURES IN THE EC 21-22 (1999); VIVIAN E. THOMSON, PEW CTR. ON CLIMATE CHANGE, EARLY OBSERVATIONS ON THE EUROPEAN UNION'S GREENHOUSE GAS EMISSION TRADING SCHEME: INSIGHTS FOR UNITED STATES POLICYMAKERS 16 (2006); Joseph Kruger & William A. Pizer, *The EU Emissions Trading Directive: Opportunities and Potential Pitfalls* 36 (Resources for the Future, Discussion Paper 04-24, 2004).

EU ETS uses a seller-liability framework,[138] and the largely uniform price of CO_2 in the EU ETS market suggests that they are correct.[139]

Whatever liability rule is ultimately imposed, the EU ETS annual retirement and surplus trading scheme may have a significant impact on the global warming regime complex given the possibility of linkages across trading regimes. Limiting trading to surplus allowances should significantly affect liquidity in the EU ETS allowances market. With only a limited number of tradable allowances on the market, both the demand for, and the price of, those allowances will be high. The EU ETS allowance price can be expected to be much higher than other trading systems that do not limit trading to surplus allowances, *ceteris paribus*. As the EU ETS links with other systems that do not employ a surplus trading framework, this market liquidity effect can have significant implications for trades across regimes and may foster gameplaying.[140] As discussed in greater detail below, the differences between liability rules employed under the EU ETS and the Kyoto Protocol, and their relative impacts on market liquidity, can have profound effects for the GHG emissions trading regime complex and environmental protection.

2. The United Kingdom Emissions Trading Scheme as a Partially Nested Elemental Regime

The United Kingdom Emissions Trading Scheme (UK ETS), the first national GHG trading regime, was established in 2002 to promote

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[138] *See, e.g.*, CATHERINE BOEMARE & PHILIPPE QUIRION, CIRED, INTERACTION IS EU CLIMATE POLICY: INTERACTION BETWEEN THE E.U. DIRECTIVE AND SELECTED NATIONAL POLICIES: THE CASE OF FRANCE 4 tbl.1, 12 (2002); Josh Carmody, Baker & McKenzie, International Trading Schemes: Lessons and Links, Presentation at the AETF & CRC for Greenhouse Accounting Sydney Seminar, at slide 15 (Apr. 20, 2004), *available at* http://www.aetf.emcc.net.au/pdf_events/past_events_ppt/Carmody20040420.ppt; Reg'l Greenhouse Gas Initiative (RGGI), Summary of June 25, 2004 RGGI Stakeholder Workshop on GHG Offsets 3, *available at* www.rggi.org/docs/offsets_workshopsummary.pdf (last visited May 1, 2007).

[139] However, the EU has been a vocal proponent of a shared liability rule for overselling under the Kyoto Protocol. *See* ROLFE & NOWLAN, *supra* note 51, at 13. The EU proposal would impose full seller liability and would invalidate some AAUs for the buyer until the seller can demonstrate compliance. At such time as compliance is assured, the temporarily invalidated AAUs may be used by the buyer. *Id.*

[140] Although the premium obtained in the sale of tradable allowances in the EU ETS might push firms to use emissions-reducing technologies to gain tradable surplus, no full analysis of the market impacts of such a regime has been conducted as of yet. Futures markets have served to address the liquidity problem somewhat, though the impact of the system upon trading volume, efficiency, and environmental outcomes is still largely unknown.

the voluntary reduction of GHGs and assist the UK in meeting its emissions targets under the Kyoto Protocol.[141] The UK ETS was implemented prior to the Protocol taking effect and is therefore unique in some respects. While its early adoption was an important step forward in the global effort to regulate GHG emissions, it also created the possibility of linkages with countries that are not parties to the Kyoto Protocol. The UK ETS, therefore, is partially nested within the Protocol regime because unlike the EU ETS, which involves only parties to the Protocol, the UK ETS may involve both parties and nonparties to the Protocol. These cross-jurisdictional linkages can have profound implications for the success of the regime and can significantly complicate trading within the regime complex. These effects are compounded where, as here, the regimes use liability rules that differ from the Protocol.

The UK ETS is a five-year program lasting through the end of 2006.[142] The UK ETS has proven to be an important market for CO_2 trading: in the first two years of the trading regime, nearly one thousand firms traded 4.5 million tons of CO_2, or approximately 8% of the total allowances afforded to industry.[143] Although the regime began as a voluntary measure, it has since been linked with the Climate Change Levy, a tax on the use of energy by industry, and, as a result, it now has important mandatory elements.[144] The regime involves a variety of participants, including direct participants that take on emissions caps in exchange for government subsidies, firms with Climate Change Agreements (CCAs), investors in individual emissions-reduction projects, and traders.[145]

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[141] *See* UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 92.

[142] Steve Sorrell, *The UK Emissions Trading Scheme*, *in* KOREAN ENV'T INST. ET AL., DOMESTIC GREENHOUSE GAS EMISSIONS TRADING SCHEMES 29, 31 (n.d.), *available at* http://www.iges.or.jp/en/cp/output_all/presentation/ECOASIA/keiigeset.pdf (last visited May 1, 2007).

[143] *See* NERA ECON. CONSULTING, REVIEW OF THE FIRST AND SECOND YEARS OF THE UK EMISSIONS TRADING SCHEME 5-6 (2004), *available at* http://www.defra.gov.uk/environment/climatechange/trading/uk/pdf/nera-commissionreport.pdf.

[144] *See* Sorrell, *supra* note 142, at 30 (explaining the Climate Change Levy). The largely voluntary nature of the program makes unnecessary an analysis of the price-cap effects of the relatively low penalty (full payment of the Climate Change Levy for two years) upon noncompliance, which ranges from £4.6-£9.4 British pounds per ton of CO_2. *See id.* at 35 tbl.3.2. It is believed, however, that the penalty for noncompliance is still sufficiently high to be dissuasive. *See id.* at 43.

[145] UNFCCC, THE FIRST TEN YEARS, *supra* note 31, at 92; Sorrell, *supra* note 142, at 32. However, the project component—that is, the last two categories of participants—

This Article focuses on how the UK ETS regulates CO_2 trades among the nearly 6000 CCA participating firms and over 12,000 facilities.[146] CCAs establish absolute or relative emissions targets as negotiated between government and industry.[147] CCA participants are divisible into two groups: those with absolute emissions caps (i.e., total emissions are capped) that are able to engage in unrestricted trading, and the much larger group of those without absolute caps that are restricted to trading their relative emissions (i.e., emissions relative to output) within a real-time registry known as the Gateway.[148] CCA participants that meet their targets receive an eighty percent discount from the Climate Change Levy, a tax on the industrial use of energy. Failure to meet the targets results in payment in full of the Climate Change Levy.[149] Under the UK ETS, superior performing organizations can sell their unused allowances to other entities after such allowances are verified as accurate by a third-party organization.[150]

Like the EU ETS, the UK ETS permits trading of surplus allowances only after compliance is assured. However, like the EU ETS, trading can and does occur before such compliance is assured, such as when, prior to verification, a facility "ring-fences" (or captures) its surplus so that it cannot be used by the industry as a whole.[151] Such ring-fenced allowances become valid only after verification, but futures trading of those allowances occurs regularly. This suggests a twofold approach to liability similar in nature to the EU ETS model, but different in kind.

As with the EU ETS, the primary liability rule in the UK ETS is a seller-liability rule, though the futures trading that has developed within the UK ETS operates under a buyer-liability rule. To minimize the risk to direct participants who might purchase allowances from

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seems unlikely to come into effect. KIM & HAITES, *supra* note 112, at 21; *see also* Sorrell, *supra* note 142, at 31.

[146] *See* Sorrell, *supra* note 142, at 41.

[147] KIM & HAITES, *supra* note 112, at 25. Electricity generators and oil refineries are excluded from participation in the UK ETS due to the potential for double-counting emissions reductions by such entities. *See* Sorrell, *supra* note 144, at 5, 41. This is in stark contrast to the trading scheme in Denmark which involves only electricity generators. *Id.* at 35 n.6.

[148] KIM & HAITES, *supra* note 112, at 21.

[149] *Id.* at 25.

[150] *Id.* Allowances obtained through superior performance, however, cannot be banked into future years or commitment periods. *Id.*

[151] MATTHIEU GLACHANT & GILDAS DE MUIZON, CLIMATE CHANGE AGREEMENTS IN UK: A SUCCESSFUL POLICY EXPERIENCE? 18-19 (2006), *available at* http://www.cerna.ensmp.fr/Documents/MG-GM-ClimateChangeAgreements.pdf.

CCA participants with relative emissions targets, the UK ETS uses its Gateway real-time registry, which enables participating entities to check the status of a firm to determine whether the firm is overselling its allowances.[152] No such system, however, exists for trades by direct participants or CCA participants with absolute emissions caps.

The combination of mandatory emissions-reduction targets for direct participants, voluntary targets for CCA participants, and significant facility closures has resulted in chronic oversupply of allowances and unique demand effects in the market pricing of CO_2.[153] This oversupply problem might be resolved by applying stricter emissions targets, but the UK ETS's reliance on the voluntary CCA sector to spark market demand for allowances suggests that this resolution will likely not fix the oversupply problem. If the price of allowances gets too high, voluntary CCA participants can simply opt out of the trading scheme and pay the Climate Change Levy. This effective price cap on allowances and the voluntary elements of the UK ETS make it largely incompatible with the EU ETS.[154] Indeed, the European Commission recognized the potential for incompatibilities between the EU ETS and the UK ETS when it approved the UK schemes as required under the "state aid" rules for subsidization of industry.[155] The Commission noted that modifications to the UK ETS might be required to align it with the EU ETS.[156] No such modifications have yet occurred.

Instead of modifying its structure to ensure compatibility across trading regimes, the UK ETS seeks to expand into markets with high demand for allowances. These efforts have included discussions of possibly linking the UK ETS with a recently established emissions-reduction program in California.[157] While such linkages must be ap-

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[152] KIM & HAITES, *supra* note 112, at 26.

[153] Sorrell, *supra* note 142, at 43-44.

[154] *See* STEVE SORRELL, SCIENCE AND TECHNOLOGY POLICY RESEARCH, BACK TO THE DRAWING BOARD?: IMPLICATIONS OF THE EU EMISSIONS TRADING SCHEME FOR UK CLIMATE POLICY 25-29 (2003), *available at* http://www.sussex.ac.uk/spru/documents/drawingreport.pdf; *see also* Steve Sorrell, *Turning an Early Start into a False Start: Implications of the EU Emissions Trading Directive for the UK Climate Change Levy and Climate Change Agreements*, at 22, OECD Doc. CCNM/GF/SD/ENV(2003)7/FINAL (exploring the effect of CCAs on the relationship between the EU ETS and the UK ETS).

[155] Letter from Mario Monti, Member of the Eur. Comm'n, to the Right Hon. Jack Straw MP, Sec'y of State for Foreign & Commonwealth Affairs, U.K. 10-12 (May 28, 2001), *available at* http://ec.europa.eu/community_law/state_aids/comp-2001/n416-01.pdf.

[156] *Id.*; *see also* Sorrell, *supra* note 142, at 31.

[157] *See* George Jones, *Blair Cuts Out Bush in Deal with Schwarzenegger To Set Up Carbon Trading Scheme*, DAILY TELEGRAPH (London), Aug. 1, 2006, at 6. *See generally* Global

proved by the UK government, the chronic oversupply of CO_2 allowances and reduced trading volumes since the initial trading flurry create significant financial and political pressure for the UK to approve those linkages. These incentives may very well cause the UK ETS to link with trading regimes in California or countries that are not party to the Protocol. If the UK ETS links with trading regimes that are not nested within the Kyoto Protocol, the fungibility of allowances and liability issues will become of paramount significance for the success of the Protocol and the GHG emissions trading regime complex. The implications of such linkages are discussed in greater detail in Part III.

III. COMPETING AGAINST THE GLOBE: COMMON BUT DIFFERENTIATED LIABILITY AND COMPETITIVE ENTROPY

The ever-growing global GHG emissions trading regime complex has established a mosaic of different liability regimes. While more elemental regimes will likely emerge as emissions trading becomes more common, the existing regime complex offers significant lessons in the creation of nested and parallel regimes. This Part analyzes why countries seek to form elemental trading regimes and the pressures that push those regimes to differ from the Kyoto Protocol. After identifying the incentives that lead to the creation of differing trading regimes, this Part then analyzes how different trading regimes create entropic interregime competition within the regime complex.

A. *Creating Multiple, Differentiated Regimes To Achieve a Common Goal*

There may be a number of reasons why countries seek to create nested elemental regimes within a regime complex. International relations theories shed some light on this form of development. The neofunctionalist theory of regime development suggests that the sunk costs and sticky nature of creating an international regime make participation in nested regimes not worth the additional transaction costs unless either those regimes offer tangible benefits significantly greater than the superregime or game playing across those regimes offers instrumental values sufficient to overcome the high transaction costs.[158]

Warming Solutions Act, A.B. 3293, 2005-2006 Leg., Reg. Sess. (Cal. 2006) (enacted) (establishing a mandatory cap on California GHG emissions).

[158] *See* Laurence R. Helfer, *Regime Shifting: The TRIPs Agreement and New Dynamics of International Intellectual Property Lawmaking*, 29 YALE J. INT'L L. 1, 7 (2004) (noting that the persistence of benefits to states from regimes modify barginaing between them); *see also* ANDREAS HASENCLEVER ET AL., THEORIES OF INTERNATIONAL REGIMES 108 (1993).

Realist theory, on the other hand, suggests regime change occurs when power balances change.[159] Other theories suggest that a certain level of path dependence exists in the creation of regimes nested within a superregime.[160] Whatever the reasons, the nascent GHG regime complex is experiencing elemental regime growth at a rather abrupt pace.

This Article seeks to analyze the competitive implications of legal differences across regimes within the regime complex. This competition arises when countries establish common but differentiated regimes within a regime complex. Countries may seek to establish a separate regime because they (1) disagree with the theory and method of implementation for achieving such reductions used by the Protocol,[161] (2) agree with the Protocol's methodology and theory, but believe reductions might be more effectively managed at a different level of governance or with fewer parties,[162] (3) seek to advance their own interests and believe another regime may be more effective in doing so,[163] (4) believe another regime would more effectively reduce GHGs, (5) employ regional agreements to gain bargaining leverage in the Protocol,[164] or (6) believe that the goals elucidated by the Protocol are unworthy or contrary to their interests and therefore seek to un-

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[159] *See* ROBERT O. KEOHANE & JOSEPH S. NYE, POWER AND INTERDEPENDENCE: WORLD POLITICS IN TRANSITION 43 (1977).

[160] *See* Raustiala & Victor, *supra* note 8, at 279-80, 296-99.

[161] Indeed, shifting the discussion to a new regime may be preferable for some actors who seek to propose more radical changes, since seeking changes within an existing regime may result in a significant backlash that ultimately undermines the likelihood of adoption of the desired changes. *See* Helfer, *supra* note 158, at 14-15, 58-59 (noting that attempts to change regimes create conflicts when other countries prefer the status quo); *see also* Oona A. Hathaway, *Path Dependence in the Law: The Course and Pattern of Legal Change in a Common Law System*, 86 IOWA L. REV. 601, 609-13 (2001) (discussing path dependence in the context of international trade and politics).

[162] Indeed, negotiation efficiency between and among parties at different levels is one reason regime complexes develop. *See* Memorandum from David Victor to the Participants, Nested and Overlapping Regimes Conference (Feb. 9, 2006) (on file with author) (proposing that regimes endure where they overlap with each other).

[163] For instance, countries may seek regional agreements to tie emissions trading to other interests of theirs, such as liberalization of economic regimes. *See* Helfer, *supra* note 158, at 21-22 (describing the effectiveness of this approach in the intellectual property context).

[164] *See* Edward D. Mansfield & Eric Reinhardt, *Multilateral Determinants of Regionalism: The Effects of GATT/WTO on the Formation of Preferential Trading Arrangements*, 57 INT'L ORG. 829, 835-36 (2003) (discussing the importance of promoting the interests of smaller states to bolster bargaining power).

dermine the Protocol.[165] Each of these goals may result in pressures to create a regime different from that of the Kyoto Protocol.

The differing liability rules employed by the elemental regimes within the regime complex may be explained, in part, by countries' differing obligations to achieve emissions reductions. This difference is manifested by a clear division of incentives between net buyer countries, which are, on the whole, highly developed parties, and net seller countries, which are generally EITs. Net buyer countries have an economic incentive to seek a seller-liability rule to protect themselves from default in the event of noncompliance by the sellers and to reduce their overall transaction costs. On the other hand, net seller countries may prefer a buyer-liability rule if they fear that they may become noncompliant through accidental or intentional overselling,[166] or may prefer a seller-liability rule if they desire to maximize their financial return through sales of allowances. Of course, these general buyer and seller incentives cannot be imposed wholesale on a particular country, since each country may prefer a different liability rule depending on its unique political, historical, social, cultural, and economic situation.

The method of regime line drawing matters with respect to the ultimate liability rule and procedural mechanisms imposed by the resulting regime. Realist theory suggests that the strongest economic players, generally net buyers, would hold the greatest clout in each regime. It should, therefore, be expected that each regime will result in a seller-liability rule. As some commentators have noted, however, a

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[165] Structural differences from, or opposition to, the Protocol might cause a country to seek to form a regime operating in parallel to the Protocol. On the other hand, implementation differences alone might counsel a country to form a subsidiary, nested elemental regime designed to implement the goals of Kyoto. Such differences, however, might also push a country toward seeking the creation of a parallel regime, if, for instance, the country desires additional prestige or voice in the process. The effect of parallel regimes, such as the Asia-Pacific Partnership on Clean Development and Climate, on the global warming regime complex is beyond the scope of this Article, but it is likely significant.

[166] Based upon economic indicators, net buyers and sellers should prefer different liability rules until emissions targets become strict—something unlikely to happen within the next commitment period. At such a time, the selling country would prefer seller's liability because the cost of absorbing the liability is less than the constraint placed upon market liquidity by buyer liability in such a situation. *See* Katrin Rehdanz, Economic Aspects of Climate Change 92-94 (May 3, 2004) (unpublished dissertation, University of Hamburg) (on file with author).

seller-liability rule may not always be politically feasible.[167] Even assuming that the realist theory has the answer, which seems unlikely given the use of differing liability rules across regimes,[168] the issue is not simply one of buyers versus sellers.

Adopting a seller-liability rule would require either a strong enforcement mechanism or the imposition of supplemental liability mechanisms to prevent overselling. Different regimes with different players may have divergent theories as to which supplemental mechanisms are most effective at limiting overselling. Indeed, the analysis conducted above demonstrates that existing regimes do, in fact, employ different liability mechanisms to achieve compliance even within a seller-liability framework. As the next Sections discuss in greater detail, these liability mechanisms are not equally effective, and the existence of differing liability rules and mechanisms within a regime complex regulating a global public good may result in some undesirable environmental outcomes.

B. *Regime Complexes and Competitive Entropy*

As noted above, countries with different incentives seek to establish different regimes. Similarly, regimes, once created, may seek to differentiate themselves to attract participants, have practical meaning, or develop new strategies.[169] This differentiation creates competition between regimes to gain membership and trading volume and competition between countries as they seek to maximize their interests. This Article seeks to dispel the myth that interregime competition is productive in an international regime complex.

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[167] *See, e.g.*, Charles D. Kolstad & Michael Toman, *The Economics of Climate Policy* 51 (Res. for the Future, Discussion Paper 00-40REV, 2001) (noting that buyer liability is a potential alternative when seller liability is politically infeasible).

[168] While within each regime there will be net buyers and net sellers, countries may not know their relative status as buyers or sellers within a particular regime with great clarity. Whether or not a particular country understands which liability rule is to its own economic advantage, political balances vary by regime, as different countries hold differing amounts of political clout. Thus, different liability rules may emerge across different regimes. Further, some net buyer countries may seek a buyer-liability rule to promote increased responsibility and compliance from non-Annex I parties.

[169] *See* Memorandum from Ken Abbott & Duncan Snidal for Alter-Meunier Princeton Nesting Conference, Nesting, Overlap and Parallelism: Governance Schemes for International Production Standards 10-11 (Feb. 2006), *available at* http://www.princeton.edu/~smeunier/Abbott%20Snidal%20memo.pdf (discussing points of conflict in regime competition).

The global warming regime complex is not unlike the United States's cooperative federalist system of environmental governance, implemented in statutes such as the Clean Air Act and Clean Water Act.[170] The cooperative federalist system operates under a superregime, the federal government, which establishes generally applicable rules and emissions limits. States, for their part, create regimes designed to implement the federal rules and establish emissions targets tailored to their own specific emitters or locations. This ensures that a state meets its obligations under the federal rules, including ensuring that its emissions do not exceed the federal limits. Each state may use a different regulatory approach to ensure it meets its federal environmental statutory obligations. These differences promote competition between states to attract business, because companies will locate in the states they determine have the most desirable overall regulatory schemes for their operations.[171] There is significant dispute as to whether such competition is beneficial for the overall public good and the quality of the human environment.[172]

Like the United States's cooperative federalist system, the international global warming regime complex has a superregime, the Kyoto Protocol, which establishes generally applicable rules and emissions targets for participating countries. Countries may seek to ensure compliance with their obligations under the Protocol in a number of ways, including establishing national emissions trading regimes, command-and-control regulation, taxation, or any variety of other mechanisms. The regime complex involves a patchwork of national and regional regimes designed to reduce GHG emissions. As with the cooperative federalist system, the different regulations, mechanisms, and rules used by the various elemental regimes of the regime com-

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[170] Clean Air Act, 42 U.S.C. §§ 7401-7700 (2000); Clean Water Act, 33 U.S.C. §§ 1251-1387 (2000).

[171] Of course, companies may decide to locate in a particular state for a number of reasons, and the environmental regulatory framework is not the only issue they consider. *See* Richard L. Revesz, *Rehabilitating Interstate Competition: Rethinking the "Race-to-the-Bottom" Rationale for Federal Environmental Regulation*, 67 N.Y.U. L. REV. 1210, 1234-35 (1992) (discussing traditional markets as a point of comparison for interstate competition and the "race-to-the-bottom").

[172] *Compare id. with* Richard B. Stewart, *Environmental Regulation and International Competitiveness*, 102 YALE L.J. 2039, 2058 (1993) ("[T]here is no reason to suppose that international competition for comparative advantage will lead nations to adopt inappropriately low environmental standards."), *and* Richard B. Stewart, *Pyramids of Sacrifice? Problems of Federalism in Mandating State Implementation of National Environmental Policy*, 86 YALE L.J. 1196, 1212 (1977) (noting that local governments face many uncertainties when unilaterally adopting high environmental standards).

plex are expected to promote competition for trading volume and participants across regimes. Although some scholars believe interregime competition may improve regulatory outcomes in a cooperative federalism system,[173] such competition in the international global warming regime complex is entropic because it undermines the goals of the regime complex.

Three significant differences between the cooperative federalist system and the global warming regime complex cause interregime competition to have entropic effects. First, significant interaction across elemental regimes may exist within a global regime complex. Unlike the federalist system, which operates in a vertical, hierarchical fashion with regulation at the state level designed to ensure compliance with federal law, a global regime complex operates on both vertical and horizontal axes. In the global warming regime complex, trading and regulation designed to ensure compliance with the targets established by the Kyoto Protocol may occur at the national or regional level, or across elemental regimes. This overlapping and cross-jurisdictional regulatory regime complex creates the potential for conflict and confusion concerning which rules apply to a particular transaction or trade. This highlights the second significant difference between the cooperative federalist structure of U.S. environmental law and the global warming regime complex.

The second difference is that international law lacks rules to resolve conflicts across regimes. In the international context, judges are unlikely to decide which rule trumps the other, even in nested systems.[174] As a result, "a conflict of international rules may be no more resolvable in a nested context than in an overlapping context."[175] When trading occurs between regimes with different rules validating trades and ascribing liability in the event that a trade goes sour, it is difficult for a particular entity to know which regime's rules will apply. For example, when a country has conflicting obligations between the levels of a nested regime, such as the EU ETS, and the superregime, like the Kyoto Protocol, how does that country decide which obligation to meet? Certainly, the country's obligations to adhere to re-

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[173] *See, e.g.*, Tamara L. Joseph, *The Debate Over Environmental Standards in the European Community: A Race to the Top Rather Than a Race to the Bottom?*, 6 N.Y.U. ENVTL. L.J. 161 (1997); Revesz, *supra* note 171.

[174] *See* Alter & Meunier, *supra* note 114, at 365 ("[T]he inherently fluid and political nature of international politics makes judges far more hesitant to weigh in to resolve disputes about the hierarchy of competing rules.").

[175] *Id.* at 364.

gional agreements may be as strong as, or stronger than, its obligations to adhere to international agreements. Since nested regional agreements often include extraregime inducements such as trade liberalization and carry stricter penalties for noncompliance, it is not difficult to imagine countries resolving the conflict in favor of the regional agreement. The existence of the regime complex, therefore, can introduce a conflict that forces countries to make a compliance choice. Adherence to the regional agreement, however, may not fully advance the goals of the regime complex because the regional agreement may not harmonize completely with the Protocol. Application of one particular rule instead of another can mean the difference between a windfall and liablity for millions of dollars in losses. The inability to ensure application of a particular rule for a particular transaction in international law means interregime competition and conflict in the international setting is far more destabilizing than competition between states in a federalist system of governance.

The final difference between the federalist system and the global warming regime complex relates to the nature of the competition across regimes. In the federalist system, competition among states occurs as states seek to encourage businesses to locate within their borders. In the global warming regime complex, while competition can occur over business location, it is more likely to be a competition on paper, as trading regimes compete for trading volume. As a result, interregime competition generally is not expected to cause businesses to relocate to a more favorable regulatory environment, especially since most businesses regulated by the global warming regime complex are energy companies that must, for economic reasons, locate within a certain distance of their consumers. Rather, interregime competition within a regime complex relates to how trades of emissions are validated and guaranteed. Since trading is a low-cost endeavor, minor regime differences have greater significance than in the federalism context, where sunk costs prevent businesses from relocating over minor regime differences. The differences between an international regime complex and the United States's system of cooperative federalism cause interregime competition to have entropic effects on the goals of the regime complex. After developing the concept of competitive entropy, this Part analyzes the GHG emissions trading regime complex for the signs of such entropy, identifying adverse environmental outcomes occurring on three major axes of competition: liability rules, procedural regulations, and enforcement.

Different liability rules, procedures, and enforcement mechanisms across elemental regimes within a regime complex create opportunities for accidental and intentional noncompliance that are not present in a harmonized global regime.[176] Although ever present, incentives to shirk are heightened in a global warming regime complex where different regimes may be designed to increase wealth transfer or to advance protectionist goals.[177] The reduced transparency and increased complexity of trading across elemental regimes within the global warming regime complex also increase the likelihood of noncompliance by making it more difficult for countries to determine the compliance status of other countries or even their own status. As discussed in greater detail in the next Section, the magnitude and extent of the competition and entropic effects vary by regime complex, with the most serious effects felt in regime complexes regulating public goods. Irrespective of the subject of regulation or whether competition occurs at the regime or country level, however, regime complexes, by definition, contain interregime competition. Yet, remarkably little attention has been paid to the effects of such competition on the goals of regime complexes. This Article postulates that interregime competition inherently undermines the goals of the regime complex.

Competitive entropy is especially pertinent in trading regimes—where trading volume is essential to market liquidity and the continuing vitality of the trading regime—and is experienced in a number of different respects.[178] The existence of dissimilar regimes permits a country to experiment with different regimes to maximize its gains.[179]

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[176] *Cf.* Cass R. Sunstein, *Montreal Versus Kyoto: A Tale of Two Protocols* (AEI-Brookings Joint Ctr. for Regulatory Studies, Working Paper No. 06-17, 2006), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=913395 (suggesting that political motivations can explain the success of the Montreal Protocol, a harmonized regime, and the failure of the Kyoto Protocol, a multilayered regime complex).

[177] *See* Brett Frischmann, *Using the Multi-Layered Nature of International Emissions Trading and of International-Domestic Legal Systems To Escape a Multi-State Compliance Dilemma*, 13 GEO. INT'L ENVTL. L. REV. 463, 491-506 (2001) (focusing on the different forms of noncompliance and the means that can be used to prevent and punish this behavior).

[178] This analysis draws upon the neorealist theory of international relations. *See, e.g.*, HANS J. MORGENTHAU, POLITICS AMONG NATIONS: THE STRUGGLE FOR POWER AND PEACE 9 (5th ed. 1973) ("Political realism does not assume that the contemporary conditions under which foreign policy operates, with their extreme instability and the ever present threat of large-scale violence, cannot be changed."); KENNETH N. WALTZ, THEORY OF INTERNATIONAL POLITICS 134 (1979) (discussing the need for countries to "consider[] the ends of the state in relation to its situation," which may vary).

[179] Helfer, *supra* note 158, at 55.

"In both the domestic and international contexts, the existence of nesting/overlapping institutions creates the opportunity for policy entrepreneurs and interest groups to choose the political forum that is both willing to adopt their policy preference and is most authoritative."[180] Indeed, the mere existence of different elemental regimes leads to a multiplication of efforts, strained capacities, strategic behavior, and higher transaction and adaptation costs.[181] Forum shopping[182] or regime shifting between these different regimes may even create "competition among intergovernmental organizations and conflicts between competing principles, norms, and rules."[183]

C. *Regime Complexes and the Regulation of the Public Good*

Although competitive entropy is inherent to regime complexes, it occurs with greater force when the regime complex is designed around a public good. The existence of different liability rules and mechanisms, as well as other procedural and enforcement differences within the GHG regime complex, allows forum shopping and competition between regimes. This competition enables countries to shift trades across regimes to ensure compliance and diffuse political pressure calling for compliance without actually achieving the requisite emissions reductions. Linkages across regimes also increase the complexity and reduce the transparency of trades, making it difficult for countries to determine their compliance status, prevent accidental noncompliance, and ensure the stability of the global climate.

International law recognizes that "climate change is a common concern of mankind, since climate is an essential condition which sustains life."[184] The global climate meets the definition of a public good

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[180] Alter & Meunier, *supra* note 114, at 365.

[181] *See* Patrick Pfister, Clashing Arenas or Network Governance? The Challenges of Interplay in GM Food Regulation 20 (2005) (draft), *available at* http://web.fu-berlin.de/ffu/akumwelt/bc2005/papers/pfister_bc2005.pdf.

[182] *See* Raustiala & Victor, *supra* note 8, at 299-300 (arguing that forum shopping will persist because of different environmental regimes).

[183] Helfer, *supra* note 158, at 17; *see also* David D. Caron, *The International Whaling Commission and the North Atlantic Marine Mammal Commission: The Institutional Risks of Coercion in Consensual Structures*, 89 AM. J. INT'L L. 154, 155 (1995) (providing an example of such competition and conflict in the whaling context); Joel P. Trachtman, *Institutional Linkage: Transcending "Trade and . . ."*, 96 AM. J. INT'L L. 77, 92 (2002) (observing that international organizations are constantly competing with each other for authority). Regime shifting is, in essence, forum shopping.

[184] G.A. Res. 53, ¶ 1, U.N. Doc. A/RES/43/53 (Dec. 6, 1988), *available at* http://www.un.org/documents/ga/res/43/a43r053.htm.

because the enjoyment of a stable climate is both nonrivalrous and nonexcludable:[185] no one can be prevented from enjoying a stable climate and one's enjoyment of a stable climate does not affect the ability of another to enjoy that same stable climate. Accordingly, the regulatory problems associated with public goods, including the now-familiar "tragedy of the commons,"[186] are present in the regulation of the global climate. The challenge for regulators is to design a system that ensures that all parties take responsibility for the enjoyment of the good.

At a macro level, the pressures to shirk responsibility make international negotiated outcomes difficult and tenuous. These pressures create collective action problems, which can inhibit the creation of a regime governing a public good and an effective enforcement system to hold noncompliant states accountable.[187] When international regimes are established to regulate global public goods, those regimes are generally weak, which subsequently encourages noncompliance.[188] This cycle of noncompliance in the regulation of global public goods is difficult to avoid, but preventing such noncompliance is an inherent goal of public good regulation.

A regime complex enables greater noncompliance than harmonized international regimes because a regime complex creates shirking opportunities. A regime complex is necessarily a set of overlapping institutions with differing rules, mechanisms, and regulations. This complicated web of institutions and jurisdictions reduces the transparency and visibility of the complex for its constituents. The ability to detect the subtle, yet significant, differences between the regime's rules generally requires more resources than the general public is willing to expend. The regime complex framework, therefore, reduces the already minimal incentives to comply. Additionally, stigmatic and political pressures are largely unable to prevent countries from intentionally free riding the system.

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[185] *See* Busby, *supra* note 40, at 41.

[186] *See* Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

[187] Laurence R. Helfer, *Exiting Treaties*, 91 VA. L. REV. 1579, 1637-38 (2005); *see also* Brett Frischmann, *A Dynamic Institutional Theory of International Law*, 51 BUFF. L. REV. 679, 788-90 (2003) (arguing that the public good nature of the climate encourages states to hold out or demand concessions in the creation of regulatory regimes).

[188] *See, e.g.*, Tseming Yang, *International Treaty Enforcement as a Public Good: Institutional Deterrent Sanctions in International Environmental Agreements*, 27 MICH. J. INT'L L. 1131, 1155-59 (2006) (recognizing that collective action and consensus-building problems make it difficult to ensure ex ante compliance, requiring ex post compliance mechanisms).

Entropy also occurs as a result of forum shopping within the regime complex framework. As countries identify regimes with liability rules, procedural regulations, or enforcement mechanisms more beneficial to their interests, they are expected to engage in trading through these regimes. In a public good context, where utilization of the good is free for everyone, a country's interests generally will lie with the least effective or least stringent regime. As they start to lose trading volume to more lenient regimes, other elemental regimes may, in the interest of self-preservation, seek to harmonize their rules with the regimes dominating the trading market. As such, the possibility of forum shopping in a regime complex regulating a public good encourages a race to the bottom in terms of environmental protection.[189]

A regime complex also increases accidental noncompliance by reducing transparency and increasing the complexity of trading. As the number of elemental regimes within a regime complex increases, and as cross-jurisdictional linkages are made among regimes, each interaction and trade becomes more complex. Regimes will be required to evaluate the potential implications of trades on themselves, other nested regimes, and the Protocol. Such a task can quickly become daunting for regimes with limited financial and technical resources. As these resources vary by regime, it is expected that different regimes will adopt different rules and regulations to achieve the common goal of reducing GHG emissions. Whether such regimes will adopt the rules and regulations most compatible with other regimes, and least likely to result in game playing, remains to be seen. This Article argues, however, that the limited and varying technical and financial resources of regimes within the regime complex will result in different rules on which sophisticated parties will capitalize to achieve a false

[189] On the other hand, the more stringent regimes may not harmonize at the lowest common denominator of regulation and enforcement. *See* OECD Env't Directorate & IEA, *Towards International Emissions Trading: Design Implications for Linkages*, at 33, OECD Doc. COM/ENV/EPOC/IEA/SLT(2002)5 (2002) (*prepared by* Richard Baron & Stephen Bygrave) [hereinafter OECD, *International Emissions Trading*] ("[T]here is no reason *a priori* why the lowest penalty should be what is agreed as the common penalty rate in the end."). In such a situation, the strict requirements of any particular regime become meaningless, though, as countries can shop for the least restrictive forum and trade through the various linked regimes. As linkages between elemental regimes increase over time, countries may validate trades conducted in the least protective regime through a linkage with the most protective regime. As a result, the regime complex is only as stringent as the weakest interlinked elemental regime.

sense of compliance, or avoid compliance altogether, making compliance more difficult for all parties.

The existence of a regime complex in the regulation of climate stability presents avenues through which countries may comply nominally with their obligations without achieving the required global emissions reductions. In the public good context, the incentive to defect and not comply is significant. The regime complex framework enables noncompliance by reducing transparency, increasing complexity of interactions, and enabling forum shopping; these characteristics encourage countries to join the least protective regime. These effects must be addressed to maximize compliance and assure a stable global climate.

D. *Competitive Entropy in the Global Warming Regime Complex*

While the full impact of the GHG emissions trading regime complex is not yet known, forum shopping within the regime complex raises significant concerns that outcomes will be suboptimal and inconsistent.[190] Similarly, as elemental regimes link between one another, environmental effectiveness may suffer.[191] "The success or failure of the Kyoto mechanisms will very much depend on the principles, rules, guidelines, or modalities that the parties are developing to flesh out the mechanisms."[192]

Linking differing elemental regimes within the GHG regime complex (where countries are risk averse and uncertainties are high) may deflate the effectiveness of the complex as parties seek to minimize their commitments and develop strategic inconsistencies across

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[190] *See* Keith Aoki, *Reclaiming "Common Heritage" Treatment in the International Plant Genetic Resources Regime Complex*, 2007 MICH. ST. L. REV. (forthcoming) (manuscript at 13, on file with author) (providing an example, in the context of intellectual property law, of how overlapping regimes create forum shopping); Raustiala & Victor, *supra* note 8, at 299-302 (same); *see also* Abbott & Snidal, *supra* note 169, at 8-11 (explaining how overlapping regimes generally lead to forum shopping and strategic inconsistency); Alexander Gillespie, *Forum Shopping in International Environmental Law: The IWC, CITES, and the Management of Cetaceans*, 33 OCEAN DEV. & INT'L L. 17 (2002) (discussing similar issues in relation to environmental law protecting cetaceans).

[191] *See* Ralf Schüle, Linked Emissions Trading Schemes and the International Climate Regime—Bottom-Up Support of Top-Down Processes?, Presentation at JET-SET Conference on Linking Schemes: Potential Impacts of Linking the European Union Emissions Trading System with Emerging Carbon Markets in Other Countries (May 29-30, 2006), *available at* http://www.wupperinst.org/uploads/tx_wibeitrag/18-Schuele_Linking_Post2012_and_summary.pdf.

[192] Jutta Brunnée, *A Fine Balance: Facilitation and Enforcement in the Design of a Compliance Regime for the Kyoto Protocol*, 13 TUL. ENVTL. L.J. 223, 236 (2000).

regimes.[193] Competition, therefore, may result in a variety of suboptimal outcomes, all of which are entropic for the regime. Three axes of competition within the GHG emissions trading regime—differing liability rules and mechanisms, procedural regulations, and enforcement mechanisms and abilities—are discussed more fully below.

1. Liability

Different liability mechanisms are employed by different elemental regimes within the GHG emissions trading complex. There is a consensus developing, albeit slowly, in support of the use of seller liability in trading regimes. There are some trading regimes, however, that continue to employ buyer-liability rules.[194] Differing liability rules are predicated on different normative goals. Seller-liability endorses the principle of reduced transaction and administration costs, while buyer liability promotes greater environmental protection.

Linking a buyer-liability regime with a seller-liability regime is largely entropic because it can result in confusion over which country is responsible in the event of noncompliance, and, furthermore, it can promote greater noncompliance. For example, if France is in a seller-liability regime and sells to Japan in a buyer-liability regime, neither country would be entitled to use the allowances if France becomes noncompliant. If the regimes are reversed (France in a buyer-liability regime and Japan in a seller-liability regime), and France becomes noncompliant, both countries will seek to hold the other liable and to use the allowances.

Under the Kyoto Protocol, countries can link their national emissions trading regimes,[195] some of which are based upon buyer liability. Anytime a buyer-liability regime exists within the Protocol's regime complex (which uses seller liability), the possibility exists that the selling country will hold the buyer liable under that regime, while under the Protocol, the seller would be liable. This is a systemic problem resulting from linking trading regimes with different liability rules. In addition to the conflicts that may arise through linkages across nested

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[193] *See* Memorandum, David Victor, *supra* note 162; *see also* Raustiala & Victor, *supra* note 8, at 301-02 (noting that states often create rules that are inconsistent across regimes in order to force change).

[194] *See* ERIK HAITES WITH FIONA MULLINS, LINKING DOMESTIC AND INDUSTRY GREENHOUSE GAS EMISSION TRADING SYSTEMS 9-37, *available at* http://www.sbcsd.ch/web/projects/cement/tf1/IETALinking.pdf (discussing a variety of trading programs).

[195] Haites, *supra* note 61, at 106.

and partially nested regimes, linkages of differing liability regimes may permit parties to shirk their responsibilities. Indeed, "[i]t would be difficult (although perhaps not impossible) to integrate trading systems with different liability rules."[196] Liability conflict is, therefore, largely entropic and can a have significant impact on the effectiveness of the regime complex.

Although some have suggested that nested regimes need not have the same liability rules,[197] the above discussion illustrates the Catch-22 presented when differing liability regimes are linked within a regime complex. Liability rule differences among regimes, however, need not be conflicting to raise significant concerns. Significant concerns also exist when seller-liability regimes use different supplemental liability mechanisms to minimize overselling because not all supplemental liability mechanisms are created equal.

As discussed above, some liability mechanisms, such as annual retirement and surplus trading, may undermine market liquidity or may

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[196] PEW CTR. ON GLOBAL CLIMATE CHANGE, LINKING U.S. AND INTERNATIONAL CLIMATE CHANGE STRATEGIES 7 (2002), *available at* http://www.pewclimate.org/docUploads/us_international_strategies.pdf.

[197] *See* CTR. FOR CLEAN AIR POLICY, *supra* note 137, at 40-41 (contending that "buyer liability under the Kyoto Protocol . . . in no way means that buyer liability would be necessary within the EU system"). Others have argued that trading between differing liability schemes would mean that "trade would probably need to be restricted to banked allowances/credits. This assures the purchaser in the buyer-liability program that the allowances/credits are surplus to the seller's compliance needs." HAITES WITH MULLINS, *supra* note 194, at 60. As with a nonlinking scheme, this would result in significant liquidity concerns and might also promote two-tier pricing between guaranteed (banked) allowances and nonguaranteed allowances.

Some have also suggested that market pressures will yield compliance mechanisms acceptable to all, rejecting the notion argued by some that there will inevitably be a race to the bottom. *See* OECD, *International Emissions Trading*, *supra* note 189, at 33; Peterson, *supra* note 71, at 10. While this Article agrees that there is no race to the bottom that occurs along a single axis of the amount of the penalty or of the liability rule, it nevertheless concludes that a race to the bottom of overall enforcement is likely to occur in a regime complex, undermining environmental effectiveness.

Nevertheless, the debate regarding linkages is one best left for another day. An especially intriguing question is how linkages affect compliance within the superregime when those linkages are partially nested or parallel regimes but involve both parties and nonparties to the superregime. In such situations, nonparty-party trades may eventually become converted into Kyoto allowances, but the allowances in circulation would not properly reflect the emissions reductions achieved. In these partially nested linked systems, nonparty countries can establish their own emissions targets and increase their allowances in an effort to capture more revenue from buyers. However, such a strategy can affect the global price of tradable allowances or the shadow price of CO_2. Rehdanz, *supra* note 166, at 84. There appears to be no solution to this problem in a single- or multicountry game. *Id.* at 84-85.

be less effective than other mechanisms at minimizing overselling.[198] The impact on market liquidity, in turn, results in different allowance prices between trading regimes, creating the possibility of a race to the cheapest allowances. The cheapest allowances should be found, not surprisingly, in the regime that least effectively controls the overselling of allowances.[199] A regime complex with rule differentiation across elemental regimes creates distinct allowance markets with different allowance prices, and thereby promotes a race to the regime with the least ability to control overselling and protect the environment.

Linking regimes with different liability rules and mechanisms also complicates trading and makes compliance more difficult for countries. Rule differentiation means that a valid trade in one regime may not be acceptable under a different regime. For example, countries in the UK ETS may be prevented by that regime from trading allowances that are not surplus, but may still trade those allowances in another regime. This issue becomes more complicated when the countries buying such nonsurplus allowances seek to sell the allowances back into the UK ETS or even the EU ETS. How the allowances are properly validated by linked regimes will be critical to ensuring that the regime's requirements are not circumvented through trading across regimes with different and more permissive liability rules and mechanisms.

The ability to shop fora with differing liability rules means, however, that linking need not exist to create suboptimal outcomes. Countries may "experiment" with different regimes, opting in and opting out of regimes at their own whim and the whim of the regimes. Regimes desperate to increase their market liquidity may welcome new participants (especially net seller countries) even if they obtained

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[198] OECD Env't Directorate & IEA, *Emissions Trading: Taking Stock and Looking Forward*, at 28, OECD Doc. COM/ENV/EPOC/IEA/SLT(2004)3 (June 1, 2004) (*prepared by* Cedric Philibert & Julia Reinaud). Conflict between such trade and environmental principles, manifested through a conflict between international trading regimes, could have serious impacts for international politics and global financial flows and widen the rift between the United States and Europe. *See* Gilbert R. Winham, *International Regime Conflict in Trade and Environment: The Biosafety Protocol and the WTO*, 2 WORLD TRADE REV. 131, 132 (2003).

[199] When price caps in a safety-valve system are not comparable, the lowest price cap should predominate. *See* Peterson, *supra* note 71, at 10 (arguing that if linked systems have penalties that are not comparable, "non-compliance is likely to be exported to the system with the lowest penalty level"). Linking schemes with price caps can be quite complicated and the issues raised by such linkages are beyond the scope of this Article. For a discussion of such issues, *see* OECD, *Linking*, *supra* note 137, at 29-31.

surplus allowances from countries that oversold their allowances to the point of noncompliance. As a result, regime shifting may result in the acceptance of oversold allowances, yielding a suboptimal outcome.

2. Procedural Mechanisms

Differing procedural regulations can also significantly affect the environmental outcomes of the regime complex. A particular regime's approaches to any of a range of key design issues, such as defining the tradable unit, allowing absolute or relative targets, setting the stringency of targets, allocating allowances, determining the length of the commitment period, deciding whether allowance surpluses may be banked into future years or commitment periods, and selecting monitoring, reporting, and verification methodologies, all affect the regime's environmental outcomes.[200] For example, differing definitions of what constitutes an allowance may result in trading across allowances, which can overvalue the emissions reductions achieved. Trading between regimes may, therefore, undermine the goals of the regime complex as a whole. As such, in the context of a public good, it is expected that forum shopping and regime linkages will serve as conduits for noncompliance. The experience of the EU ETS with procedure differentiation demonstrates that lack of harmonization across member states may undermine the effectiveness of the regime. Recognizing the problems inherent with procedural differences across regimes, the EU ETS has called for greater harmonization across member states.[201]

Procedural differences may also make linkage across elemental regimes difficult, if not impossible. Such differences may create a flood of trading through the least restrictive regime, causing the stringencies of other elemental regimes to become for naught.[202] Additionally, differences in how allowances are defined, counted, and verified, among other issues, may cause transfers out of nested elemental

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[200] Wolfgang Sterk, Ready To Link Up? Implications of Design Differences for Linking Domestic Emission Trading Schemes, Presentation at JET-SET Conference on Potential Impacts of Linking the European Union Emissions Trading System with Emerging Carbon Markets in Other Countries (May 29-30, 2006), *available at* http://www.wupperinst.org/uploads/tx_wibeitrag/11-Sterk.pdf.

[201] *Commission Report*, *Building a Global Carbon Market*, *supra* note 118, at 7-8, 12-14.

[202] *See* Peterson, *supra* note 71, at 195 ("[I]f penalties are not comparable across linked systems, non-compliance is likely to be exported to the system with the lowest penalty level.").

regimes to be double counted,[203] while transfers into a nested elemental regime may "inflate emissions without [a] corresponding acquisition of Kyoto units."[204] As with liability rule differences, differences in procedures across elemental regimes can significantly undermine the goals of the regime complex.

3. Enforcement

As with differences among procedural mechanisms, differences among enforcement approaches can have significant impacts on the effectiveness of the regime complex. Countries can be expected to shift their trading to the regime with the weakest enforcement mechanisms.[205] Regimes may have weak enforcement because they lack penalties and strong compliance mechanisms or because they have insufficient funding for detection of violations and enforcement.[206] While the Kyoto Protocol is generally regarded as having weak enforcement mechanisms, the creation of other, stricter, regimes nested within the Protocol may do little to prevent overselling in the global warming regime complex. For instance, the EU ETS is generally regarded as having stronger enforcement mechanisms than the Protocol. Although the EU ETS may be stronger than the Protocol, if the EU develops a bubble agreement[207] to achieve jointly the emissions targets ascribed to EU member countries under the Protocol, the EU ETS may not be able to prevent overselling by EU ETS

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[203] *See* OECD Env't Directorate & IEA, *Linking Project-Based Mechanisms with Domestic Greenhouse Gas Emissions Trading Schemes*, at 35-36, OECD Doc. COM/ENV/EPOC/IEA/STL(2004)5 (June 16, 2004) (*prepared by* Stephen Bygrave & Martina Bosi) (describing the "double-counting" that can occur when an emissions credits regime is introduced on top of a previously existing one).

[204] Sterk, *supra* note 200; *see also* SORRELL, *supra* note 154, at 23 (noting that permitting parties with relative emissions targets to participate in trading regimes may result in a valid increase in the number of allowances provided under the elemental regime, but that such an increase could exceed the amount of allowances provided by the Protocol).

[205] *See* Helfer, *supra* note 158, at 56-58 (explaining the incentives governments face, in the intellectual property context, to shift to regimes lacking strong enforcement mechanisms); Peterson, *supra* note 71, at 10 (emphasizing the problems created when linked trading regimes have different enforcement mechanisms).

[206] *See* Erik Haites & Xueman Wang, Environmental Effectiveness of Linked Trading Schemes, Presentation at JET-SET Conference on Potential Impacts of Linking the European Union Emissions Trading System with Emerging Carbon Markets in Other Countries (May 29-30, 2006), *available at* http://www.wupperinst.org/uploads/tx_wibeitrag/16-Haites_Wang.pdf.

[207] *See supra* note 124.

member countries. Such a bubble agreement would change the frame of reference for determining compliance with the Protocol from a single European party to the EU as a whole. As a result, a violation of the EU ETS by an EU member country would not result in a violation of the Protocol if the EU parties jointly met their cumulative obligations under the Protocol. The regime complex is therefore only as strong as its weakest regime.

IV. MINIMIZING COMPETITIVE ENTROPY IN THE GLOBAL WARMING REGIME COMPLEX

Global warming threatens our existence. Action must be taken soon to prevent catastrophic climate change. A consensus is emerging that emissions trading will be the most effective and economical means of achieving the emissions reductions necessary to protect against global warming.[208] As countries and regions have begun to experiment with emissions-reduction programs both within and outside the Kyoto Protocol, however, a complicated regime complex has emerged that has the potential to undermine the potential environmental benefits of trading.

This regime complex has created significant incentives and opportunities for noncompliance. Differentiation of liability rules, for instance, is expected to result in forum shopping and competitive entropy.[209] This Part proposes a way out of the compliance conundrum created by the GHG regime complex. The first Section addresses the feasibility of dissolving the regime complex in favor of a superregime and the potential benefits of harmonizing the regime complex. Recognizing the difficulty in achieving full harmonization, the final Section of this Part proposes the use of a clean development fund to maximize compliance, albeit ex post compliance, under the Protocol.

A. *Harmonizing the Regime Complex Cacophony*

This Article seeks to dispel the notion that interregime competition within a regime complex is similar to competition in a cooperative federalism structure, and is therefore the most effective frame-

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[208] *See* Tietenberg, *supra* note 112, at 251-52 (documenting the proliferation of trading schemes worldwide); Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 682 (1999) (describing the emerging consensus that "incentive based instruments such as . . . tradable allowances" are best suited to controlling emissions).

[209] *See supra* Part III.

work for the regulation of a global public good.[210] The existence of elemental regimes with different rules, procedures, and enforcement mechanisms promotes competitive entropy within the regime complex. The competitive entropy inherent in regime complexes regulating public goods affects the outcomes of all regimes within the complex. In such a context, forum shopping matters to the system and not just the parties.

In the context of a global public good, the positive law of harmonization appears desirable.[211] This Article suggests that a single trading regime is preferable to a regime complex in terms of effi-

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[210] Some commentators have suggested that a trading regime complex might be desirable so "the international community will not have [to] put all its eggs in a single basket." DANIEL BODANSKY, U.S. CLIMATE POLICY POST-KYOTO: ELEMENTS FOR SUCCESS 1 (Carnegie Endowment for Int'l Peace, Policy Brief No. 15, 2002). These commentators argue that the nested and parallel regimes of the GHG regime complex may coexist peaceably with the Kyoto Protocol because they are merely supplements to Kyoto and would be beneficial. *See id.* at 6 (describing the opportunities for local regulatory regimes to develop parallel to Kyoto); Busby, *supra* note 40, at 47, 50 (arguing that sub-Kyoto regimes such as the Asian-Pacific Partnership on Clean Development and Climate can bring more countries to the Kyoto standard); Oppenheimer & Petsonk, *supra* note 124, at 11-15 (describing the "possibility of a post-2012 climate regime comprised of nested and overlapping systems with positive 'markets beget markets' elements"). Indeed, some have also suggested that regional regimes enjoy a more favorable political environment and thus are likely to be stronger regimes, since they do not have to deal as much with countries having different views. *See* BODANSKY, *supra*, at 6 (arguing that "regional human rights agreements have tended to be more effective than global regimes" because the participants' "common views . . . give them greater trust in one another"). A more inclusive regime, however, is likely to avoid potential intentional noncompliance by developing countries that view a club model of developed country-led regional regimes as unrepresentative of their interests. *See* Busby, *supra* note 40, at 46 ("If . . . major emitters create an agreement among themselves . . . [p]oor countries can be expected to protest if there is no institution to represent their interests."). Indeed, when isolated into smaller trading groups, developed countries will likely be able to exert significantly greater pressure on seller parties to obtain monopsony prices.

[211] One commentator has argued that design differences in national trading schemes are surmountable and will likely be resolved because "at least one of the governments involved has an incentive to solve the problem." Haites, *supra* note 61, at 115. This Article is skeptical of such an outcome, because at least one country is likely to have an equal incentive to avoid harmonization. The trend for harmonization, as is typical for international regimes, is to occur at the most stringent point at which all parties can agree—a point certain to be less stringent than bilateral or regional trading systems. This applies to liability rules because buyer-liability rules are likely to result in environmentally preferable outcomes, while seller-liability rules provide systemic and administrative benefits. A strict regime focused on environmental benefit would prefer a buyer-liability system, while a system intent on administrative ease would employ a seller-liability rule.

ciency and environmental outcomes.[212] Indeed, a single trading regime would best achieve the normative goal of equalizing the costs and benefits of compliance in each country.[213] Harmonization is also desirable to "ensure that there is sufficient compatibility among national systems to facilitate transactions and to guarantee the overall environmental performance of the trading system."[214] In the regulation of a public good, regimes avoid free-rider problems most effectively by first achieving a wide breadth of participants and then deepening their goals and requirements.[215] A regime complex, on the other hand, increases the potential for free riders to leech off the system.

Harmonization across elemental regimes would certainly alleviate the competitive entropy resulting from different liability rules, procedures, and enforcement mechanisms. While some have suggested that differences among trading regimes can be overcome,[216] this Article has identified some axes of competition that result in suboptimal outcomes and make the fungibility of allowances and trades across regimes limited. "Because international law is weak, it may be better to hold one party primarily liable rather than risk the dilution of sanctions through ambiguity about liability,"[217] as might result in a regime complex with multiple liability rules.

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[212] *See* Katrin Rehdanz & Richard S.J. Tol, *Unilateral Regulation of Bilateral Trade in Greenhouse Gas Emission Permits*, 54 ECOLOGICAL ECON. 397 (2005) (describing the need for an international mechanism through which regional emissions plans can be coordinated to achieve efficient reduction of emissions); Dieter Schmidtchen et al., *Conflict of Law Rules and International Trade: A Transaction Costs Approach* 25 (Ctr. for the Study of Law and Econ., Discussion Paper 2004-01, 2004) ("The transaction costs of international business can be reduced by a workable international legal order."). A single regime may be preferable to a harmonized regime because a regime complex, even when harmonized, introduces complicated reporting, monitoring, and other issues, while undermining global efforts at achieving cooperation. A single regime has the added benefit of increasing pressure on holdouts to join the regime. On the other hand, a harmonized regime allows for the possibility of greater participation through inclusion of countries that may not be signatories to the Kyoto Protocol.

[213] *See* BOEMARE & QUIRION, *supra* note 138, at 15 (arguing that a "high degree of harmonization" is necessary to "equali[z]e costs and benfits in each country").

[214] OECD, *International Emissions Trading*, *supra* note 105, at 16.

[215] Robert N. Stavins, *Policy Instruments for Climate Change: How Can National Governments Address a Global Problem?* 25-26 (Res. for the Future, Discussion Paper 97-11, 1997) (describing the advantages of the "broad, then deep" strategy for eliminating free riding).

[216] *See* Haites, *supra* note 61, at 107-08 (arguing that "voluntary links" between different regimes can achieve the same goal as formal harmonization).

[217] Kerr, *supra* note 83, at 10.

Although desirable, harmonization may not be achieved fully due to the sheer complexity of the regime complex, the differences across trading entities,[218] and the different liability rules used in the Protocol for JI projects, CDM projects, and Article 17 trading.[219] While "the Kyoto Protocol imposes no requirements relating to harmonisation of the national emissions trading schemes,"[220] international law is largely helpless to prevent a proliferation of elemental regimes or to resolve conflicts among them. Further, it may not be feasible politically to dissolve the regime complex in favor of a single superregime or to prevent the emergence of additional elemental regimes. A variety of different political, economic, historical, cultural, and social interests may pressure countries to develop elemental regimes within or outside the regime complex.

Accordingly, a second-best solution must be sought that can address the entropic competition resulting from different liability rules, procedures, and enforcement mechanisms. The most realistic solution to the problem of noncompliance inherent in public good regime complexes is one that is endogenous to those regime complexes. In the global warming regime complex, the way out of the compliance conundrum is the Clean Development Fund.

B. *The Clean Development Fund: A Way Forward*

The inherent obstacles to harmonizing a public-good-regulating regime complex and to achieving compliance in a regime complex counsel for the creation of unique mechanisms to assist countries in meeting their obligations under the complex. Although this Article suggests that competitive entropy can be avoided only through the significant harmonization of the regime complex, it acknowledges that full harmonization is impossible and even significant harmonization may not be forthcoming. Accordingly, this Article postulates that noncompliance inevitably will be rampant in the regime complex, either through accident or intention. This Article builds upon the

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[218] Barton "Buzz" Thompson, Remarks at the University of Pennsylvania Law Review Symposium: Responses to Global Warming: The Law, Economics, and Science of Climate Change (Nov. 16-17, 2006) (noting that countries may not approve of linkages with stronger trading regimes or with regimes that do not have similar procedures to recognize offsets, for instance).

[219] *See* Raustiala & Victor, *supra* note 8, at 300-01 (noting that it is hard to achieve "legal consistency" where there are an "extremely large number of issues and complex interactions" to be harmonized).

[220] Haites, *supra* note 61, at 114.

seller-liability framework and CPR of the Kyoto Protocol, implemented through a real-time validating registry akin to the UK ETS's Gateway,[221] to call for the creation of a Clean Development Fund (CDF) to assist countries that, through no fault of their own, become noncompliant under the Protocol.[222]

The CDF would operate essentially as an emissions-reduction investment bank or a compliance insurance mechanism.[223] It would be a wholly voluntary mechanism that parties could use to avoid facing the sanctions of noncompliance under the Protocol.[224] Protocol par-

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[221] While a surplus trading regime may be equally effective in limiting overselling, this Article considers a CPR to be preferable as it creates greater liquidity and avoids the speculation of futures markets.

[222] The concept of a CDF was proposed initially by Brazil in the lead-up to Kyoto. *Proposed Elements of a Protocol to the United Nations Framework Convention on Climate Change, Presented by Brazil in Response to the Berlin Mandate* (May 28, 1997), *in* UNFCCC, Ad Hoc Group on the Berlin Mandate, *Implementation of the Berlin Mandate: Additional Proposals from Parties*, at 3, 6-7, U.N. Doc. FCCC/AGBM/1997/MISC.1/Add.3 (May 30, 1997) [hereinafter *Brazil Proposal*]. CIEL and EURONATURA were also early CDM proponents. *See* GOLDBERG ET AL., *supra* note 40, at 17. *See generally* GLENN M. WISER & DONALD M. GOLDBERG, CTR. FOR INT'L ENVTL. LAW, RESTORING THE BALANCE: USING REMEDIAL MEASURES TO AVOID AND CURE NON-COMPLIANCE UNDER THE KYOTO PROTOCOL (2000) (describing the logic of creating a fund to address noncompliance).

When the CDF was proposed in Protocol negotiations, it initially drew significant support. It was abandoned, however, because some countries "perceived it as a potential form of financial penalty, while others suspected that it would be used to set a 'price cap' on the compliance costs of parties." Xueman Wang & Glenn Wiser, *The Implementation and Compliance Regimes Under the Climate Change Convention and Its Kyoto Protocol*, 11 REV. EURO. COMMTY. & INT'L ENVTL. L. 181, 197 (2002). Given these prior negotiations, the parties might be unlikely to accept a CDF with a safety-valve price mechanism. Such a view, however, should not prevent the creation of a CDF, as parties potentially could only have the option of paying into the fund when AAUs are unavailable on the market.

While some have viewed the CDF as a possible financial penalty, this view is inaccurate. Article 18 of the Kyoto Protocol prohibits the imposition of binding financial penalties as a result of party noncompliance without first amending the Protocol. Kyoto Protocol, *supra* note 37, art. 18. It may be desirable in the future to mandate the use of the CDF, at which time an amendment to the Protocol would be necessary. In the meantime, however, the tenuous political alliance surrounding the Protocol may make achieving such an amendment difficult. Accordingly, as an interim measure until political will for a mandatory CDF is established, the CDF should be an optional compliance mechanism in which noncompliant parties may elect to participate.

[223] *See Brazil Proposal*, *supra* note 222.

[224] As long as the CDF is optional, though, there will be a continuing danger that parties will not elect to avoid noncompliance through the CDF, but rather will submit to the existing sanctions under the Protocol since those sanctions are weak. Consider, for instance, a sanction requiring noncompliant parties to reduce their emissions to a greater extent in future commitment periods. Such a sanction is likely to be ineffectual, as parties may be noncompliant within every commitment period despite the

ties found to be provisionally noncompliant with their obligations under the Protocol at the end of the commitment period could opt to achieve compliance through the placement of funds in the CDF. If parties elected not to participate in the CDF, then they would incur the consequences of noncompliance under the Protocol.[225] Because the CDF would be optional, it would not be considered a "binding consequence" under Article 18 and therefore could be implemented without the need for an amendment to the Protocol.[226]

The CDF would be operated either by the Executive Board of the Protocol or an entity authorized by the Board. It would identify low-risk emissions-reducing projects for investment that could be certified under the CDM. Parties found provisionally noncompliant at the end of the commitment period could fund, through the CDF, emissions-reducing projects to earn enough CERs to become compliant. Once a party decided to achieve compliance through the CDF, the party would be unable to later withdraw its funds and would be required, within reason, to provide additional funding in the event the CDF-certified project did not achieve expected emissions reductions.[227]

The optional CDF would serve as an important mechanism for achieving compliance in the GHG regime complex because the features of the regime complex discussed throughout this Article increase the likelihood of noncompliance under the Protocol. As a result, parties may mistakenly validate trades deemed unacceptable by the Protocol, resulting in overselling and encouraging noncompliance by parties to the Protocol. Linked regimes also create the potential for pass-through trading, which can increase the intentional and accidental noncompliance of parties to the Protocol. The potential for accidental noncompliance suggests that there should be an option available for countries that attempt sincerely to meet their emissions targets under the Protocol, but are confused into noncompliance by the complicated nature of the system. The creation of the CDF would provide those noncompliant parties with an option of achieving elev-

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sanction, thereby "borrowing" future emissions reductions. GOLDBERG ET AL., *supra* note 40, at 20.

[225] *Id.*

[226] *Id.*

[227] The possibility of failed CDF projects and the time lag for achieving emissions reductions through CER projects suggest the CDF should be used only as a last resort. This Article proposes that the CDF be made available to innocent parties to the Protocol only when the price of AAUs exceeds a predetermined safety-valve price or, if such an approach is difficult to achieve politically, when no AAUs may be purchased on the trading market.

enth-hour compliance.[228] Additionally, the existence of an ex post mechanism to achieve compliance, even if optional, would put political pressure on noncompliant countries to meet their obligations at the time of noncompliance rather than simply promising to reduce emissions greatly in future commitment periods.

The CDF is also desirable from a normative standpoint. Under a seller-liability framework, seller parties have incentives to oversell. When such parties are deemed noncompliant, they face sanctions under the Protocol, including the inability to trade in future commitment periods. Although buyer parties have a clear incentive to underpurchase allowances, no similar sanction is applied to them if they are noncompliant.[229] The CDF would level the playing field between buyer and seller parties, enabling each to achieve compliance and thereby continue trading in future commitment periods.

A properly designed and integrated CDF could promote overall compliance and alleviate many of the compliance problems inherent to the global warming regime complex. Although the global warming regime complex promotes competitive entropy within the complex and makes it difficult for countries to ensure compliance with their Protocol targets throughout the commitment period, the CDF would permit parties to achieve eleventh-hour compliance with those targets and ensure that the goal of the Kyoto Protocol to reduce GHG emissions is achieved.

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[228] The CDF can also be used to promote compliance by parties that intentionally oversell. Application of the CDF to intentionally noncompliant parties, however, requires caution. From a normative standpoint, a showing of a bad faith attempt to comply with the Protocol should trigger enhanced penalties so those parties do not reap any benefit from their noncompliance. This might happen if the price of AAUs on the trading market increases above the cost of obtaining emissions reductions through the CDF. This Article suggests that a multiplier should be applied to the price of emissions reductions earned through the CDF for intentionally noncompliant parties. *See* GOLDBERG ET AL., *supra* note 40, at 19 (arguing that use of such a "multiplier" would allow the CDF to avoid "becoming a solution of first choice"). While such a requirement might be somewhat difficult to implement in practice, from both political and merits-based perspectives, this Article contends that the CDF or the enforcement body of the Protocol could fairly determine whether a country was in noncompliance as a result of intentional game playing and strategic behavior or through an innocent mistake. Certainly, checks and balances in such a determination will be necessary to avoid politically motivated determinations by the enforcement body and self-serving determinations by the CDF.

[229] *See* Bohm, *supra* note 68, at 21 ("[C]ompliance is controlled by two deterrents for seller parties but by only one for other parties that violate the same rules and face the same incentives to do so.").

This Article has identified how the GHG emissions trading regime creates competitive entropy as a result of the different liability rules, procedures, and enforcement mechanisms in the elemental regimes of the complex. Although nascent, the regime complex is already composed of elemental regimes that vary significantly in the liability rules they impose and the procedures through which trades are accepted and verified. These differences are particularly troublesome in the context of regulating a public good because differing national and regime interests promote forum shopping and interregime competition that undermine the goals of the regime complex. This competitive entropy results in suboptimal outcomes that are not resolved easily in the context of regulating the global public good of climate stability.

The GHG regime complex is difficult to navigate for most countries, leading many countries to end up, either by accident or through intention, noncompliant with their obligations under the Kyoto Protocol. The potential for noncompliance, therefore, must be minimized through the harmonization of elemental regimes and the creation of a CDF that will enable innocent noncompliant parties to meet their obligations under the Protocol.

Global GHG emissions reductions will not be achieved easily. The institutions overseeing emissions reductions must strive to minimize the effects of the competitive entropy in the global warming regime complex. Harmonizing the regime complex and providing ex post compliance opportunities are important ways to counteract the entropic effects of differing liability rules, procedures, and enforcement mechanisms across elemental regimes within the global warming regime complex. In the absence of regime harmonization, however, the global warming regime complex must still ensure the reduction of greenhouse gas emissions. The CDF is a low-impact way to help ensure that the public good of climate stability is ensured for all, even within the Byzantine framework of the global warming regime complex.