

MEASURING THE CLEAN DEVELOPMENT MECHANISM'S PERFORMANCE AND POTENTIAL

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The Clean Development Mechanism (CDM) of the Kyoto Protocol is the first global attempt to address a global environmental public goods problem with a market-based mechanism. The CDM is a carbon credit market where sellers, located exclusively in developing countries, can generate and certify emissions reductions that can be sold to buyers located in developed countries. Since 2004 it has grown rapidly and is now a critical component of developed-country government and private-firm compliance strategies for the Kyoto Protocol. This Article presents an overview of the development and current shape of the market, then examines two important classes of emission reduction projects within the CDM and argues that they both point to the need for reform of the international climate regime in the post-Kyoto era, albeit in different ways. Potential options for reforming the CDM and an alternative mechanism for financing emissions reductions in developing countries are then presented and discussed.

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INTRODUCTION

Global warming is one of the most difficult and important environmental challenges facing the international community. To date, the most substantial effort to address climate change is the Kyoto Protocol (Protocol).¹ Although not ratified by the United States and only recently by Australia,² the Protocol was signed and ratified by every other large developed country and entered into force on February 16, 2005.³ It is likely the largest and most expensive international effort to combat a global environmental commons problem.

The Protocol is a highly innovative international agreement as it both incorporates and allows for numerous trading mechanisms. These flexibility mechanisms were inserted into the text during the negotiation process at the insistence of the United States, its most prominent nonsignatory.⁴ They are quickly becoming, if they have not already become, the preeminent examples of attempts to address an international environmental problem using market-based approaches.

The United States and the international community are at a critical juncture in the effort to address the problem of climate change. Although the United States declined to join the Protocol, regulations to control carbon dioxide (CO₂) emissions are currently being developed by a coalition of seven

1. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22, available at <http://unfccc.int/resource/docs/cop3/07a01.pdf> [hereinafter Kyoto Protocol].

2. *World Briefing: Australia; Kyoto Ratification First Act of New Leader*, N.Y. TIMES, Dec. 4, 2007, at A8, available at <http://query.nytimes.com/gst/fullpage.html?res=9800E7DF1E3BF937A35751C1A9619C8B63>.

3. United Nations Framework Convention on Climate Change, Kyoto Protocol: Status of Ratification, http://unfccc.int/essential_background/kyoto_protocol/status_of_ratification/items/2613.php (last visited June 5, 2006) [hereinafter Kyoto Protocol Status]. The Kyoto Protocol entered into force on the ninetieth day after at least fifty-five parties to the Convention, including Annex 1 parties accounting for at least 55 percent of total 1990 carbon dioxide emissions ratified the treaty. Kyoto Protocol, *supra* note 1, art. 25 § 1.

4. Daniel Bodansky, *Bonn Voyage: Kyoto's Uncertain Revival*, NAT'L INTEREST, Fall 2001, at 5.

northeastern states,⁵ by California,⁶ and are proposed in multiple bills in the U.S. Senate.⁷ In addition, many U.S. firms will be forced to comply with the Protocol in their international operations. Finally, the Protocol is set to expire at the end of 2012, and negotiations for a future global warming treaty, including market-based components, are therefore underway.⁸

The effort to curb global warming will be difficult and costly. Sustaining necessary political support and expenditure will require that policies implemented to achieve climate stabilization are both environmentally sound and cost effective. This Article aims to contribute to the success of this effort by presenting a critical empirical analysis of the current market for greenhouse gases (GHGs) under the Protocol and suggesting possible reforms. It is highly likely that any future global warming treaty will include market-based solutions; all current examples of climate regulation incorporate market-based mechanisms, and such mechanisms may result potentially in substantial cost savings.⁹ These markets for pollution, if they are to succeed in accomplishing a future treaty's environmental goals, must both incorporate the successes and eliminate the shortcomings of previous efforts. Given the rapid development of the Protocol's GHG markets over the last three years and the incipient negotiations over a future treaty, the time is ripe for an analysis that attempts to identify the successes and the failures of the initial experiments in GHG emissions trading.

The Clean Development Mechanism (CDM), a market-based emissions trading mechanism created under the auspices of the Protocol,¹⁰ certifies GHG emission-reduction credits generated by projects in the developing world that can be sold to emitting developed countries facing compliance obligations under the treaty. Payment for the credit is intended to fund the

5. The coalition includes Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont. Memorandum of Understanding From the Regional Greenhouse Gas Initiative *passim* (Dec. 20, 2005), http://www.rggi.org/docs/mou_12_20_05.pdf [hereinafter RGGI Memo].

6. MKT. ADVISORY COMM., CAL. AIR RES. BD., RECOMMENDATIONS FOR DESIGNING A GREENHOUSE GAS CAP-AND-TRADE SYSTEM FOR CALIFORNIA, at iv–v (2007), available at http://www.climatechange.ca.gov/documents/2007-06-29_MAC_FINAL_REPORT.PDF.

7. The most prominent federal proposal to reduce U.S. greenhouse gases (GHG) emissions, which includes a market for GHG emissions, is America's Climate Security Act of 2007, S. 2191, 110th Cong. (2007).

8. The Bali Action Plan lays out a path for negotiation of a post-Kyoto framework. See United Nations Framework Convention on Climate Change, Conference of the Parties, Thirteenth Session, Bali, Indon., Dec. 3–15, 2007, *Decision 1/CP.13: Bali Action Plan*, U.N. Doc. FCCC/CP/2007/6/Add.1 (Mar. 14, 2008), available at <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3> [hereinafter *Bali Action Plan*].

9. Kyoto Protocol, *supra* note 1, arts. 6, 12, 18; RGGI Memo, *supra* note 5; America's Climate Security Act of 2007, S. 2191, §§ 2101–2503.

10. Kyoto Protocol, *supra* note 1, art. 12, § 1.

cost of reducing GHG emissions, thereby facilitating developing-country participation in the international climate regime and assisting in the achievement of sustainable development.¹¹ All emissions reductions certified under the CDM are supposed to be voluntary, real, and additional to any that would occur in the absence of the credit system.¹²

The CDM is the first attempt to address a global atmospheric commons problem using a global emissions trading market.¹³ Over the past three years, the CDM has developed the shape that it will likely have during the first commitment period of the Protocol.¹⁴ The goal of this Article is both to describe this broad outline and to use it to inform the design of future treaty architectures and administrative legal regimes¹⁵ aimed at the control of GHG emissions and global warming.

This analysis builds both on legal scholarship that first identified the potential of emissions trading regimes to reduce the costs of providing environmental goods,¹⁶ and on a relatively extensive body of legal scholarship analyzing the results of attempts to design and to implement emissions trading markets. Empirical work on emissions trading markets has focused on the strategic behavior of market participants,¹⁷ the complicated role of the regulator,¹⁸ environmental justice problems caused by emissions trading markets,¹⁹ and the difficulty of monitoring certain air pollutants necessary for

11. *Id.* art. 12, § 2.

12. *Id.* art. 12, § 5.

13. In contrast, the Montreal Protocol utilized a fund contributed to by developed countries to pay for the cost of emissions reductions of ozone-depleting substances in developing countries. See The Montreal Protocol on Substances That Deplete the Ozone Layer art. 10, opened for signature Sept. 16, 1987, 1522 U.N.T.S. 28, available at <http://www.unep.org/OZONE/pdfs/Montreal-Protocol2000.pdf> [hereinafter Montreal Protocol].

14. The first commitment period extends from January 1, 2008 to December 31, 2012. Kyoto Protocol, *supra* note 1, art. 3.1.

15. Regarding the emergence of a body of international administrative law, see Benedict Kingsbury et al., *The Emergence of Global Administrative Law*, 68 LAW & CONTEMP. PROBS. 15 (2005).

16. Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1341–51 (1985).

17. David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 WASH. & LEE L. REV. 289, 310 (1998); Gary C. Bryner, *Carbon Markets: Reducing Greenhouse Gas Emissions Through Emissions Trading*, 17 TUL. ENVTL. L.J. 267, 291 (2004).

18. Lesley K. McAllister, *Beyond Playing “Banker”: The Role of the Regulatory Agency in Emissions Trading*, 59 ADMIN. L. REV. 269, 312–13 (2007).

19. Richard Toshiyuki Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles’ Failed Experiment in Air Quality Policy*, 9 DUKE ENVTL. L. & POL’Y F. 231, 252 (1999); James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 628–29 (2000).

emissions trading.²⁰ To date, however, these analyses have focused on domestic markets. International markets, because they involve both an international regulator as well as developing-country governments and firms, are likely to present both similar and unique challenges.

The CDM was designed around the insight that the marginal cost of emissions reductions in developing, and especially rapidly developing, countries would be less than those faced by developed nations.²¹ The basis for this insight was that the cost of building more efficient, lower-GHG-emitting industrial and energy facilities in the developing world would be far lower than the cost of prematurely retiring or retrofitting existing developed-world capital stock.²² By means of the CDM, GHG emissions reductions could occur in the developing world that would otherwise have occurred in the developed world at far higher cost.²³ The expectation was that by putting a price on GHG emissions in the developing world and by linking that price to developed-world cap-and-trade markets for CO₂, costs of compliance with the Protocol in the developed world could be significantly reduced. This Article will show that what has in fact occurred is something far different: (1) the CDM has primarily proffered an exchange of CO₂ emissions reductions in the developed world for reductions of various non-CO₂ gases in the developing world; (2) substantial strategic behavior has occurred, aimed at manipulating baselines in order to increase the number of offsets created; and (3) as participation in the energy sectors of developing countries has deepened, the regulatory challenge faced by the CDM Executive Board in determining whether a project's reductions are "additional to any that would occur"²⁴ in its absence has become deeply problematic.

The CDM in its current form is, from an environmental perspective, highly imperfect. It is nonetheless creating both powerful political institutions and stakeholders interested in maintaining the current system or something similar.²⁵ Given the relatively poor performance, at least initially,

20. Drury et al., *supra* note 19, at 280–81; Thomas O. McGarity, *Missing Milestones: A Critical Look at the Clean Air Act's VOC Emissions Reduction Program in Nonattainment Areas*, 18 VA. ENVTL. L.J. 41, 57 (1999).

21. See Michael A. Toman, Richard D. Morganstern & John Anderson, *The Economics of "When" Flexibility in the Design of Greenhouse Gas Abatement Policies 2–3* (Resources for the Future, Discussion Paper No. 99-38-REV, 1999).

22. Prepared Testimony of Janet Yellen, Chair, Council of Economic Advisors Before the House Commerce Committee Energy and Power Subcommittee (Mar. 4, 1998), *reprinted in* FED. NEWS SERVICE, Mar. 4, 1998, at 5.

23. Toman, Morganstern & Anderson, *supra* note 21, at 2–3.

24. Kyoto Protocol, *supra* note 1, art. 12, § 5(c).

25. See for example, the membership of the International Emissions Trading Association, a strong CDM supporter which includes many of the largest global financial institutions.

of other markets for atmospheric pollution, the imperfect performance of the CDM is not entirely surprising and should not be a reason to abandon the system. The CDM is failing as a market because its rules, rather than producing real reductions, have accounting loopholes that allow participants to manufacture GHG credits at little or no cost beyond the payment of consultants necessary to surmount the necessary regulatory hurdles. Further, although it is supplying credits to developed signatories of the Protocol at prices less than they would otherwise be, the CDM is an excessive subsidy that represents a massive waste of developed-world resources. It is too late to change the structure of the CDM to address its shortcomings prior to the end of the first commitment period.²⁶ The overarching aim of this Article is to argue that in the period after 2012, both the financial resources devoted to the current CDM architecture and the additional resources likely to be added as developed-world commitments to cut GHGs deepen, might be far more efficaciously allocated in the international effort to stem global warming.

Such reform need not compromise the notable success of the CDM as a political mechanism. The CDM has produced remarkable participation in the developing world. Participation has been most active in countries with relatively high rates of economic growth. In other words, the developing countries whose efforts are most needed to help resolve the global warming problem are the same countries that have been engaged. At the same time, this has created political difficulties within developed countries where the subsidy of nations such as China and India is unpopular and hard to justify given their high rates of growth. Relative levels of developing-world participation and benefit from the CDM have also created tensions among the signatories to the Protocol²⁷ because of the growing perception that the distribution of credit revenues is extremely inequitable; most of the funds flow to a few relatively well-off developing countries.

Two tracks for reform seem possible. One option is to address the current regime's shortcomings while maintaining its basic structure in the post-2012

International Emissions Trading Association, Membership, <http://www.ieta.org/ieta/www/pages/getfile.php?docID=556> (last visited July 15, 2008).

26. The Kyoto Protocol's First Commitment Period, the interval of time during which developed-world parties to the treaty must comply with quantified emissions limits, extends from 2008 to 2012. Kyoto Protocol, *supra* note 1, art. 3.

27. United Nations Framework Convention on Climate Change, Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Bali, Indon., Dec. 3–15, 2007, *Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol in Its Third Session, Held in Bali From 3 to 15 December 2007*, ¶ 36, at 11, U.N. Doc. FCCC/KP/CMP/2007/9 (Mar. 14, 2008), available at <http://unfccc.int/resource/docs/2007/cmp3/eng/09.pdf>; see also, United Nations Framework Convention on Climate Change, The Nairobi Framework-Catalyzing the CDM in Africa, http://cdm.unfccc.int/Nairobi_Framework/index.html (last visited Mar. 31, 2008).

climate regime. This would involve strengthening the administrative procedures within the CDM in order to increase the certainty that projects are producing real reductions that are additional to any that would have occurred without the program. This reform would have to be accomplished without increasing transaction costs or project risks to such an extent that participation in the scheme was reduced below a useful level. The second option would discard the market-based approach of the CDM and adopt a fund-based approach best exemplified by the Montreal Protocol's Multilateral Fund.²⁸ While a fund approach would not necessarily solve all of the problems associated with the CDM, and might create new and as yet unforeseen difficulties, it would improve the efficiency of the system and likely increase its environmental effectiveness.

In Part I, I will first briefly introduce the Kyoto Protocol and the Clean Development Mechanism. I will then present in Part II a description of the current state of supply to the CDM market, followed in Part III by a story of the participation of a particular highly specialized industry that produces small quantities of a very potent greenhouse gas. Part IV explains how the underlying structure of the market has incentivized this particular industry to generate large numbers of CDM credits and thus to dominate the first phase of market growth. I will also tell a second story in Part V about the challenges presented by the recent dramatic increase in the level of CDM participation by China's energy sector. Here, the interaction between international regulators and a state-regulated industry is leading to attempts to generate large numbers of credits for behavior that would have occurred even in the absence of the CDM. Finally, in Part VI I will conclude by sketching out two possible futures for international emissions trading between developed and developing countries that incorporate lessons from the unforeseen problems of the first three years of emissions crediting under the CDM.

I. THE KYOTO PROTOCOL AND THE CLEAN DEVELOPMENT MECHANISM

A. The Kyoto Protocol

The international agreements aimed at controlling greenhouse gas emissions are hierarchically structured. The most general and overarching agreement, known as the United Nations Framework Convention on Climate Change (UNFCCC or Convention), adopts as its goal the stabilization

28. Montreal Protocol, *supra* note 13, art. 10, § 3.

of GHG concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system.²⁹ The UNFCCC has been signed and ratified by 192 countries,³⁰ including all major emitters of greenhouse gases.³¹ Although its goal is ambitious, the UNFCCC contains no provisions that compel action to accomplish it. Rather, it lays out a process through which various protocols containing more specific commitments might be negotiated.³² The first of these protocols was negotiated at Kyoto in 1997.³³ The Kyoto Protocol (Protocol), as it has come to be called, establishes binding caps on emissions for developed nation parties and parties with economies in transition (Annex B parties or Annex B nations).³⁴ These caps are limits on emissions of GHGs during the 2008–2012 period.³⁵ The caps are set as reductions below each party's 1990 emission level³⁶ of six GHGs: CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).³⁷ Emission reduction commitments specified by the Protocol are typically 5 to 8 percent below the 1990 emissions baseline, although some parties successfully negotiated a commitment of no reduction, or even an increase

29. United Nations Framework Convention on Climate Change, New York, U.S., May 9, 1992, art. 2, U.N. Doc. FCCC/Informal/84, available at <http://unfccc.int/resource/docs/convkp/conveng.pdf> [hereinafter UNFCCC Convention].

30. United Nations Framework Convention on Climate Change, Status of Ratification, http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php (last visited July 15, 2008).

31. Compare United Nations Framework Convention on Climate Change, Status of Ratification, available at http://unfccc.int/files/essential_background/convention/status_of_ratification/application/pdf/unfccc_conv_rat.pdf (last visited Apr. 3, 2006), with UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, GREENHOUSE GAS EMISSIONS DATA FOR 1990–2003 SUBMITTED TO THE U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, KEY GHG DATA 21, 92–94 (2005), available at http://unfccc.int/resource/docs/publications/key_ghg.pdf. I define major emitters of greenhouse gases somewhat arbitrarily as those nations emitting more than 500 million metric tons (Mt) of CO₂ or its equivalent in other GHGs (CO₂) per year. As of their latest reports of GHG emissions to the United Nations Framework Convention on Climate Change (UNFCCC), this list included Australia, Brazil, Canada, China, France, Germany, India, Italy, Japan, the Russian Federation, Ukraine, the United Kingdom of Great Britain and Northern Ireland, the United States, and collectively, the European Union. *Id.*

32. UNFCCC Convention, *supra* note 29, at arts. 7, 17.

33. Kyoto Protocol, *supra* note 1, at art. 28.

34. *Id.* art. 3. Note that not all Annex I nations of the UNFCCC adopted commitments as specified in Annex B of the Kyoto Protocol. The most notable of these are the United States and Australia. This Article will use the terminology “Annex B” nation or party to refer to a signatory that did adopt such a commitment. These nations are sometimes referred to as Annex I nations or parties.

35. This period is commonly referred to as the “commitment period” or the “first commitment period.” *Id.*

36. *Id.* art. 3, annex B.

37. *Id.* annex A.

above the baseline.³⁸ Additionally, different levels of economic growth or stagnation since 1990 mean that while some Annex 1 nations face steep cuts, others actually have excess allocations.³⁹

The Protocol includes various flexible mechanisms aimed at reducing the cost of compliance for Annex B parties.⁴⁰ These include provisions allowing parties to trade their allowable emissions (assigned amount units or AAUs)⁴¹ as long as such trading is supplemental to domestic actions.⁴² Also included are provisions allowing Annex B parties to pay for additional emissions reductions within other Annex B parties and then credit them against their own assigned amount units.⁴³ This plan is known as Joint Implementation (JI).⁴⁴ Finally, Annex B parties may pay for emissions reductions within developing (non-Annex B) parties and also credit these against their commitments under the Protocol. The purchasing Annex B nation may then credit these emissions reductions against its assigned amount units. This provision is known as the Clean Development Mechanism (CDM).⁴⁵

The Protocol was ratified by a sufficient number of nations representing a sufficient proportion of global GHG emissions to enter into force,⁴⁶ but it

38. These nations include Australia (108 percent), Iceland (110 percent), New Zealand (100 percent), Norway (101 percent), Russia (100 percent), and Ukraine (100 percent). *Id.* annex B.

39. Compare *id.*, with United Nations Framework Convention on Climate Change, Total Aggregate Greenhouse Gas Emissions of Individual Annex B Parties, 1990–2003, http://ghg.unfccc.int/graphics/graph1_05.gif (last visited Apr. 6, 2006). The Annex B parties with the most headroom are Russia and Ukraine. To date, no nation has purchased assigned amount units (AAU's) from either nation, although there is much discussion of this compliance option. Another nation whose compliance was made far easier by the chosen baseline is Germany. Germany's allocation includes that of the former East Germany, where heavy industry and power demand collapsed after unification. This led to a large decrease in emissions relative to allocation, making the unified Germany's and hence the European Community's compliance challenge much more tractable. See WOLFGANG EICHHAMMER ET AL., GREENHOUSE GAS REDUCTIONS IN GERMANY AND THE UK—COINCIDENCE OR POLICY INDUCED? AN ANALYSIS FOR INTERNATIONAL CLIMATE POLICY 1 (2001), available at <http://publica.fraunhofer.de/eprints/N-6386.pdf>.

40. Lawrence H. Goulder & William A. Pizer, *The Economics of Climate Change*, in THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 10 (Steven Durlauf & Lawrence Blume eds., 2d ed. 2005), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=869644.

41. Indeed, the structure of the agreement is essentially a cap-and-trade system in which AAUs are freely allocated permits to emit that can then be traded between parties via a common registry, administered by the UNFCCC Secretariat. Kyoto Protocol, *supra* note 1, art. 3 ¶ 7.

42. *Id.* art. 17.

43. *Id.* art. 6.

44. Joanna Depledge, *Tracing the Origins of the Kyoto Protocol: An Article by Article Textual History*, 61, 64, delivered to the UNFCCC, U.N. Doc. FCCC/TP/2000/2 (Nov. 25, 2000), available at <http://unfccc.int/resource/docs/tp/tp0200.pdf>.

45. Kyoto Protocol, *supra* note 1, art. 12.

46. *Id.* art. 25 (At least 55 parties to the Protocol representing at least 55 percent of 1990 emissions of GHGs must ratify for the treaty to enter into force.); Kyoto Protocol Status, *supra* note 3.

was not ratified by either the United States or Australia.⁴⁷ It now appears at least possible, if not likely, that one Annex B party, Canada, will either withdraw or fail to comply with the Protocol, while another, Australia, may now join the treaty.⁴⁸ In order to induce a sufficient number of Annex B parties to ratify the treaty, significant concessions were made to particular parties. Notably, the Russian Federation and Ukraine were allowed to join the Protocol with commitments of a zero percent reduction below 1990 levels, although by the time of the negotiations their actual emissions were already far below the 1990 baseline because of the post-Soviet economic contraction.⁴⁹ These nations were able to join the Protocol without fear of facing emissions reductions and with the prospect of future sale of their excess AAU's to countries facing a commitment requiring actual cuts in emissions.⁵⁰

Before and after its entry into force, the Protocol has faced severe criticism: It has been criticized for doing little to combat global warming;⁵¹ for being economically inefficient in requiring nations to reduce emissions too quickly;⁵² for utilizing absolute emissions caps rather than emissions intensity targets or a carbon tax;⁵³ and for not committing the largest developing nations, most notably China and India, to binding emissions

47. *Id.*

48. Both changes are due, of course, to a change in government. In Canada, the election of a conservative government in 2006 led to a reevaluation of Canada's efforts on climate. In Australia, subsequent to the 2007 election, Prime Minister Kevin Rudd's first action was to ratify the Protocol. See, Doug Struck, *Canada Alters Course on Kyoto*, WASH. POST, May 3, 2006, at A16; *World Briefing: Australia; Kyoto Ratification First Act of New Leader*, *supra* note 2.

49. David G. Victor et al., *The Kyoto Protocol Emission Allocations: Windfall Surpluses for Russia and Ukraine*, 49 CLIMATIC CHANGE 263, 264 (2001).

50. ALAIN BERNARD ET AL., MIT JOINT PROGRAM ON THE SCI. & POL'Y OF CLIMATE CHANGE, REPORT NO. 98, RUSSIA'S ROLE IN THE KYOTO PROTOCOL 1-3 (2003), available at http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt98.pdf.

51. William D. Nordhaus, *Global Warming Economics*, 294 SCIENCE 1283, 1283-84 (2001).

52. Joseph E. Aldy et al., *Thirteen Plus One: A Comparison of Global Climate Policy Architectures*, 3 CLIMATE POL'Y 373, 391 (2003). For the argument that economically efficient greenhouse gas reduction trajectories differ little from business as usual in the short term but substantially in the long term, see Alan Manne & Richard Richels, *On Stabilizing CO₂ Concentrations—Cost-Effective Emission Reduction Strategies*, 2 ENVTL. MODELING & ASSESSMENT 251 (1997).

53. William Pizer, *The Case for Intensity Targets* 1-2 (Resources for the Future, Discussion Paper No. 05-02, 2005). The case for setting intensity targets, which limit a country's CO₂ emissions per dollar of GDP, is a consequence of Weitzman's insight that when uncertainty exists as to costs of abatement and the slope of the marginal benefit of abatement curve for an environmental good is relatively flat, a tax rather than a quantity control leads to a superior welfare outcome. See William A. Pizer, *Prices vs. Quantities Revisited: The Case of Climate Change* 3-4 (Resources for the Future, Discussion Paper No. 98-02, 1997); Martin L. Weitzman, *Prices vs. Quantities*, 41 REV. ECON. STUD. 477 (1974).

reductions.⁵⁴ Finally, its flexible mechanisms also have been criticized as dependent on counterfactuals, namely an emissions baseline, that is either unknowable or politically determined.⁵⁵ Reflecting this criticism, at least thirteen modified treaty architectures have been offered as alternatives or improvements for the post-2012 period.⁵⁶

The most common response to these criticisms is that the Protocol has been, since its negotiation in 1997, the only game in town when it comes to controlling the growth in global GHG emissions and mitigating future harms from global warming. Further, it has spurred the emergence and growth of institutions and capacities that will likely endure beyond its existence, albeit perhaps in altered and improved form. Some of the most notable diplomatic successes of the twentieth century were the result of a long series of negotiations and agreements. Institutions like the GATT and its successor, the WTO, and perhaps most of all, the European Union, that have ultimately delivered tremendous benefits to their members, began with modest and limited agreements. Members were not afraid to tinker with these institutions as they learned by doing. The Protocol has given birth to a whole set of institutions and has fostered capacity development both in the developed and developing world that will prove invaluable in ultimately overcoming the challenges presented by climate change.

This Article's aim is to take a close look at the actual, as opposed to the theoretical, outcome of one of the Protocol's most significant institutional creations—a global market for GHG emission credits. Most or all of the criticisms of the Protocol were made prior to the development of a substantial track record for the CDM and the other flexible mechanisms, so these criticisms were of necessity theoretical in nature. Although to date there has been little use of JI and no sale and purchase of AAUs, there has been an explosion of activity within the CDM that now provides a basis for an empirical critique of the Protocol. This critique aims not to undermine the rationale for the Protocol, but to understand how, in the next phase of the international effort to avoid “dangerous anthropogenic interference”⁵⁷ with the world's climate, trading can accomplish more than it has or is likely to under the Kyoto regime.

54. Prepared testimony of Janet Yellen, *supra* note 22, at 4; Letter From George W. Bush, President of the U.S., to Senators Hagel, Helms, Craig, and Roberts (Mar. 13, 2001), <http://www.whitehouse.gov/news/releases/2001/03/20010314.html>. Since developing nations are involved in the Kyoto Protocol through the CDM, this criticism is the extent of their involvement. Kyoto Protocol, *supra* note 1, art. 12.

55. Chi Zhang et al., *Carbon Intensity of Electricity Generation and CDM Baseline: Case Studies of Three Chinese Provinces*, 33 ENERGY POL'Y 451 (2005).

56. Aldy et al., *supra* note 52, at 373.

57. UNFCCC Convention, *supra* note 29.

B. Clean Development Mechanism

1. Structure of the CDM

The CDM is a market-based approach to the problem of global warming. It allows buyers, who may be Annex B parties or firms within Annex B nations, to purchase credits from emission reduction projects carried out in non-Annex B nations. The CDM builds on experience derived from various regional markets for atmospheric pollutants, most notably the United States' experience with emissions trading under the Clean Air Act.⁵⁸ The developing country (non-Annex B) firms that are sellers of Certified Emission Reductions (CERs), the currency of the CDM system, have no limit to the mass of GHGs that they may emit under the Protocol. This absence of a cap on emissions for designated parties necessitates a far more complex design than had been attempted for most previous pollution markets. Adding further complexity to the program is the fact that the CDM is the first atmospheric pollutant trading program that covers multiple gases and allows conversion between them through the medium of its common currency, CERs.

Further, the CDM is a project-based system. It accomplishes its objectives at the microlevel of individual emission reduction projects that are each validated by designated third party verifiers and then registered by the mechanism's governing body, the CDM Executive Board (CDM EB), as eligible for crediting. Each project wishing to participate in the CDM must prepare a Project Design Document (PDD) that explains in detail how its future emissions reductions will be voluntary, real, additional, and will not induce leakage. It must also either utilize a previously approved monitoring methodology that explains in detail how it will monitor emissions reductions made by the project or propose a new methodology. Voluntary emissions reductions are not compelled by national or provincial law or regulation. Real emissions reductions are monitored with sufficient care to ensure that they actually occur. Additional emissions reductions are those that are in addition to any that would have occurred absent the CDM subsidy. Leakage of emissions occurs when emissions reductions that would have occurred from a CDM project absent the CDM subsidy are displaced to another location because of the subsidy.

58. Prepared testimony of Janet Yellen, *supra* note 22, at 12; see also Robert W. Hahn & Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109, 151–53 (1989) (detailing the successes and disappointments of the EPA program and suggesting that many of the program's failings stemmed from regulators' need to satisfy multiple constituencies with divergent objectives).

All four of these concepts require that a hypothetical baseline of emissions be defined for each project, and in the case of leakage, the world outside the project. This baseline represents the timeline of emissions that would have occurred absent the subsidy provided by the CDM (and thus absent the emission reduction project). It is an attempt to estimate the counterfactual of typical levels of emissions in a world without CDM. The CDM project baseline is described in terms that vary by project type. Nevertheless, several common variables can be seen in most PDDs.⁵⁹ Project proponents often describe the regulatory baseline, that is, the emissions permitted by local law and regulation.⁶⁰ They also often describe the financial baseline, which is the lack of an adequate return on investment without the benefit of the CDM subsidy.⁶¹ They often describe typical technologies applied by the type of project in the PDD and how the CDM-subsidized project exceeds these local standards.⁶² Finally, they sometimes must describe a sectoral or national baseline for installations of the project type.⁶³ Ultimately, the CDM project proponents must quantify, third party verifiers must check, and the CDM EB must certify the hypothetical emissions that would have occurred in the future without the CDM project subsidy.

Project proponents and environmental regulators do not live in a world without CDM. As will be shown below, they have acted strategically in order to maximize many projects' baselines and so maximize the potential for the generation of CER revenues. The fact that most industries involved in CDM projects are already highly regulated makes this strategy attractive

59. PDDs follow a standardized format that includes a general description of the project, a description of how the baseline for the project is determined, a specification of the duration of the project, an explanation of how the project's emissions reductions will be monitored, a quantitative estimate of the project's emissions reductions, a discussion of any other environmental effects of the project, and finally a synthesis of comments on the project by local stakeholders. CDM Executive Bd., UNFCCC, *Guidelines for Completing the Project Design Document (CDM-PDD), The Proposed New Methodology: Baseline (CDM-NMB) and the Proposed New Methodology: Monitoring (CDM-NMM)* (Version 04, 2005), available at http://cdm.unfccc.int/Reference/Documents/Guidel_Pdd/English/Guidelines_CDMPDD_NMB_NMM.pdf.

60. See, e.g., CDM PROJECT DESIGN DOCUMENT OF THE REPUBLIC OF NORTH KOREA: HFC DECOMPOSITION PROJECT IN ULSAN 20 (2005), available at http://cdm.unfccc.int/UserManagement/FileStorage/FS_302727382.

61. See, e.g., CDM PROJECT DESIGN DOCUMENT: ZHANGBEI MANJING WINDFARM PROJECT 9–11 (2005), available at <http://cdm.unfccc.int/UserManagement/FileStorage/5X09Y9XLJO28P4KEA4GNSWVG275CF5T>.

62. See, e.g., CDM PROJECT DESIGN DOCUMENT: EQUIPAV BAGASSE COGENERATION PROJECT (EBCP) 13–14 (2005), available at <http://cdm.unfccc.int/UserManagement/FileStorage/PL0URYVPKVZOV8TIW2MI8EG1Y3CBM1>.

63. See, e.g., CDM PROJECT DESIGN DOCUMENT: WASTE HEAT BASED 7 MW CAPTIVE POWER PROJECT 35 (2006), available at <http://cdm.unfccc.int/UserManagement/FileStorage/6WOJFJIP40XRP77Y7M83R6UVYCBLL>.

and easy to implement. An environmental regulator faced with the choice of preventing an emission with a costly domestic regulation⁶⁴ or by means of the CDM will have obvious political incentives for selecting the international program over new domestic regulation.⁶⁵

The end product of the CDM process is the issuance by the CDM EB of an emission offset to the project participants. This offset can then be sold to an Annex B nation or a party within one that has obligations under the Protocol. The offset, called a certified emission reduction or CER, assuming that certain CDM facilities are established, may be used by Annex B countries in lieu of emissions reductions within their territories in order to meet their targets under the Protocol.⁶⁶ Private parties that are assigned emissions allowances by their governments may also purchase CERs and use them as permits to emit in excess of their assigned allocations, or as an alternative to purchasing allocations from other participants in their domestic market. The European Union and Japan will likely be the major purchasers of CERs during the first commitment period.⁶⁷

The official public process leading to the production of CERs by a CDM project begins with the submission of a PDD to the CDM EB for a period of public comment. This comment process is a part of a project's validation by an independent Designated Operational Entity (DOE).⁶⁸ The project must also receive approval from its host country's Designated National Authority (DNA), typically the host country's environmental ministry, before being submitted for registration to the CDM EB.⁶⁹ Once registered, a project must submit monitoring reports providing data to show how many CERs have actually been generated during a particular period. These reports must be

64. It is costly both from the perspective of total societal costs and from the perspective of allocation of regulator personnel and funding.

65. The incentive not to regulate created by the CDM led the CDM EB to adopt rules specifying the dates after which a new regulation must be taken into account. CDM Executive Bd., UNFCCC, *Twenty-Second Meeting Report, Annex 3: Clarifications on the Consideration of National and/or Sectoral Policies and Circumstances in Baseline Scenarios* (Version 02, 2005), available at http://cdm.unfccc.int/EB/022/eb22_repan3.pdf.

66. Kyoto Protocol, *supra* note 1, art. 12, § 3(b).

67. POINT CARBON, CARBON 2006: TOWARDS A TRULY GLOBAL MARKET 5 fig.2.1 (2006), available at http://www.pointcarbon.com/wimages/Carbon_2006_final_print.pdf. Canada was also likely to have been an important purchaser of Certified Emission Reductions (CERs), but actions by its recently elected conservative government have made it doubtful that it will comply with the Protocol. See Doug Struck, *Canada Alters Course on Kyoto: Budget Slashes Funding Devoted to Goals of Emissions Pact*, WASH. POST, May 3, 2006, at A16.

68. U.N. ENV'T PROGRAM, LEGAL ISSUES GUIDEBOOK TO THE CLEAN DEVELOPMENT MECHANISM 32-34 (2004), available at <http://cd4cdm.org/Publications/CDM%20Legal%20Issues%20Guidebook.pdf>.

69. *Id.*

both consistent with the monitoring plan spelled out in the project's PDD and verified and certified by a DOE.⁷⁰ At that point, the CDM EB will issue CERs into a project participant's account.⁷¹ These CERs will eventually be transferable to a buyer who establishes an account with the International Transaction Log, a yet to be constructed database of Kyoto Protocol GHG accounts.⁷²

2. Goals of the CDM

The CDM was created for three reasons. First, it aims to accomplish the overarching goals of the Framework Convention. Second, it aims to encourage sustainable development in non-Annex B nations. Third, the CDM is intended to reduce the cost of compliance with the Protocol for Annex B nations.⁷³

The CDM is intended, according to the Protocol, to help in accomplishing the Convention's goal of "prevent[ing] dangerous interference" with the climate system.⁷⁴ It aims to do this by assisting developing countries to reduce their emissions of GHGs. Thus, the CDM is significant, and indeed the only way in which non-Annex B signatories to the Protocol will contribute toward achieving the Protocol's goals. A realistic hope for the CDM is that by providing non-Annex B nations with financial incentives for low-carbon intensity development, they might be nudged, however slightly, onto more climate-friendly trajectories.

The second CDM objective—sustainable development—is left largely undefined by the Protocol or the implementing directives of later conferences of the parties.⁷⁵ To the extent that the provision has teeth, it is given them by the requirement under the CDM that the host country DNA of a project must certify that the project meets the DNA's standards of sustainability.⁷⁶ Although some DNAs have prioritized particular types of projects, they have not rejected other types that would otherwise be capable of producing CERs.⁷⁷

70. *Id.*

71. *Id.*

72. UNFCCC, Subsidiary Body for Sci. & Tech. Advice, Twenty-Second Session, Bonn, F.R.G., May 19–27, 2005, *Checks to Be Performed by the International Transaction Log*, at 3–4, U.N. Doc. FCCC/SBSTA/2005/INF.3 (May 13, 2005), available at http://unfccc.int/files/meetings/unfccc_calendar/pre-sessional/application/pdf/inf03.pdf.

73. Kyoto Protocol, *supra* note 1, art. 12.

74. *Id.* art. 12, § 2.

75. *Id.* art. 12, § 2; U.N. ENV'T PROGRAM, *supra* note 68, at 49.

76. U.N. ENV'T PROGRAM, *supra* note 68, at 49.

77. China's official CDM policy favors renewable energy, energy efficiency, and methane capture projects, but the Chinese DNA has approved numerous other types of projects. See Office of Nat'l Coordination Comm. on Climate Change, Measures for Operation and Management of Clean

The third CDM goal—lowering the cost of compliance for Annex B parties—was thought possible for two reasons. First, the majority of new energy capacity to be built up during the First Compliance Period will be located in the developing world where rates of economic growth are highest and energy infrastructure is least developed.⁷⁸ Also, the relative cost of prematurely retiring high-carbon-emission intensity power plants is significantly higher than building new low- or zero-carbon emission energy capacity. Thus, if the CDM could be used to subsidize the substitution of new, clean power capacity in the developing world for the premature retirement of old, dirty power capacity in the developed world, it could substantially lower the cost of treaty compliance. Further, such a substitution would not change the environmental outcome, because the location at which an emission reduction of a particular quantity of CO₂ takes place has no impact on the environmental benefit—lower atmospheric greenhouse gas concentrations.⁷⁹ However, as will be shown in our first story about CDM implementation, a substantial proportion of the emissions reductions generated by the CDM are not of this type and are in reality extremely inefficient in terms of the cost of the subsidy compared to the cost of environmental benefits obtained. Our second story regarding CDM implementation will take a close look at the fraction of emissions reductions created by construction of new electric-generating capacity and will show that it is increasingly difficult to tell which CDM projects are producing emissions reductions additional to those that would have occurred in the baseline, and which are claiming credit for nonadditional, anyway credits.

II. RAPID DEVELOPMENT OF THE CLEAN DEVELOPMENT MECHANISM SINCE 2004

The CDM project pipeline began operation in December of 2003, when the first project was accepted for public comment and validation. In

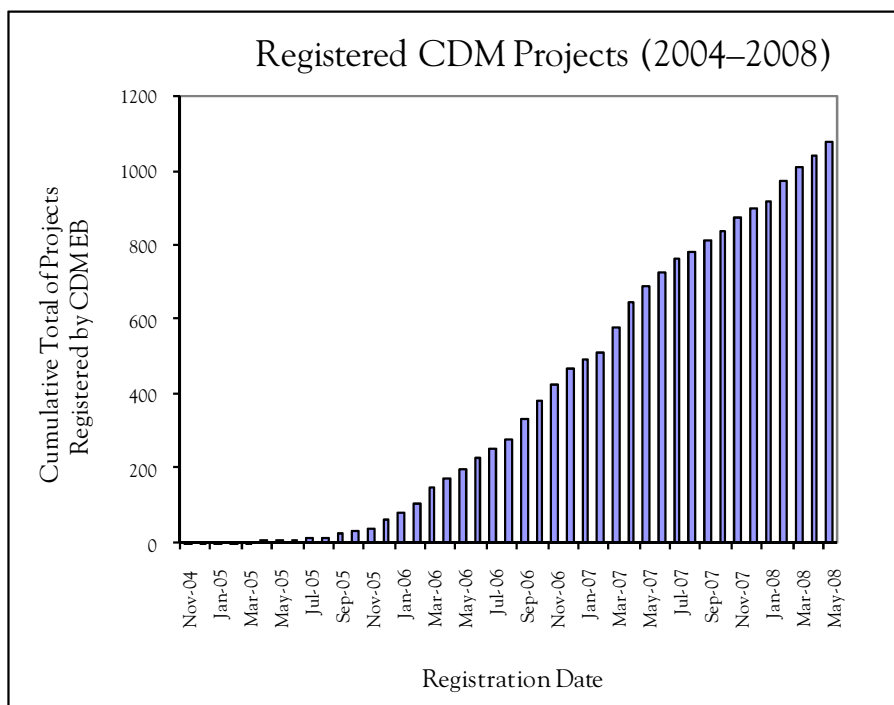
Development Mechanism Projects in China, art. 4 (Nov. 21, 2005), available at <http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=905>.

78. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, INTERNATIONAL ENERGY OUTLOOK 2007, at 61 (2007), available at [http://www.eia.doe.gov/oiaf/ieo/pdf/0484\(2007\).pdf](http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2007).pdf).

79. Because CO₂ is a well-mixed atmospheric gas with a long residence time, the extent to which it causes environmental harm is a function of its concentration in the atmosphere rather than the rate at which it is being added at any one time. William D. Nordhaus, *Life After Kyoto: Alternative Approaches to Global Warming Policies* 6 (Nat'l Bureau of Econ. Research, Working Paper No. 11889, 2005), available at <http://www.nber.org/papers/W11889.pdf>.

November of 2004, the first project was registered by the CDM EB.⁸⁰ Finally, in October 2005, the first CERs were issued to a project participant's account.⁸¹ Since then, there has been extremely rapid growth in the number, type, and total volume of emissions reductions in the CDM pipeline. Figure 1 shows the number of projects completing the registration process by month since the CDM began its activities. Beginning in the second half of 2005, the registration process picked up significant steam so that by the end of 2007, there were 895 projects registered and able to produce CERs for sale in the carbon market.

FIGURE 1: NUMBER OF PROJECTS REGISTERED BY THE CDM EXECUTIVE BOARD SINCE DECEMBER 2003, WHEN PDDs FIRST ENTERED THE CDM PIPELINE⁸²



80. See UNFCCC, Project 0008: Brazil NovaGerar Landfill Gas to Energy Project, <http://cdm.unfccc.int/Projects/DB/DNV-CUK1095236970.6> (last visited Apr. 30, 2008).

81. See UNFCCC, CERs Issued, http://cdm.unfccc.int/Issuance/cers_iss.html (last visited July 15, 2008).

82. Data for Figure 1 comes from UNEP Risø Centre, UNEP Risø CDM/JI Pipelines Database and Analysis, <http://www.cdmpipeline.org/publications/CDMpipeline.xls> (last visited May 2, 2008). As of November 1, 2007, there were 827 projects registered by the CDM EB.

It was not until November of 2005 that the volume of CO₂ reductions deliverable by registered CDM projects to the end of the First Commitment Period began to grow large enough to play a significant role in Protocol compliance for Annex B parties. From the last quarter of 2005 to the present, the potential CDM supply has grown at a breakneck pace. By January 1, 2008, more than 1150 million tons (Mt) CO₂ equivalent (CO₂e)⁸³ had been registered for delivery via the CDM by the end of the first compliance period (see Figure 2).⁸⁴ Another pattern emerging from the project registrations that have occurred is the dominance of large projects in the CDM. As seen in Figure 2, a small number of very large projects dominate the supply of CERs from registered projects. In fact, the 45 largest projects (5 percent of the total number) represent 64 percent of the total supply to the end of the First Commitment Period.⁸⁵

The trend of large projects dominating supply holds for the CDM pipeline as a whole, including projects registered, projects for which registration has been requested, and projects that have entered the validation stage. As of this writing, there are more than 2800 projects in the CDM pipeline that will eventually, if all are registered and deliver reductions as promised in their PDDs, supply more than 2600 Mt CO₂e to the market for Protocol compliance instruments.⁸⁶ This amount represents approximately 2.8 percent of Annex B 1990 GHG emissions for each year of the First Commitment Period.⁸⁷

83. The standard measure of greenhouse gas reduction under the Protocol is 1 ton CO₂e. It is the mass of any one of the six Kyoto gases equal to the 100-year global warming potential (GWP) of one ton of CO₂. GWP is defined as the time integrated radiative forcing from the release of 1 kg of a trace substance to 1 kg of CO₂. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) & TECH. & ECON. ASSESSMENT PANEL, SAFEGUARDING THE OZONE LAYER AND THE GLOBAL CLIMATE SYSTEM: ISSUES RELATED TO HYDROFLUOROCARBONS AND PERFLUOROCARBONS 385 (2005), available at http://www.ipcc.ch/pdf/special-reports/sroc/sroc_full.pdf [hereinafter IPCC].

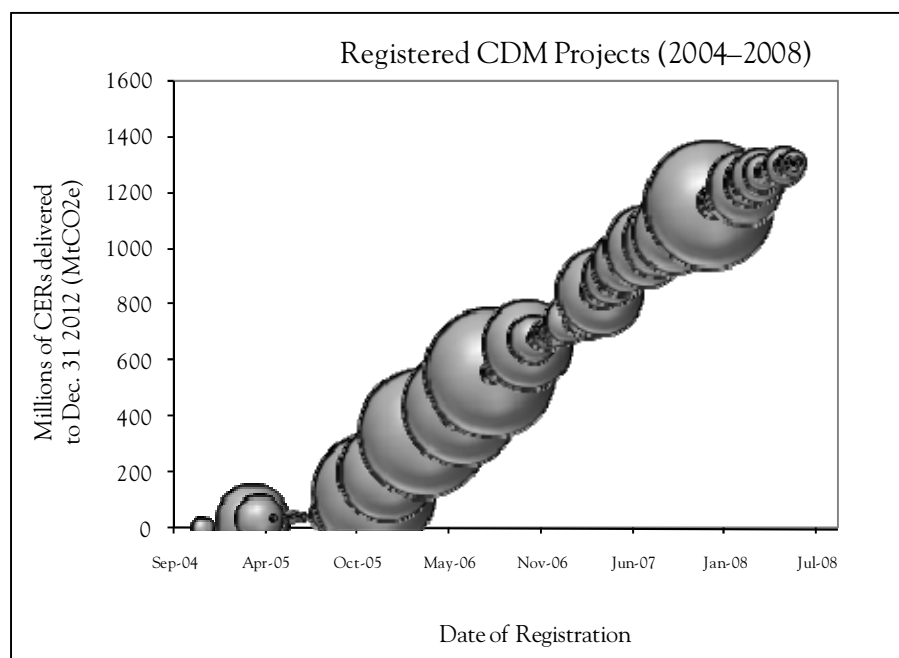
84. See UNEP Risø Centre, *supra* note 82.

85. *Id.*

86. See UNFCCC, CDM Statistics, <http://cdm.unfccc.int/Statistics/index.html> (last visited Jan 7, 2008). I count a project as in the CDM pipeline if it has advanced to the public comment phase of validation. UNFCCC, Validation Projects, <http://cdm.unfccc.int/Projects/Validation> (last visited July 15, 2008).

87. See UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, GREENHOUSE GAS EMISSIONS DATA FOR 1990–2003, *supra* note 31, at 15. Dividing the 2600 Mt CO₂e estimate for production of credits by 5 provides an annual estimate of supply during the First Commitment Period of 520 Mt CO₂e/year. Annex B GHG Emissions in 1990, not including credits for land use, land use change, and forestry, were 18,372 Mt CO₂e. Thus the CDM will provide 520/18,372 or 2.8 percent of Annex B 1990 GHG emissions.

FIGURE 2: PROJECTS REGISTERED IN TERMS OF CER SUPPLY PROJECTED BY END OF FIRST COMMITMENT PERIOD⁸⁸



Projects yet to be registered or yet to even enter the CDM pipeline face a diminishing probability of generating credits as the end of the First Commitment Period draws closer. The flow of projects is likely to diminish over time unless agreement is reached as to the future of the CDM in the post-2012 climate treaty architecture. The shorter the interval before the end of the First Commitment Period, the less money there is to be made from CERs and so the transaction costs associated with registration and monitoring loom larger.⁸⁹ Without certainty about the shape of any future UNFCCC-based trading program or subsidy, financial incentives to invest with post-2012 in mind are absent.⁹⁰ Even for the 2008–2012 market, there is significant

88. Data for Figure 2 comes from UNEP Risø Centre, *supra* note 82. The y-axis shows the total credits promised by December 31, 2012 of CERs to the carbon market from CDM projects; the size of each bubble shows the relative size of the particular project. This figure shows projects registered by November 1, 2007.

89. ERIC HAITES, ESTIMATING THE MARKET POTENTIAL FOR THE CLEAN DEVELOPMENT MECHANISM: REVIEW OF MODELS AND LESSONS LEARNED 63–64 (2004), available at <http://carbonfinance.org/docs/EstimatingMarketPotential.pdf>.

90. *Id.*

demand (and hence price) uncertainty because of the possible competition of CDM with both JI project-based reductions and outright purchases of AAUs from Russia, Ukraine, and the remainder of Eastern Europe.⁹¹ Whether these alternative supplies of AAUs and JI credits are sought out by Annex B parties depends on the costs of domestic compliance, the price of CERs, and other political considerations.⁹²

III. CURRENT SUPPLY OF CERs IN THE CDM PIPELINE BY PROJECT TYPE

The original intent of the CDM was to spur development of low-carbon energy infrastructure in the developing world both through achievement of sustainable development goals and substitution for early retirement of expensive, high-carbon energy infrastructure in the developed world.⁹³ It comes as a surprise, then, to find then that the CDM pipeline bears only a partial relationship to this vision. Instead, the subsidy provided by purchase of CERs to date will largely ensure that high GWP industrial gases such as trifluoromethane (HFC-23) and N₂O as well as CH₄ emitted by landfills and confined-animal-feeding operations (CAFOs) in non-Annex B nations are captured and destroyed. The very large projects dominating the supply of CERs are confined primarily to two relatively obscure industries—adipic acid and chlorodifluoromethane (HCFC-22) production. Adipic acid is the feedstock for the production of nylon-66 and releases abundant N₂O as a production byproduct.⁹⁴ HCFC-22 has two major applications. It is one of two major refrigerants that was phased in to replace the CFC's under the auspices of the Montreal Protocol to Protect on Substances that Deplete the Ozone Layer.⁹⁵ HCFC-22 is also the primary feedstock in the production

91. Russia was granted significant excess AAUs in negotiations leading up to its accession to the Protocol as an inducement to join. SCOTT BARRETT, ENVIRONMENT AND STATECRAFT: THE STRATEGY OF ENVIRONMENTAL TREATY-MAKING 372–73 (2003). This concession, when combined with the post-Soviet economic contraction, leaves Russia with significantly lower actual emissions than its assigned amount under the Protocol. POINT CARBON, *supra* note 67, at 8; Victor et al., *supra* note 49, at 263. Ukraine and the remainder of Eastern Europe also have excess AAUs due to economic contraction. *Id.*

92. See discussion *infra* Part VI.

93. See discussion *infra* Part I.B.2.

94. R.A. Reimer et al., *Adipic Acid Industry—N₂O Abatement: Implementation of Technologies for Abatement of N₂O Emissions Associated With Adipic Acid Manufacture*, in NON-CO₂ GREENHOUSE GASES: SCIENTIFIC UNDERSTANDING, CONTROL AND IMPLEMENTATION 347, 347 (J. van Ham et al. eds., 2000).

95. A. MCCULLOCH, INCINERATION OF HFC-23 WASTE STREAMS FOR ABATEMENT OF EMISSIONS FROM HCFC-22 PRODUCTION: A REVIEW OF SCIENTIFIC, TECHNICAL AND ECONOMIC ASPECTS 2 (2005), available at http://cdm.unfccc.int/methodologies/Background_240305.pdf.

of PTFE,⁹⁶ more commonly known by its Dupont brand name, Teflon. HCFC-22 production inevitably produces HFC-23 as an unwanted byproduct.⁹⁷ These two relatively small industries represent nearly 55 percent of the supply of issued CERs in the CDM to date.⁹⁸

Contrary to ex-ante predictions, CO₂-based projects, including renewable energy, fuel switching from coal to gas, demand side energy efficiency, waste heat capture, and cement process modification account for less than half of the CER supply to 2012. Renewable energy projects alone account for 28 percent. Nineteen HFC-23 capture projects at HCFC-22 production facilities and three projects that capture the N₂O made as a byproduct of adipic acid or nitric acid production account for the third of the pipeline composed of high GWP industrial gas reduction projects. Finally, CH₄-capture and flaring projects, mostly located at large landfills, coal mines, and CAFOs, account for another 19 percent. Moreover, because the HFC-23, N₂O, and to a lesser extent, CH₄, projects are typically of larger size than the renewable energy projects, they are more likely to overcome the transaction costs associated with registration and production of CERs than the smaller hydro, wind, and biomass energy projects that compose the CDM's renewable portfolio.⁹⁹

To date, relatively small numbers of CERs have actually been issued. This slow trickle will likely turn to a flood in the coming years as registered projects begin submitting monitoring reports to the CDM EB. In order for the issuance of a CER to occur, a third-party monitor must audit a CDM project and certify that monitoring of the emissions reductions was adequate to ensure that they actually occurred.¹⁰⁰ Submission of this report to the CDM EB results in the issuance of CERs to that project participant's account.¹⁰¹ The first CERs were issued by the CDM EB in late October 2005.¹⁰² As of January 1, 2008, only 103 million CERs have been issued and deposited into project participant accounts.¹⁰³ The fact that more than half of these issuances are to HFC-23 abatement projects (55 percent) is likely due to the superior financial and logistical capacity of these projects relative to either the CH₄ or renewable-energy projects. The pattern most evident in the early issuances of CERs is the dominance of large over small projects in terms of actually

96. *Id.*

97. *Id.*

98. UNEP Risø Centre, *supra* note 82.

99. HAITES, *supra* note 89, at 45.

100. U.N. ENV'T PROGRAM, *supra* note 68, at 38–39.

101. *Id.* at 39.

102. UNFCCC, *supra* note 81.

103. This amount represents less than 10 percent of CERs promised by registered projects for delivery to 2012. *Id.*

producing emissions reductions. Early issuance shows once again that the barrier represented by transaction costs is more substantial for small CDM projects. As discussed above, the classes of small and large projects are largely coextensive with the CO₂ projects versus the N₂O, HFC-23, and to a lesser extent CH₄ projects.

Contrary to theory and expectation, the CDM market is not a subsidy implemented by means of a market mechanism by which CO₂ reductions that would have taken place in the developed world take place in the developing world. Rather, most CDM funds are paying for the substitution of CO₂ reductions in the developed world for emissions reductions in the developing world of industrial gases and methane. Indeed, the industrial gas emissions that account for one third of CDM reductions do not even occur in the developed world, not because of an absence of adipic acid or HCFC-22 manufacture, but because Annex B industries, after recognizing the threat posed by these emissions and the low cost of abating them, have opted to voluntarily capture and destroy them.¹⁰⁴

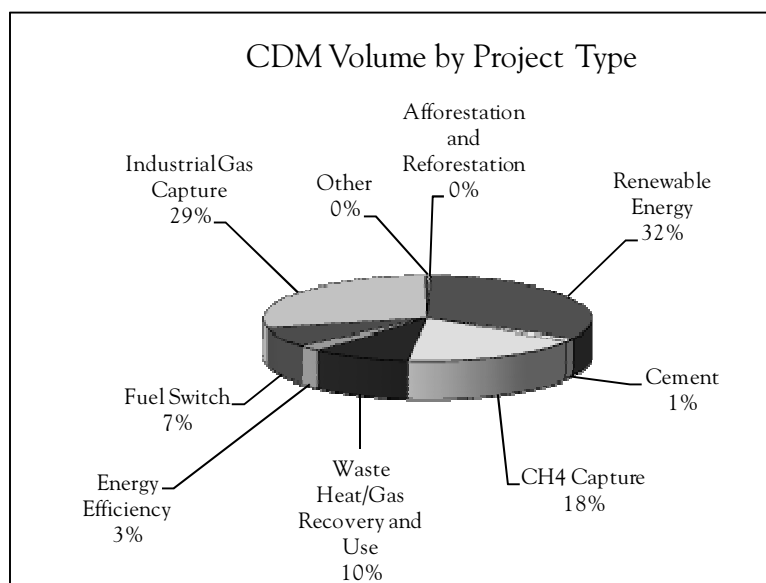
While renewable energy projects do make up 1600 out of 2647 (60 percent) projects in the CDM project pipeline, they account for only 28 percent of the emissions reductions produced. It is important to note that a significant proportion of the CERs generated by biomass power projects are from the CH₄ emissions that are avoided because biomass is burned rather than allowed to biodegrade.¹⁰⁵ Much of the publicity surrounding the CDM has emphasized the number of renewable energy projects sponsored by the CDM while neglecting the relative volume of emissions,¹⁰⁶ hence CERs produced and the relative scale of subsidy provided to various sectors. This emphasis provides a false picture of the true subsidy flows being generated by the international market for carbon (see Figure 3).

104. MCCULLOCH, *supra* note 95, at 18; Reimer et al., *supra* note 94, at 349.

105. Anaerobic digestion of crop residues leads to significant emission of CH₄ that is prevented by collection and use of the waste as a fuel. Many biomass energy projects claim this emission reduction in addition to the fossil-fuel-based energy avoided. See, e.g., CDM PROJECT DESIGN DOCUMENT: CAMIL ITAQUI BIOMASS ELECTRICITY GENERATION PROJECT 7-9 (2005), available at <http://cdm.unfccc.int/UserManagement/FileStorage/7Q7IH03DPAA2EL4SA8AM415CKQ7502>.

106. Compare *infra* fig. 3, with UNFCCC, Registration: Distribution of Registered Project Activities by Scope, <http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html> (last visited May 4, 2006), and The World Bank, Carbon Finance Unit, About World Bank Carbon Finance Unit, <http://carbonfinance.org/Router.cfm?Page=About&ItemID=24668> (last visited May 4, 2006).

FIGURE 3: FRACTION OF CERS SUPPLIED TO 2012 BY PROJECT TYPE FOR ALL PROJECTS CURRENTLY IN THE CDM PIPELINE¹⁰⁷



It is clear that the CDM has induced market participants to produce a large number of emissions reductions in the developing world for sale to those nations with quantified emissions reductions under the Protocol. However, to evaluate whether the CDM as actually realized is a success, more information is required: One must also ask whether Annex B nations get their money's worth. To answer this question, Part IV will examine HFC-23 projects and energy projects in the CDM.

IV. STRATEGIC MANIPULATION OF BASELINES: THE CASE OF HFC-23 ABATEMENT PROJECTS IN THE CDM

A. HFC-23 is a High GWP Byproduct of HCFC-22 Manufacture

Our first story concerns both the strategic behavior on the part of proponents of HFC-23 capture projects, an important class of large projects within the CDM, and the responses of the CDM EB to these attempts to inflate credit issuance. These emission reduction projects are an important component of the emissions market's initial rapid growth. There are

107. Data current as of Dec. 4, 2007. UNEP Risø Centre, *supra* note 82.

nineteen HFC-23 capture projects currently participating in the CDM.¹⁰⁸ These projects consist of the capture and destruction of HFC-23 produced as a byproduct of HCFC-22 manufacture.¹⁰⁹ The primary use of HCFC-22 is as a refrigerant, although its use as a feedstock for fluoroplastics such as PTFE is also significant and growing.¹¹⁰ For every 100 tons of HCFC-22 produced, between 1.5 and 4 tons of HFC-23 are produced.¹¹¹ This group of emission reduction projects have played an important role in shaping the early CDM emissions market and, because of their substantial market share, in determining its environmental performance.

An understanding of the incentives faced by creators of HFC-23 abatement projects must begin with an understanding of the atmospheric chemistry of HFC-23, because this chemistry lies at the heart of what makes them successful CDM projects. HFC-23 is an extremely potent and long-lived greenhouse gas. Its one-hundred-year GWP is 11,700.¹¹² As a consequence of this high GWP and the rules of the CDM, which convert the other six Protocol gases to CO₂e and hence CERs using their GWPs, 1 ton of HFC-23 abated is considered equivalent to 11700 tons of CO₂. In other words, for every kilogram of HCFC-22 produced, between 15 and 30 g of HFC-23 is produced, and potentially captured and destroyed. This 15 to 30 g of HFC-23 is equivalent to 175 to 350 kg of CO₂, or 0.175 to 0.350 CERs.

Although approximately half of HCFC-22 production occurs in the developed world,¹¹³ there are essentially no byproduct emissions of HFC-23 there because major producers have voluntarily adopted measures to capture and destroy it.¹¹⁴ Participation in voluntary abatement programs was substantial but not universal by 2005.¹¹⁵ The situation in the developing world was, prior to CDM, quite different. There, HCFC-22 manufacturers vented all HFC-23 produced to the atmosphere.¹¹⁶ One market analyst predicts that global HCFC-22 production will grow by 6 to 7 percent per year until 2020 and by 16 percent per year in the developing world.¹¹⁷ Thus,

108. This figure is as of Jan. 1, 2008. UNEP Risø Centre, *supra* note 82.

109. CDM Executive Bd., UNFCCC, *Revision to Approved Baseline Methodology AM0001: "Incineration of HFC 23 Waste Streams" 1* (Version 03, 2005), available at http://cdm.unfccc.int/UserManagement/FileStorage/AM0001_version3%20.pdf.

110. MCCULLOCH, *supra* note 95, at 4.

111. *Id.* at 10.

112. *Id.* at 21.

113. *Id.* at 4.

114. *Id.* at 18, 21.

115. IPCC, *supra* note 83, at 409.

116. MCCULLOCH, *supra* note 95, at 4.

117. *Id.*

reducing non-Annex B emissions of HFC-23 should be a goal of any treaty aimed at curbing GHG emissions.

Non-Annex B manufacturers of HCFC-22 have, to a remarkable extent, become participants in the CDM. Developing world production of HCFC-22 in 2005 was approximately 237,000 metric tons.¹¹⁸ Assuming a 3 percent HFC-23 production rate, which has been fairly typical for the 19 HCFC-22 plants participating in the CDM,¹¹⁹ this equates to a production of 83 million CERs per year.¹²⁰ Taken together, the PDDs of the nineteen HCFC-22 plants estimate that they will produce 81.8 million CERs per year. Using these estimates, it would appear that essentially all developing world HCFC-22 production, as of 2005, is currently participating in the CDM. This is a remarkable achievement for the CDM and begs the question of how a financial mechanism was able to achieve near total market penetration in an industry so quickly. An examination of the economics of HCFC-22 abatement and HFC-23 capture explains that the reasons may have as much to do with the perverse incentives created by the carbon market as with an ability to identify low cost emissions reduction opportunities.

B. The Perverse Incentives of HFC-23 Abatement as a CDM Project

The economics of HFC-23 projects create incentives for strategic behavior that, if left unchecked, would undermine the environmental efficacy of the CDM (see Table 1). Consider the 1 kg of HCFC-22 produced by a CDM project that the calculation above showed to be equivalent to 0.35 t CO₂ or 0.35 CERs. At current market prices of €10/CER,¹²¹ the production of 1 kg of HCFC-22 will produce a subsidy of €3.51. The cost of HFC-23 abatement is estimated to be on the order of €0.09/kg HCFC-22.¹²²

118. *Id.*

119. See UNEP Risø Centre, *supra* note 82. The average HFC-23/HCFC-22 ratio of the first 10 plants is 2.99 ± 0.58 (data on file with author).

120. 237,000 Mt HCFC-22 * 0.03 = 7110 Mt HFC-23; 7110 Mt HFC-23 * 11700 = 83,187 Mt CO₂e.

121. Data collected from publicly available reported trades of CERs is used to create this estimate. Note that the pricing of CERs is dependent upon when in the regulatory process they are sold. Most sales occur prior to registration of a project, let alone monitoring, verification, and issuance of promised CERs. These forward contracts for CERs are termed "primary CER" sales. Primary CER prices reflect validation, registration, credit, and country risk. Issued CERs, termed "secondary CERs" trade at approximately 80 percent of EU ETS allowance prices. This price spread is expected to decrease substantially once the interconnections required for trading are established between the CDM registry and the EU ETS registry.

122. MCCULLOCH, *supra* note 95, at 12. This value is derived assuming an 8 percent return on the investment in destruction facilities (€240,000/year) plus €200,000 operating expenses and a

Thus, the net from subsidy minus abatement costs to an HCFC-22 producer is approximately €3.41/kg HCFC-22. This subsidy compares quite favorably with the wholesale price for HCFC-22, which as of the fourth quarter of 2005 was approximately €1.60/kg.¹²³ A developing world producer of HCFC-22 can earn more than twice as much from its CDM subsidy as it can gross from the sale of its primary product. Even when CER prices were only half of their current value, HCFC-22 manufacturers found these calculations to be a compelling incentive to enter the CDM process.¹²⁴ Given these incentives, it is perhaps not a tremendous surprise that participation in the CDM by the non-Annex B based HCFC-22 industry is nearly universal.

TABLE 1: ESTIMATING THE VALUE OF THE CDM SUBSIDY
TO HCFC-22 PRODUCERS

Step 1: Calculate CO ₂ e produced by 1 kg HCFC-22	1 kg HCFC-22 → 0.03 kg HFC-23 0.03 kg HFC-23 * 11700 = 351 kg CO ₂ e = 0.351 t CO ₂ e
Step 2: Estimate gross subsidy	0.351 t CO ₂ e * €10/CER = €3.51 Gross subsidy per kg HCFC-22 = €3.51
Step 3: Estimate the cost per kg HCFC-22 (calculations are for a facility capable of capturing and destroying 200 t HFC-23/year)	€3,000,000 investment at 8% interest + €200,000 per year operating costs = €590,000 per year cost.
Step 5: Calculate the cost per kg HCFC-22	€590,000/200 t HFC-23 = €2950/t HFC-23 €2950/t HFC-23 * 3% HFC-23 = €88.5/t HCFC-22 €88.5/t HCFC-22 * 1 t/1000 kg = €0.09 Cost of subsidy per kg HCFC-22 = €0.09
Step 6: Calculate the net CDM subsidy	€3.51 - €0.09 = €3.42/kg HCFC-22

The perverse incentives created by the economics of HFC-23 capture CDM projects were, from a very early stage, a point of controversy.¹²⁵ The CDM methodology, without which HFC-23 projects could not advance to registration, went through several rounds of revision because of fears that

production rate of 200 t HFC-23 per year, equivalent to 6666 t HCFC-22 per year, and a 3 percent HFC-23 production rate.

123. Telephone Interview With Mack McFarland, Environmental Fellow, DuPont Fluoroproducts (Fall 2005) [hereinafter McFarland Interview].

124. Should primary CER prices fall from their current highs of €10 due to the fall in the value of ETS permits, HFC projects will remain economically attractive.

125. Letter From Thomas R. Jacob, Senior Advisor, Global Affairs, Dupont, to Jean-Jacques Becker, Chair, CDM Methodology Panel (June 3, 2004), available at http://cdm.unfccc.int/methodologies/inputam0001/letter_Dupont_03/June04.pdf [hereinafter Jacob].

HCFC-22 manufacturers would produce gas simply to generate CERs, thereby diluting the CDM's currency, at least in terms of its environmental effectiveness.¹²⁶ Recall that a key requirement of CERs is that they be "additional to any that would have occurred in the absence of the project activity."¹²⁷ The economics of HFC-23 projects are a *reductio ad absurdum* of this requirement. It is quite likely that no capture of HFC-23 would occur without the CDM. On the other hand, with the CDM, HCFC-22 factories have very strong incentives to create extra HFC-23 specifically to capture and destroy it. Indeed, merely by capturing what they would have made anyway, a manufacturer can triple revenues and, based on the cost estimates presented above, more than triple profits.

C. Imperfect Regulatory Compromise for HFC-23 Plants in the CDM

To deal with the perverse incentives to overproduce HCFC-22 in order to capture and destroy HFC-23, the CDM EB decided to approve only those projects involving previously existing HCFC-22 production capacity.¹²⁸ New plants or added capacity are not currently allowed into the CDM.¹²⁹ In order to qualify for registration, a plant must have been in operation and able to supply both HCFC-22 and HFC-23 production data for at least three years in the 2000 to 2004 period.¹³⁰ This prerequisite creates the obvious problem of incentivizing the capture and destruction of HFC-23 that is emitted incidental to the 16 percent annual growth of HCFC-22 production predicted to occur in the developing world.¹³¹ The Conference of the Parties has asked for guidance on new plant and added capacity from the Subsidiary Body for Scientific and Technical Advice of the UNFCCC.¹³²

Even with these relatively restrictive rules on eligibility, there is circumstantial evidence and very good reason to suspect that HCFC-22 manufacturers participating in the CDM have behaved strategically to direct a greater share of the subsidy to themselves by artificially inflating their

126. On the concept of tradable emissions permits as a property right, see Hahn & Hester, *supra* note 58, at 110, 117; on the concept of tradable emissions permits as a currency, see David G. Victor et al., *A Madisonian Approach to Climate Policy*, 309 *SCIENCE* 1820 (2005).

127. Kyoto Protocol, *supra* note 1, art. 12, § 5(c).

128. CDM Executive Bd., *supra* note 109, at 3.

129. *Id.* at 1.

130. *Id.*

131. MCCULLOCH, *supra* note 95, at 4.

132. *Summary of the Twenty-Second Sessions of the Subsidiary Bodies of the UN Framework Convention on Climate Change: 19–27 May, 2005*, *EARTH NEGOTIATIONS BULL.* (Int'l Inst. For Sustainable Dev., New York, N.Y.), May 30, 2005, at 5, available at <http://www.iisd.ca/download/pdf/enb12770e.pdf>.

base-year production in two ways. First, the fraction of HFC-23 produced by the production of HCFC-22 can be reduced by modification of the conditions under which chemical synthesis occurs. Dupont has consistently produced, in its United States HCFC-22 plant, HFC-23 byproduct percentages as low as 1.3 percent.¹³³ Developing-country manufacturers have not been able to achieve such rates of HFC-23 production, with reported rates between 2 and 4 percent. The economics of HCFC-22 production in the absence of a CDM subsidy dictate that HFC-23 production should be minimized because it is a waste product costing both energy and materials.¹³⁴ For this reason, almost all plants have historically monitored their HFC-23/HCFC-22 ratio in order to optimize productivity of HCFC-22.¹³⁵

Dupont argued in comments presented to the CDM EB that the crediting methodology for HFC-23 projects should be limited to crediting global best practice—the Dupont value. CDM project proponents responded that their plants lacked necessary capacity and could not be expected to perform with the same efficiency as those in the developed world. Presented with these conflicting arguments, the CDM EB forged a crude compromise. The CDM methodology eventually approved for HFC-23 abatement set 3 percent as the maximum percentage of HFC-23 byproduct allowable in the baseline data of a participating plant, a rough average of reported developing world values.¹³⁶ The average of all reported baseline data from the nineteen participating plants is 2.99 percent—very close to the maximum allowable value.¹³⁷ This suggests that even if the project participants were not actually aiming for the 3 percent sweet spot that would minimize their production costs (due to wasted feedstocks) but maximize their CDM subsidy (due to more CERs for a given production rate of HCFC-22), they were certainly not as concerned with minimizing this percentage as developed-world manufacturers who are not eligible for the CDM subsidy. Furthermore, the presence of the CDM and the prospect that crediting may ultimately be allowed for new plants removes any incentive to improve capital stock or process at existing

133. Jacob, *supra* note 125.

134. IPCC, *supra* note 83, at 394, 396.

135. Jacob, *supra* note 125.

136. Letter From Thomas R. Jacob, Senior Advisor, Global Affairs, Dupont, to Jean-Jacques Becker, Chair, CDM Methodology Panel (Oct. 2, 2004), available at <http://cdm.unfccc.int/methodologies/inputam0001>.

137. It is important to note that at the time the CDM EB made its decision, it had data only from two HCFC-22 plants. Compare, UNFCCC, AM0001: Incineration of HFC 23 Waste Streams—Version 5.2, <http://cdm.unfccc.int/methodologies/DB/0MKGF12PM6TSNFNJZUESTSKG581HN6/view.html> (last visited May 2, 2008) (showing approval of Version 3 of AM0001 on May 13, 2005), with UNEP Risø Centre, *supra* note 82 (showing the public comment phase of the third HFC-23 project beginning on June 5, 2005).

plants, or to invest extra capital in state of the art facilities. Rather, it encourages construction of inefficient plants in order to create a high baseline and maximize potential for future CDM revenues.

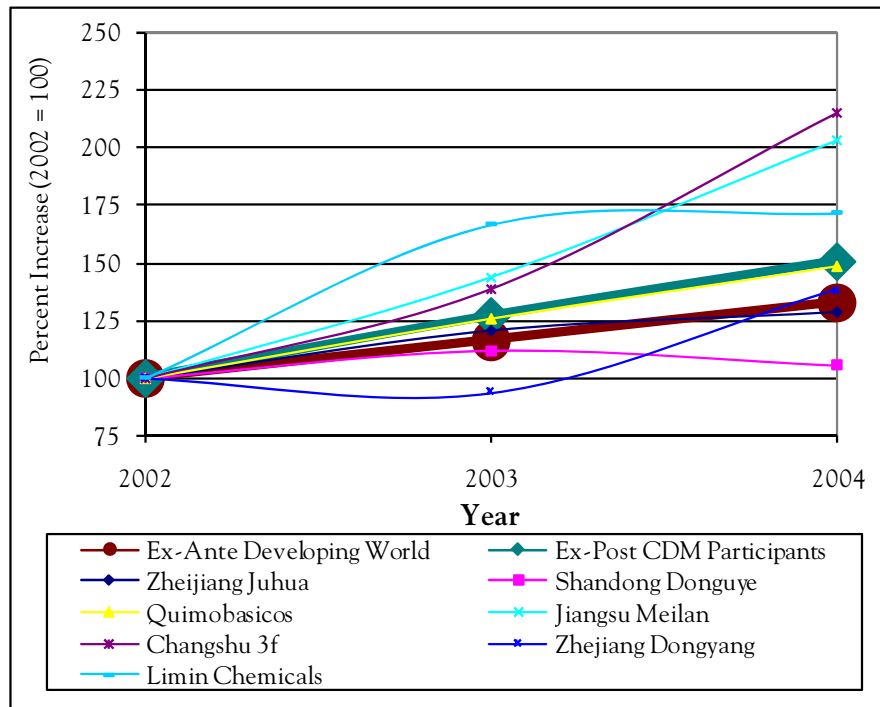
Second, at least some of the HCFC-22 plants participating in the CDM appear to have ramped up production during the baseline period (2000–2004) far beyond expected growth in the sector (15 percent per annum). Figure 4 shows baseline data supplied by plants participating in the program compared with the predicted growth rate for the industry over the 2002–2004 period.¹³⁸ Most plants exceeded the growth rates predicted for the developing-world industry as a whole. The increases in HCFC-22 production among the developing-world manufacturers led to a CDM participant production growth rate of 50 percent rather than 33 percent, as had been predicted ex-ante by market analysts.¹³⁹ Whether these plants increased production because of demand for HCFC-22 or in anticipation of higher CER revenue is impossible to say given existing publicly available information. Nevertheless, circumstantial evidence suggests that, rather than building new plants, HCFC-22 manufacturers elected to add capacity at existing plants during the CDM baseline period in order to take advantage of the CDM subsidy.¹⁴⁰

138. For predicted growth rates, see MCCULLOCH, *supra* note 95, at 4; production data for individual HCFC-22 plants on file with author.

139. *Id.*

140. Adding capacity at some existing plants would have been relatively simple because some developing-world plants are swing plants, able to shift configuration to produce a number of different halocarbon gases. With advance knowledge of the CDM and even a forecast price signal of \$3 to \$5, shifting to near constant HCFC-22 production and away from other halocarbons would have made sense during the baseline period. See TECH. & ECON. ASSESSMENT PANEL, U.N. ENV'T PROGRAM, RESPONSE TO DECISION XVIII/12: REPORT OF THE TASK FORCE OF HCFC ISSUES (WITH PARTICULAR FOCUS ON THE IMPACT OF THE CLEAN DEVELOPMENT MECHANISM) AND EMISSIONS REDUCTION BENEFITS ARISING FROM EARLIER PHASE-OUT AND OTHER PRACTICAL MEASURES 51–55 (2007), available at http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-aug2007.pdf.

FIGURE 4: PERCENTAGE INCREASES AT HCFC-22 PLANTS REPORTING MULTIPLE YEARS OF BASELINE DATA RELATIVE TO EX-ANTE ANALYST PREDICTIONS FOR THE INTERVAL¹⁴¹



In response to the windfall profits enjoyed by their domestic HCFC-22 producers as a result of the CDM, China has imposed a 65 percent tax on CER revenue generated by HFC-23 projects.¹⁴² Revenues from this fund, currently in excess of \$2 billion, are to be devoted to sustainable development, although none have yet been dispersed. In this way, as had been predicted by the critics of the CDM’s baseline concept, Chinese environmental regulators, rather than create regulations that would eliminate a CDM project’s eligibility, have acted to extract a substantial portion of the subsidy-derived rent. This tax reduces the CERs income to only 60 percent of that derived from the sale

141. The ex-ante developing world growth rate is 16.5 percent. The ex-post CDM participant growth rate is 25 percent. The thick lines show ex-ante (filled circles) and the average CDM participant (filled diamonds) rates of production growth.

142. Office of Nat’l Coordination Comm. on Climate Change, *supra* note 77, art. 24.

of HCFC-22. However, at prices greater than €15, even with a 65 percent tax, it will again make sense to produce gas solely for CER revenue.¹⁴³

The CDM provides perverse economic incentives to HCFC-22 producers that have led to a large fraction of the CER supply being produced by HFC-23 abatement. Even if some fraction of these reductions are voluntary, real, and additional, they still may not be the best use of Annex B resources for addressing non-Annex B GHG emissions. To abate all developing-world HFC-23 emissions would cost approximately \$31 million per year.¹⁴⁴ Instead, by means of a CDM subsidy, the Annex B nations will likely pay between €250 and €750 million to abate 2005 non-Annex B HFC-23 emissions.¹⁴⁵ This is a remarkably inefficient path to an environmental goal.

The case of HFC-23 capture projects, which currently account for nearly 22 percent of the CERs expected for delivery by 2012, illustrates both the success and some fairly significant problems with the CDM market. On one hand, the CDM was successful in identifying a class of emitters with very low marginal abatement costs and inducing near total sectoral abatement. On the other hand, it appears quite likely that the sector is also gaming the system by modifying its behavior in order to generate extra credits that can then be sold to developed countries with compliance obligations. Because of the inherent information asymmetries, the regulator has had a very difficult time, and indeed has not genuinely tried, dealing with these problems. It is not clear under the current system how it could. At the same time, because of the limitation on eligibility for old plants, the problems associated with HFC-23 for the CDM are to some extent limited. It is worth noting, however, that what saves the CDM from being awash in CDM credits does not help the environment. Recent press reports indicate incredibly high rates of growth in the HCFC-22 market, including the construction of new plants. Until these plants are included in the CDM or some other climate regime, they will emit their HFC-23 byproducts into the atmosphere.¹⁴⁶

143. A €15 CER price, taxed at 65 percent will net €1.60 after abatement costs and tax per kg HCFC-22 produced. The market price for HCFC-22 is approximately €1.60. See McFarland Interview, *supra* note 123.

144. MCCULLOCH, *supra* note 95, at 21.

145. 80 Mt CO₂e * €5 = €400,000,000; 80 Mt CO₂e * €20 = €1,600,000,000.

146. At recent climate negotiations, China has been arguing for and the EU against inclusion of new plants and additional capacity in the CDM. At this point, no agreement has been reached as to how to incorporate them into the CDM. Keith Bradsher, *Use of Air-Conditioning Is Widening the Hole in the Ozone Layer*, N.Y. TIMES, Feb. 23, 2007, at C1.

V. ANYWAY CREDITS IN CHINA'S POWER SECTOR

The most recent development in the CDM is the entry of important components of the Chinese electricity sector into the market. Early CDM power projects were mostly small power plants utilizing run-of-river hydro or biomass combustion technologies, mostly with nameplate capacity below 25 megawatts (MW). Recently, that picture has changed dramatically with the entry of significant numbers of large hydro¹⁴⁷ and natural-gas-fired power projects into the project pipeline. These projects present extremely challenging regulatory decisions to the CDM EB because it must decide which projects would or would not have gone forward without the carbon finance funds. Answering the question of whether projects are additional or would have happened anyway is always challenging, but is made particularly difficult by two factors: The energy sector in China is heavily regulated and primarily owned by the Government or state-owned entities, and participation rates by several elements of the sector is near 100 percent. On one hand, this outcome is to be applauded because modifications to the development path of the non-Annex B energy sector were a key goal for the CDM. However, this emerging result also raises important questions regarding the assumptions underlying the CDM as well as its potential for growth beyond 2012. The following section sheds light on these issues by telling the story of recent attempts by natural-gas-fired power plants to generate credits under the CDM.

A. Natural-Gas-Fired Power in China

Ultimately, if the problem of global climate change is to be effectively addressed, the methods by which electricity is generated both in the developed and the developing world will have to change. Currently, most electricity is generated via large coal-fired generating stations.¹⁴⁸ This is because large coal-fired generating stations are, at present, the lowest cost supplier of electricity, particularly in countries like the United States, China, and India,

147. For a discussion of the participation of large hydro in the CDM that reaches similar conclusions for that sector, see BARBARA NAYA, *FAILED MECHANISM: HOW THE CDM IS SUBSIDIZING HYDRO DEVELOPERS AND HARMING THE KYOTO PROTOCOL 4-5* (2007), available at http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf.

148. ENERGY INFO. ADMIN., *supra* note 78, at 62; Gerard Wynn, *U.N. Talks Will Not Decide on New HFC Incentives*, REUTERS, Dec. 8, 2007, available at <http://www.reuters.com/article/latestCrisis/idUSL08166304>.

where coal supplies are abundant.¹⁴⁹ Thus, developing both short-term and long-term alternatives to coal-fired generation capacity is critical to mitigating the impacts of climate change. In China, where new capacity is being added at an extremely high rate in order to meet surging demand for electricity, short-term alternatives are especially important.¹⁵⁰

One currently available alternative to the large coal-fired generating station that is superior from a GHG emissions perspective is large power plants that utilize combined cycle gas turbines (CCGT) technology. These plants are superior from a climate perspective because they produce substantially less CO₂ per MW hour (MWh) of electricity than typical coal-fired power plants.¹⁵¹ In addition, CCGTs emit substantially lower quantities of particulate matter, soot, sulfur oxides, and nitrogen oxides per unit of power produced than do coal-fired power plants, because the fuel they burn is cleaner and combustion is more complete.¹⁵² This cleaner emission makes them extremely appealing for new baseload generation to developing countries that have severe local air pollution concerns. It is for this reason that California in-state baseload generation, in contrast to the United States as a whole, is largely via CCGT.

Even with these environmental advantages, natural-gas-fired power has struggled to gain a foothold in developing countries because of the different underlying prices of coal and natural gas.¹⁵³ Capital costs and construction times are generally far higher for coal than for natural gas, while the reverse is true for fuel prices. Thus, while a coal plant requires significant upfront investment, it is relatively cheap to operate compared to a CCGT plant, which is cheap to build but costly to operate. Overall, the higher fuel costs

149. These three are also the countries with the greatest current and future impacts on climate, precisely for the reason that they are large and generate most of their electricity using coal-fired power plants. ENERGY INFO. ADMIN., *supra* note 78, at 62.

150. China built 114 GW of new fossil-fuel-fired generating capacity in 2006 and is on track to build 95 GW of new fossil-fuel-fired generating capacity in 2007. For comparison, the UK electricity grid has a capacity of 75 GW, and the California Independent System Operator administers 46.5 GW. Both of these grids were built out over decades. Keith Bradsher, *China's Green Energy Gap*, N.Y. TIMES, Oct. 24, 2007, at C1; Envtl. Energies Tech. Div., Lawrence Berkeley Nat'l Lab., Current Energy: Supply of and Demand for Electricity for California, <http://currentenergy.lbl.gov/ca/index.php> (last visited July 15, 2007).

151. On average, a subcritical coal-fired power plant produces CO₂ at a rate of 0.92 metric tons CO₂ per MWh while a CCGT has a carbon intensity of 0.35 metric tons CO₂ per MWh. Mike Jackson et al., *Greenhouse Gas Implications in Large Scale Infrastructure Investments in Developing Countries: Examples From China and India* (Stanford Program on Energy & Sustainable Dev., Working Paper No. 54, 2006), available at http://iis-db.stanford.edu/pubs/21061/China_and_India_Infrastructure_Deals.pdf.

152. ENERGY INFO. ADMIN., *supra* note 78, at 62.

153. *Id.*

of gas swamp the higher capital costs of coal. This outcome is especially true in China where coal's capital costs are relatively lower, and CCGT's relatively higher, than global averages.¹⁵⁴ These economics have made gas and the CCGT simultaneously attractive to foreign investors and unattractive to government-controlled power sectors like China's.

In China, these contrasting environmental and economic dynamics have played out via substantial state control of the power sector in ways that have encouraged construction of new CCGT power plants, and at the same time have created substantial uncertainties for their operation. On one hand, the state intervened to insure construction of the West-East Pipeline, opening up a major supply of new gas for the eastern provinces where demand is greatest.¹⁵⁵ Financial viability of this project was assured by take-or-pay contracts for natural gas between the pipeline and the proposed new CCGT's in the coastal provinces.¹⁵⁶ State-owned enterprises are also in the process of constructing multiple new liquefied natural-gas facilities to serve the coastal provinces.¹⁵⁷ In addition, as part of China's eleventh five-year plan, the National Development and Reform Commission, which sets tariffs on China's two electricity grids,¹⁵⁸ is charged with developing the gas industry in an effort to reduce pollution.¹⁵⁹ Although its high costs might make it seem unattractive, the environmental and energy security benefits of increased utilization of gas-fired power have meant that China plans to build twenty-three CCGT power plants between 2005 and 2009, with a combined nameplate capacity of more than 18 GW.¹⁶⁰

154. In China, because the critical components for coal-fired power plants are produced domestically while those for CCGT must be imported, capital cost for subcritical coal-fired power plants may actually be lower than for CCGT. *Id.*; INT'L GAS UNION, GAS TO POWER-CHINA 15 (2005) (on file with author).

155. People's Republic of China, China Factfile: Key National Projects, http://english.gov.cn/2006-02/08/content_182600.htm (last visited July 15, 2008).

156. This support was critical, because in the absence of a well-developed residential and commercial distribution network and demand for gas, a complete pipeline would have insufficient customers to whom it could sell its gas. INT'L GAS UNION, *supra* note 154, at 5, 9.

157. *See id.* at 5.

158. *Id.* at 16.

159. NAT'L DEV. & REFORM COMM'N, PEOPLE'S REPUBLIC OF CHINA, THE OUTLINE OF THE ELEVENTH FIVE-YEAR PLAN FOR NATIONAL ECONOMIC & SOCIAL DEVELOPMENT OF THE PEOPLE'S REPUBLIC OF CHINA, ch. 3: Optimizing and Upgrading Industrial Infrastructure, http://en.ndrc.gov.cn/hot/t20060529_71334.htm (last visited July 15, 2008).

160. For comparison, the entire California Independent System Operator manages 46.5 GW of nameplate capacity. *Compare* Envtl. Energies Tech Div., *supra* note 150, with INT'L GAS UNION, *supra* note 154, at 2.

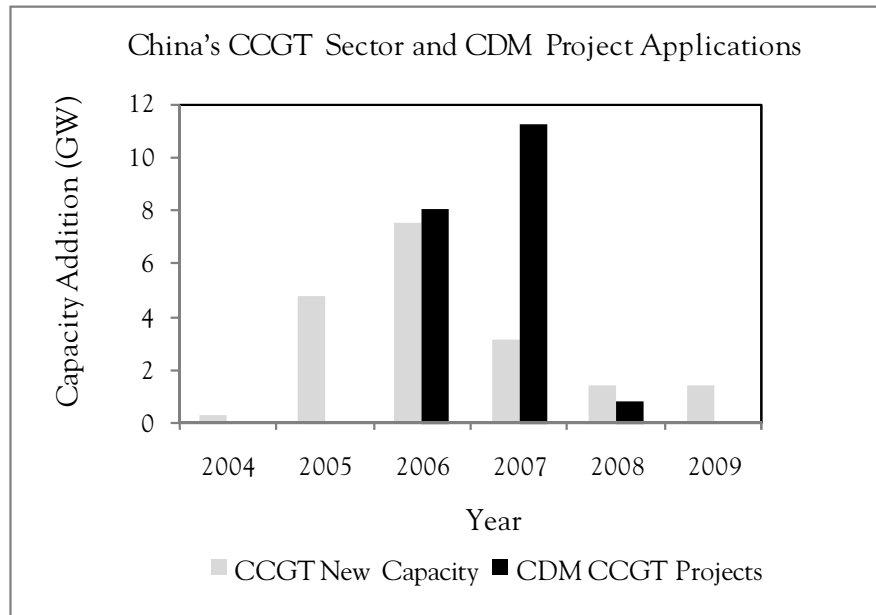
B. Natural-Gas-Fired Power as a CDM Project

Because the primary sources of power to the Chinese electrical grid are subcritical coal-fired power plants and most new builds are either subcritical or supercritical coal,¹⁶¹ construction of a CCGT instead of a coal-fired power plant arguably represents a reduction of GHG emissions. As described in the previous section, the economics in China do not favor the decision to build a CCGT rather than a subcritical coal power plant. Nevertheless, this choice would have clear climate benefits. If such a decision could be influenced by the potential supply of funds from the sale of carbon credits, equal to the difference in GHG emissions between the alternatives, crediting as a CDM project would be possible. Such thinking led to the submission and approval of just such a CDM methodology in mid-2006, called the Baseline Methodology for Grid Connected Electricity Plants Using Natural Gas (AM0029).¹⁶²

161. Subcritical coal-fired power plant boilers operate at temperatures and pressures below the critical point for water—the point at which water no longer turns into steam when heated but instead decreases in density. Supercritical plants operate above this point and as a result achieve significantly higher heat rates and efficiency than is possible for subcritical plants. See World Coal Inst., *Supercritical & Ultra-Supercritical*, <http://www.worldcoal.org/pages/content/index.asp?PageID=421> (last visited Mar. 31, 2008).

162. CDM Executive Bd., UNFCCC, *Approved Baseline Methodology AM0029: “Baseline Methodology for Grid Connected Electricity Generation Plants Using Natural Gas”* (Version 01.1, 2006), available at http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_KTKZTS1HEG4JBIETV74WMLZY10061X.

FIGURE 5: CONSTRUCTION OF COMBINED CYCLE GAS TURBINE POWER PLANTS IN CHINA AND APPLICATIONS FOR CREDITING UNDER THE CDM BY NAMEPLATE CAPACITY (2004–2009)¹⁶³



By the end of 2007, twenty-four CCGT projects, representing essentially all power plants actually being built (as opposed to planned) in China between 2005 and 2010, had applied under the methodology to claim credit for the difference between their emissions and the baseline established by AM0029 (see Figure 1).¹⁶⁴ All plants built or under construction since 2005 are arguing that they would not have been built but for the CDM. This argument, when presented on a project-by-project basis, sounds plausible. It is only when the comparison between total project applications and the entire natural-gas-fired power sector is made, and the two are found to be roughly equivalent, that it becomes problematic.

163. The total CCGT builds equal 18.4 GW while applications for CDM crediting so far equal 17.6 GW.

164. Planned CCGT power plant builds during the 2004–2009 interval equal 18.37 GW. INT'L GAS UNION, *supra* note 154, at 3. CDM applications to the end of 2007 for crediting of plants entering operation between 2005 and 2008 equal 17.59 GW, UNEP Risø Centre, *supra* note 82.

Of the 24 Chinese CCGT CDM projects currently proposed, six have been registered¹⁶⁵ and a further three have requested registration but the CDM EB has required corrections after review.¹⁶⁶ Registration is automatic eight weeks after it is requested unless a project participant or at least three members of the CDM EB submit a Request for Review (RFR) of the project.¹⁶⁷ An RFR is then considered by the full CDM EB at its next meeting. Decisions on whether to grant review and on the scope of review are then made.¹⁶⁸ To date, all requests for review on Chinese CCGT CDM projects by CDM EB members list concerns about additionality as a reason for the RFR.¹⁶⁹ In other words, the CDM EB members requesting review are concerned that these projects would have been built even in the absence of the CDM, and that any emissions reductions claimed by them would not be in addition to what would have occurred in its absence.

165. Six Chinese CCGT CDM projects have been registered as of July 1, 2008. Five of the six were registered only after Requests for Review by the CDM EB and subsequent corrections. UNFCCC Project 1320: Beijing Taiyanggong CCGT Trigeneration Project [hereinafter UNFCCC Project 1320], <http://cdm.unfccc.int/Projects/DB/SGS-UKL1188570070.22> (last visited Jul. 1, 2008); UNFCCC Project 1343: Xiaoshan Power Plant's NG Power Generation Project of Zhejiang Southeast Electric Power Co., Ltd. [hereinafter UNFCCC Project 1343], <http://cdm.unfccc.int/Projects/DB/DNV-CUK1189665775.96> (last visited Jul. 1, 2008); UNFCCC Project 1344: Zhejiang Provincial Energy Group Zhenhai Natural Gas Power Generation Co., Ltd.'s NG Power Generation Project [hereinafter UNFCCC Project 1344], <http://cdm.unfccc.int/Projects/DB/DNV-CUK1189684459.76/view> (last visited Jul. 1, 2008); UNFCCC Project 1227: Yuyao Electricity Generation Project Using Natural Gas [hereinafter UNFCCC Project 1227], <http://cdm.unfccc.int/Projects/DB/DNV-CUK1183455647.94> (last visited Jul. 1, 2008); UNFCCC Project 1304: Henan Zhengzhou Grid Connected Natural Gas Combined Cycle Power Plant [hereinafter UNFCCC Project 1304], <http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1187936755.18> (last visited Jul. 1, 2008); UNFCCC Project 1373: Beijing No.3 Thermal Power Plant Gas-Steam Combined Cycle Project Using Natural Gas [hereinafter UNFCCC Project 1373], <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1191500853.33> (last visited Jul. 1, 2008).

166. Three projects are currently being revised after the CDM EB required a review of their registration request and corrections. UNFCCC Project 1381: Shanghai Baoshan Grid Connected Natural Gas Combined Cycle Power Plant Project [hereinafter UNFCCC Project 1381], <http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1192083874.4> (last visited Jul. 1, 2008); UNFCCC Project 1243: Sulige Natural Gas Based Power Generation Project [hereinafter UNFCCC Project 1243], <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1184339707.46> (last visited Jul. 1, 2008); UNFCCC Project 1368: Qinghai Ge-ermu Gas Turbine Power Plant Project [hereinafter UNFCCC Project 1368], <http://cdm.unfccc.int/Projects/DB/BVQI1191062063.0> (last visited Jul. 1, 2008).

167. United Nations Framework Convention on Climate Change, Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Montreal, Can., Nov. 28–Dec. 10, 2005, *Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol on Its First Session, Held at Montreal From 28 November to 10 December 2005, Addendum: Part Two: Action Taken by the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol at Its First Session*, 15, U.N. Doc. FCCC/KP/CMP/2005/8/Add.1 (Mar. 30, 2006), available at <http://unfccc.int/resource/docs/2005/cmpl/eng/08a01.pdf>.

168. *Id.*

169. UNFCCC, Project 1343, *supra* note 165; UNFCCC, Project 1320, *supra* note 165; United Nations Framework Convention on Climate Change, *supra* note 167, at 14, 16–17.

In its review of these projects, it is not at all clear that the CDM EB will be able to address the fact that, taken together, current applications for crediting under the CDM of natural-gas-fired power in China imply that no CCGT builds would occur in the absence of carbon finance. Because review is on a project-by-project basis and is limited to determination that the project documents are in compliance with the AM0029 methodology, this is likely beyond the scope of review.¹⁷⁰ The AM0029 methodology determines a project's additionality by reference to a financial calculation comparing the costs of CCGT to alternative options, and by an analysis of whether the project is common practice.¹⁷¹ The investment analysis treats projects as if they were operating in a deregulated, competitive, power generation sector, rather than in a state-controlled or partially deregulated power sector. The common practice analysis, in the context of a coal-dominated energy sector such as China's, is easy to overcome. Neither takes into account the relevant national priorities for energy development that have been set by the China. Thus, the review of CCGT projects is likely to find them to be additional to what otherwise would have occurred, not because this is in fact the case, but rather because the review is constrained by the procedures of the CDM from asking the right questions about the projects.

The decisions made regarding these projects are likely to set an important precedent that could have far-reaching consequences for the CDM in light of another recently approved methodology. In the fall of 2007, the CDM EB approved, after significant controversy, a methodology for crediting supercritical and ultra-supercritical coal-fired power plants for emissions reductions relative to a grid primarily composed of subcritical coal-fired plants (ACM0013).¹⁷² This methodology is very similar to AM0029 with regard to its additionality test,¹⁷³ but will apply to a substantially larger number of power plants both in China and the rest of the developing world. In 2006 and 2007, China built more than 200 GW of new fossil-fuel-fired power plants. China has begun telling power companies that they should choose to

170. A request for review must relate to a project's failure to comply with a specific validation requirement. See United Nations Framework Convention on Climate Change, *supra* note 167, at 15, 54, 55. Validation requirements relevant to the additionality determination are defined in terms of compliance with an approved methodology, such as AM0029. *Id.* at 14, 16–17.

171. See CDM Executive Bd., *supra* note 162, at 3.

172. CDM Executive Bd., UNFCCC, *Approved Consolidated Baseline and Monitoring Methodology ACM0013: "Consolidated Baseline and Monitoring Methodology for New Grid Connected Fossil Fuel Fired Power Plants Using a Less GHG Intensive Technology"* (Version 01, 2007), available at http://cdm.unfccc.int/EB/034/eb34_repan02.pdf.

173. Compare CDM Executive Bd., *supra* note 162, at 3, with CDM Executive Bd., *supra* note 172, at 4.

build supercritical rather than subcritical plants because they use 10 percent less coal.¹⁷⁴ As China shifts from subcritical to supercritical and ultra-supercritical coal-fired generation technology, the potential for the generation of large numbers of CERs that do not correspond to any kind of behavioral change appears possible.

The AM0029 methodology and near 100 percent participation of CCGT power plants in China together have placed the CDM EB in an untenable position. On one hand, natural-gas-fired power is a climate friendly alternative to coal, whose development should be encouraged and fostered by the climate regime. Further, a program to encourage developing-country participation in the global climate change regime would strive to achieve 100 percent participation rates within developing country electricity sectors. On the other hand, it appears that the CDM, because it functions at a project rather than a sectoral level, is likely giving credit for activities that would have occurred without it. These “anyway” credits are especially important given that the CDM credit, “anyway” or not, can be sold to Annex B parties in order to reduce the extent to which they cut their own emissions.

VI. REFORM OF THE POST-2012 REGIME

The parties to both the Kyoto Protocol and the UNFCCC are now considering what to do to accomplish the goal of the UNFCCC after the first compliance period ends in 2012.¹⁷⁵ Global carbon trading is likely to play a role in any future architecture. At the same time, the U.S. Senate is considering proposals for an economy-wide cap-and-trade program for GHGs that would allow extensive utilization of international carbon credits.¹⁷⁶ Thus, consideration of how to improve the performance of the CDM is critical from both a domestic and an international perspective.

This description of the current and likely future state of the CDM is meant to point out that, before we assume that expansion of the current offset trading market is the appropriate route for engaging with developing countries, it is worth looking at the empirical evidence from the trading program as it exists now. That evidence, as detailed in the two examples above, suggests that the CDM is leading to widespread strategic behavior. In the case of the HFC-23 projects, the incentives created by the CDM are

174. Bradsher, *supra* note 150.

175. Bali Action Plan, *supra* note 8.

176. For example, the Lieberman-Warner Bill would allow 15 percent of a covered facility's compliance obligation to be met with international allowances or credits. America's Climate Security Act of 2007, S. 2191, 110th Cong. § 2501 (2007).

leading to undesirable behavior in the name of claiming credit. HFC-23 projects appear to be creating extra GHGs in order to claim credit for their capture and destruction even as they do capture and destroy some emissions that would have contributed to climate change. In the case of the CCGT projects, the incentives created by the CDM are likely leading to no change in behavior except for widespread claims for credits. Furthermore, procedures for project regulation likely limit the CDM EB from examining the issues most central to whether the projects are producing additional emissions reductions.

In addition, both cases present severe information challenges for the regulator. The rules of the game in the CDM systematically create incentives for project proponents to manipulate the transfer of information to the CDM EB while providing it with essentially no other information-gathering resources. In the case of HFC-23, the CDM creates strong incentives for project proponents to conceal the extent to which process efficiencies might lower their GHG production rate. In the case of the CCGTs, the system creates strong incentives for project proponents to misrepresent the motivations for their choice of power plant technology. Unlike in a natural market, buyers of CDM credits have no incentive to disclose information they have regarding projects. Their incentive, just like the generators of credits, is to facilitate the approval of projects and the issuance of credits. This informational problem is particularly acute because the CDM EB is called upon to make decisions requiring technical expertise across a wide array of both countries and industries.

The CDM set three goals: to produce sustainable development, to help developing countries accomplish the objective of the UNFCCC, and to reduce the costs of compliance for parties with quantitative targets.¹⁷⁷ The evidence presented above points to the possibility that the CDM is accomplishing these goals, but only to a limited extent. In one case, strategic but legal behavior is leading to the creation of extra GHGs in conjunction with emissions that would have occurred in order to generate a mix of additional and anyway credits. In another case, strategic disclosure of information and limitations on the scope of review will potentially lead to wholesale crediting of behavior that would have occurred anyway. Both indicate a need to consider reform, either by improving the CDM or by replacing it with an alternative mechanism for developing-country engagement.

177. Kyoto Protocol, *supra* note 1, art. 12.

A. Reforming the CDM

Limited reforms to the existing CDM structure might improve its ability to detect and deter strategic behavior by participants. Under the current regime, the third party verifiers charged with validating project applications face unavoidable conflicts of interest when it comes to substantive review of project proponents' claims. These DOEs are currently paid by the project proponents and face a competitive business environment.¹⁷⁸ One potential reform measure might be to include the costs of third-party verification in CDM project application fees. The CDM EB would then have adequate resources to contract directly with DOEs, who would have incentives to disclose as much as possible regarding CDM projects to avoid loss of business. Another reform possibility is to clarify that DOEs are responsible for checking not only that a project's additionality analysis is performed consistently with the applicable CDM procedures, but also that key facts and assumptions underlying it are accurate.¹⁷⁹ Standardized accounting procedures might also be specified in order to limit the extent to which creative accounting is used to argue that projects would not have gone forward without the sale of carbon credits.¹⁸⁰ Finally, under the current regime, project proponents must "take[] due account"¹⁸¹ of comments received by the public during the validation process. All of these incremental reforms would likely reduce the extent to which project proponents can game the system, increase the incentives that DOEs have for monitoring strategic behavior, and help to simplify the extremely difficult regulatory choices with which the CDM EB is often faced. These procedures might, to a great extent, help to deal with the HFC-23 case.

Nevertheless, they do not resolve the issue of how to separate additional from nonadditional projects in regulated and state-owned industries like the Chinese energy sector. Ultimately, this issue looms larger than any other because of the emissions associated with the explosive growth in the Chinese and Indian economies. Fully addressing it will likely require transforming the CDM into a system that can deal directly with the actors that matter most in these industries—the government policy makers that set energy development priorities.

178. LAMBERT SCHNEIDER, *IS THE CDM FULFILLING ITS ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT OBJECTIVES? AN EVALUATION OF THE CDM AND OPTIONS FOR IMPROVEMENT* 56 (2007), available at http://assets.panda.org/downloads/oeko_institut__2007__is_the_cdm_fulfilling_its_environmental_and_sustainable_developme.pdf.

179. *Id.* at 55.

180. *Id.* at 59.

181. United Nations Framework Convention on Climate Change, *supra* note 167.

B. Border Controls for CERs

If agreement on incremental reform proves impossible, but individual Annex B nations still want to improve the quality of the CDM market, they can do so, albeit at the cost of some market fragmentation. Nations are not required to purchase, or to allow private entities within their borders to purchase, CERs for compliance purposes. This is an option that Europe has chosen to adopt and it is one that Europe, or a future U.S. program could utilize to encourage the kind of CDM that all had hoped for, and to discourage the accounting gimmicks and oversubsidization that are present within the current market. The Linking Directive of the European Commission lays out the rules by which CERs may be imported into the EU Emissions Trading Scheme (ETS).¹⁸² It would be easy for the European Commission to modify this directive to enable additional review of CERs before their use is allowed in the EU. Currently, the Linking Directive already specifies special import criteria for CERs created by large hydro projects.¹⁸³ The United States, if it passes climate legislation including a cap-and-trade system with provision for use of international offsets, could also implement additional review of projects. Because the European ETS currently is the largest consumer of these credits, as the United States would be if it were to adopt such legislation, it has significant influence over the market. Were either country to enact CER standards tougher than mandated by the CDM EB, these standards would likely be adopted by all project proponents in order to allow sale of their credits into key markets. To some extent, this might lead to market fragmentation, with separate prices developing for EU- or U.S.-qualified CERs, but fragmentation is already a hallmark of carbon markets.¹⁸⁴

C. An Alternative to the CDM

Ultimately however, without radical reform of the incentive structure facing market proponents, the accounting tricks illustrated by the HFC-23 and CCGT examples are unlikely to be eliminated entirely. At the same time, simply eliminating the CDM without replacing it with an alternative method for engaging developing countries is unwise. It would leave many

182. Council Directive 2004/101 Amending Directive 1003/87/EC Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community, *in* Respect of the Kyoto Protocol's Project Mechanisms, 2004 O.J. (L 338) 18 (EC).

183. CERs derived from hydro projects larger than 20 MW must insure that these dams meet the criteria specified by the World Commission on Dams. *Id.* at 21.

184. And fragmentation is not necessarily a bad thing. It can promote faster learning and evolution of effective trading structures. Victor et al., *supra* note 126, at 1820.

low-cost reduction opportunities on the table, increase costs for developed-nation emitters in the short term, and both delay and increase the cost of eventual acceptance of caps by developing countries.

There is an alternative. The international community has significant experience in compensating developing countries for the reduction of dangerous atmospheric emissions in another context. The Multilateral Fund of the Montreal Protocol has been very successful at accomplishing the phase out of the most harmful ozone depleting substances (ODSs).¹⁸⁵ This fund has operated on the principle that developed nations should pay any additional costs incurred by developing countries in transitioning away from ODSs to new, ozone-friendly chemicals.¹⁸⁶ Under a future climate change protocol, this model could be adopted for the purposes of engaging developing-country sectors that are state-controlled or particularly subject to gaming while still allowing for use of the CDM in some sectors. Alternatively, a climate fund could completely supplant the CDM as the major tool for engagement with developing countries.

A climate fund might have numerous advantages over the CDM. Agreed incremental costs or a reverse auction could generate a marginal cost-abatement curve for applicants to the fund. The climate fund could then invest in projects with the lowest marginal abatement cost until its resources were exhausted. Price setting via a reverse auction would encourage low-cost reduction opportunities to surface without having to pay them substantially more than the costs of abatement, as occurs in the current system. Inframarginal rents would thus be reduced.

Another advantage of this approach is that state-managed sectors, like electric power in China, may be more effectively addressed by direct discussions with governments about priorities and costs rather than through the distorting filter of State Owned Entities. Further, low-cost emissions reduction opportunities such as building standards and avoiding deforestation, which require state intervention and regulation, can be accessed.¹⁸⁷ Finally, transaction costs of emissions reductions would likely be reduced because project proponents would not have to prove that their project would not have gone forward without the sale of carbon credits.

A climate fund approach could also continue to fulfill the function of cost control for Annex B nations that have committed to caps on their GHG

185. RICHARD ELLIOT BENEDICK, *OZONE DIPLOMACY* 265–68 (1998).

186. *Id.* at 254–65.

187. Emissions reductions must be voluntary to qualify under the CDM. Voluntary has been interpreted by the CDM EB to mean not caused by domestic law or regulation. Kyoto Protocol, *supra* note 1, art. 12.

emissions. GHG abatement in the developing world with resulting emissions reductions could be credited to Annex B countries based on their contributions to the fund or an alternative agreed upon metric. In this way, cost control would be at the national level rather than at the firm level as in the EU ETS. A nation participating in the fund could simply reduce the scarcity of permits and hence their price in its cap-and-trade system rather than, as now, allowing covered entities to surrender CDM credits in lieu of domestic tradable permits.

Perhaps the biggest advantage of this type of fund would be that it reduces the incentives of firms and governments to misrepresent their business-as-usual emissions and costs to the regulator. Under the current system, the more a project proponent can inflate its baseline, the more money there is to be made. Under a climate fund in which nations agree on incremental costs or allow a reverse-auction to establish them, firms and regulators would have at least some incentive to report a more accurate estimate of their emissions and costs. In a context in which emission reduction projects are competing for a limited pool of emissions reduction funds and where the odds of receiving payment for an activity increase as the costs of marginal abatement fall, sellers of credits have an incentive to report the lowest costs for emissions reductions that they can reasonably deliver.

The incentives created by this type of system are admittedly imperfect—governments or firms might still attempt to inflate baselines in order to lower marginal costs of abatement. The advantage, though, is that the fund manager would have information from other bidders with similar projects on the costs of abatement. The odds of collusion among governments or individual emitters in order to systematically misrepresent abatement costs or baselines are lower than the odds of such misrepresentation by individuals within the current system.

A climate fund would address many of the defects of the current system. It would allow direct engagement with domestic regulators in developing countries and an honest discussion regarding policy baselines. It would potentially reduce the costs of emissions reductions through a utilization of a reverse auction price-setting mechanism rather than allowing prices to be set by the cost of emissions reductions in developed-country cap-and-trade markets. Finally, it would likely modify the incentives facing project proponents and so lead to a better information transfer to the fund manager than is currently in the CDM. Nonetheless, it would almost certainly have its own problems. No system as complicated as the global carbon market, or a global climate fund, is likely to operate flawlessly or avoid all unintended consequences.

CONCLUSION

Climate change is a long-term problem that requires long-term solutions. Active, broad engagement of both developed and developing countries is absolutely essential for success. The preceding analysis has illustrated that the global carbon market does not live up to its current hype. Too often, market participants behave strategically to generate credits for activities that do not merit them. At the same time, the analysis shows that the incentives produced by the global carbon market do indeed have the potential to induce significant participation on the part of developing nations in the global effort to combat climate change.

The challenge for the international community is to maintain this active participation while honestly facing up to the flaws in the CDM. If it can manage this, a more environmentally effective system is possible. Moving forward, and as developed-world investment in developing-country climate mitigation increases, more effective methods must be developed. Either the CDM needs significant reform, major buyers of CERs should adopt domestic controls that raise crediting standards, or an alternative mechanism such as a carbon fund should be devised to engage the developing world in fighting climate change.