Uncertainty in Clean Development Mechanism Baselines

Sources, Ramifications, and Negotiations

Douglas Bushey

Awarding Certified Emission Reductions to Clean Development Mechanism (CDM) projects under the Kyoto Protocol involves comparing the actual emissions of the project to a counterfactual "baseline" emissions level. The baseline of a project is intended to represent the emissions that would have occurred in the absence of the project. Accordingly, there is a high degree of uncertainty in determining CDM baselines. In the years since the emergence of the CDM, scientific and political debates have occurred about how best to cut through this uncertainty and arrive at the fixed, quantitative figures necessary for the quantification and commodification of greenhouse gas emissions. My research explores the decision-making process by which practical quantifying conventions are adopted in order to narrow the operational realm of uncertainty. It focuses on the role of scientists and the use of scientific rhetoric in the negotiation process and also explores risk and the perceptions of risk held by a range of important actors. This exploratory paper is intended to serve as a springboard for future work by providing a description of the nature of the uncertainty in CDM baselines, and by exploring the ramifications of decision-making in the face of this uncertainty. It concludes with a list of future questions that probe the ways in which different actors may be expected to maneuver within this uncertainty.

THE CLEAN DEVELOPMENT MECHANISM: A BRIEF OVERVIEW

The United Nations Framework Convention on Climate Change (UNFCCC) divides the world into two groups. Annex I nations are the largely industrialized, developed, "Northern" states, and non-Annex I nations are the remaining non-industrialized nations. Under the Kyoto

Protocol to the UNFCCC, Annex I nations assume a cap on their future emissions, benchmarked to their 1990 emissions level[1]. Non-Annex I nations assume no cap. In order to allow the Annex I nations to achieve their emissions reduction goals at the least possible cost, three "flexibility mechanisms" were included in the protocol.

The first such mechanism, international emissions trading, allows countries to trade emissions allowances. This trading allows countries with high abatement costs to purchase credits from countries with lower abatement costs in order to meet the desired target at the lowest possible cost. It is presumed that countries with lower abatement costs will be able to reduce their emissions to levels below their cap and then sell the difference to high cost countries. The second flexibility mechanism, Joint Implementation (JI), is a project based mechanism, whereby an Annex I nation (or a company within an Annex I nation) may fund an emissions reduction project within another Annex I nation, and claim the reductions against its own domestic target.

The third flexibility mechanism is the Clean Development Mechanism (CDM). The CDM is similar to JI, in that it is a project based mechanism. It differs from JI in that the host nation, the nation in which the project takes place, must be a non-Annex I nation. Therefore, the CDM allows credits to be generated by investment in emissions reduction projects in non-Annex I nations. These credits, called Certified Emissions Reductions (CERs), can then be sold on the international market.

According to Article 12 of the Kyoto Protocol, the mechanism has three primary goals:

> The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments…

How best to balance these three objectives is a subject of ongoing discussion and debate. The majority of this paper will deal with decisions (often embodied within equations and/or models) which trade off between the latter two of these goals. The role of the first objective, facilitating sustainable development, was largely settled by the by the decision in the Marrakesh Accords that it is the role of the government of the host country to ensure that a given CDM project

furthers the sustainable development goals of that country.[2] Debate continues about the extent to which CDM facilitates sustainable development[3], but this will not be addressed in this paper.

Crediting CDM Projects[4]

Once all of the relevant values have been quantified, awarding CERs for CDM projects is relatively simple. Equation 1 shows how CER awards are calculated.

Equation 1:
CERs awarded/year = Baseline Emissions (tons CO_2e/year) –
Project Emissions (tons CO_2e/year)

Only two values are required for this calculation, a baseline emissions value and a project emissions value. Methodologies for calculating both must be approved by the CDM Executive Board (EB). Baselines are calculated using approved baseline methodologies, while project emissions are calculated using approved monitoring methodologies.

In order for a proposed project activity to receive CERs, the project must be registered (approved) by the CDM Executive Board (EB). The case-by-case nature of the approval process is intended to ensure that the context-specific nature of project activities in different parts of the world is accounted for, as well as to prevent the manipulation of calculations by project sponsors. Although the approval process provides this benefit, Michaelowa et al. point out that this can lead to high transaction costs, making some potentially beneficial projects unviable.[5] (2003)

When a CDM project is proposed, the potential investor must compose a Project Design Document (PDD). The PDD should describe the proposed project activity, and the monitoring and baseline methodologies selected for the project. A project may either use an existing pre-approved baseline and monitoring methodology, or propose a new one. The completed PDD is submitted to one of a number of Executive-Board-accredited entities (called Designated Operational Entities or DOEs) for review. After the review, and a 30 day public comment period, the DOE may recommend the project for approval to the Executive Board. Upon board approval, the project

may go forward, and CERs are awarded based on the selected baseline and the monitoring data.

BASELINES

As mentioned above, the quantity of CERs awarded to a given project is based not only on the measured monitoring data, but also on the selected baseline. The baseline for a project is a counterfactual value intended to represent the emissions that would have taken place in the absence of the project. Because this value is counterfactual, it is not a measurable or verifiable quantity. In addition to being a counterfactual, the baseline can also be a highly uncertain value. The sources of this uncertainty will be described below. Before coming to this, it is important to describe how baselines work, as well as how baseline uncertainty affects the different parties involved in a CDM project.

The Role of the Baseline - Quantifying CERs

Quantifying the CERs to be awarded to a project is a simple task, once the monitoring has been done and the baseline has been set. Equation 1 shows that the number of CERs awarded is equal to the baseline amount of CO_2 emitted[6], in tons, minus the actual amount of CO_2 emitted by the project, as calculated from the monitoring data.

Clearly the baseline value directly determines the number of CERs awarded, with a higher baseline leading to a proportionally higher number of CERs awarded, and thus an enhanced revenue stream for the project. Thus, for any give project, it is clearly in the best interest of the project participants to see that as high a baseline as possible is accepted for their project[7].

The Role of the Baseline – Other Ramifications

If the project participants are advantaged by a loose baseline, who is hurt by it? Figure 1 puts the baseline decision for a single project into the context of the entire climate regime. Although it is unlikely in the near future that the volume of CERs generated by CDM projects will be large enough to have a significant effect on the price of CO_2 in the international market, the relationships illustrated in Figure 1 are

important conceptually if a CDM-like system is expected to continue operation beyond the first commitment period (2008-2012).

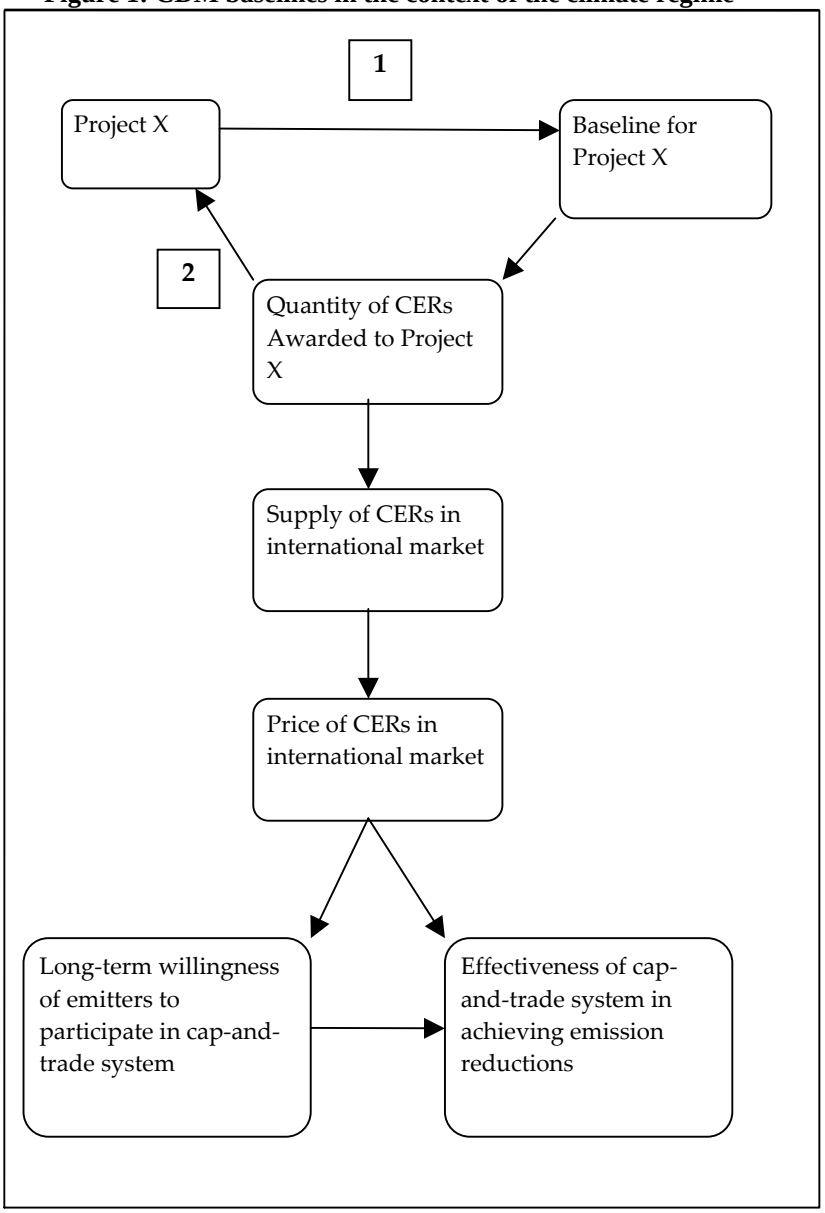
As illustrated by the cycle of three boxes at the top of the figure, the baseline for a given project determines the number of CERs awarded to the project, which in turn determines whether the project participants choose to carry out the project[8]. The boxed number 1 represents a decision point for the DOE and the Executive Board in approving the proposed baseline, while the boxed number 2 represents the project participants' decision to go ahead with the project given the decision made at point 1. Although the actual process is more complex -it may involve the submission and alteration of a proposed baseline methodology multiple times until it is either accepted by the EB or dropped by the project participants – this graphical simplification captures the essence.

It is clear that decision 1 has a direct effect on whether or not the project goes forward. The other effects of the decision are more complex. Aggregated over a large enough number of projects, the number of CERs awarded to projects begins to affect the condition of the international market in emission reductions, potentially threatening the effectiveness of the Kyoto Protocol in achieving actual global emission reductions.

SOURCES OF UNCERTAINTY

Uncertainty in CER awards to CDM projects can be divided into three categories: performance uncertainty, measurement uncertainty, and baseline uncertainty. Performance uncertainty is uncertainty about the future functioning of the project. For example, if a wind farm project is expected to produce 100 MWh per year, and instead produces 85 MWh, due to either lower than expected wind speeds, or less-than-expected system efficiency, this would fall into the category of performance uncertainty. For the purposes of this discussion, performance parameters are understood to be an empirical quantity – that is, a measurable property of a real-world system.[9]

Figure 1: CDM baselines in the context of the climate regime



If performance is accepted as a measurable empirical quantity, measurement uncertainty involves the problem of estimating the performance parameters within what is determined to be a sufficient degree of uncertainty. Monitoring methodologies, approved by the Executive Board lay down guidelines for measurement techniques that will yield values accurate enough to be accepted.

Baseline uncertainty is a very different type of uncertainty. While one can imagine performance parameters varying over time, and measurement uncertainty in determining these parameters, at least the phenomenon to be quantified can be said to have happened, and to be available for measurement. A baseline is not such a quantity. A baseline is one potential view of the future, selected from an infinite number of others. This selection takes place, and is formalized, quantified, and certified as a result of a negotiation that takes place within a pool of experts. In this sense, "uncertainty" may be a problematic term for the realm of values within which baselines are negotiated. The term uncertainty seems to imply that there exists a single fixed state of the world that would have existed in the absence of the project, and that the only problem is approximating it as closely as possible – much in the same way that we seek minimize measurement uncertainty to approximate performance parameters.

It is important to be explicit about inherent impossibility of knowing baseline quantities. Even within an ontology which accepts the existence of objective, knowable truth, this quantity is not knowable[10]. It is not (and cannot be thought about as) a value like the speed of light, the number of people in the world, or the annual energy generation from a wind farm which are, in principle, knowable to an increasingly accurate degree depending on the methods used to determine it. The baseline is a counterfactual about the future, and therefore inherently unknowable and unverifiable.

Some scholars have called for the standardization of baselines, based upon statistical extrapolations into the future based on past behavior in the energy sector.[11] Although these methods may remove or significantly reduce the possibility of opportunistic manipulation of baseline calculations by the project participants, it is important to note that these standardized baselines cannot be thought of any more or less "accurate" than other methods. They simply serve as a pragmatic, serviceable agreement.

Statistical attempts to project exactly what would have happened are not free of values and assumptions. They typically assume that the future will be like the past in a number of important ways. This is a difficult assumption out of which to tease the values and implications.

DELIBERATION AND PARTICIPATION

The architects of the CDM were no doubt aware of the unverifiable nature of baselines. It is presumably for this reason that the process requires several transparency mechanisms and opportunities for participation and deliberation. All documents related to a given project are posted on the CDM website[12], and a 30 day public comment period occurs for each project. A trained DOE must review and approve of the project, followed by a potential review by the Executive Board. This deliberation process involves not just appointed UNFCCC representatives, but project sponsors, concerned NGOs[13], and potentially analysts and scholars from around the world. This unique arrangement provides an excellent opportunity to study how these negotiations occur, as well as what types of arguments are brought forward by various participants. If baseline selection is, as I have argued, simply a negotiation selecting one possible view of the future, it is important to understand who is allowed to participate in this deliberation. Although this new form of international governance has certain qualities of a discursively democratic organization, the fact that a degree of technological fluency is required to participate, gives it a number of technocratic qualities as well.

FUTURE WORK

This paper is intended to serve as motivation for a future look into the nature of the negotiation that determines CDM baselines. With a negotiation effectively occurring every time a project is submitted, it is possible to study the strategies that project sponsors, NGOs, and others are using in order to influence the decisions of the DOEs and the Executive Board. What knowledge and/or credentials are effectively required to participate in the debate? How are different experts' opinions weighted? What type of language is being used to frame the uncertainty? My future work will attempt to answer these

questions as more projects go through the process and more data become available.

Douglas Bushey is a graduate student researcher at the *University of California Berkeley* Energy and Resources Group.

NOTES

[1] The Kyoto Protocol caps the emissions of what it calls Annex B nations. With small exceptions, the Annex B nations are largely the same as the Annex I nations.

[2] UNFCCC (2001) The Marrakesh Accords and The Marrakesh Declaration, UNFCCC.

[3] Pearson B (2004) Market Failure: Why the Clean Development Mechanism won't promote clean development, CDM Watch

[4] This section is intended as a cursory overview to the project application process. For a more detailed description see the Project Activity Cycle page on the CDM website: http://cdm.unfccc.int/Projects/pac

[5] Michaelowa A, Stronzik M, Eckermann F, Hunt A (2003) Transaction costs of the Kyoto Mechanisms. Climate Policy 3:261-278.

[6] If emissions of a non-CO_2 greenhouse gas are being reduced, these emissions are translated into CO_2 equivalent emissions (CO_2e) based on the Global Warming Potential (GWP) of the gas, as given by the IPCC.

[7] Baselines which are deemed to be relatively high within the range of uncertainty are sometimes referred to as "loose" baselines, while lower baselines are sometimes called "strict" or "conservative."

[8] Many skeptics doubt whether the revenue stream from carbon credits would be significant enough to decide whether or not a project would be carried out. This question of *financial additionality* continues to be discussed.

[9] Morgan GM, Henrion M (1990) *Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis*. Cambridge University Press, Cambridge.

[10] For an overview of how shifting public views about the possibility of objectivity in science have affected the climate debate see Holden, Barry (2002) *Democracy and Global Warming*. Continuum Press, London.

[11] See e.g. Kartha S, Lazarus M, Bosi M (2004) *Baseline recommendations for greenhouse gas mitigation projects in the electric power sector*. Energy Policy 32:545-566; Sathaye J, Murtishaw S, Price L, Lefranc M, Roy J, Winkler H, Spalding-

Fecher R (2004) *Multiproject baselines for evaluation of electric power projects*. Energy Policy 32:1303-1317.

[12] cdm.unfccc.int.

[13] Most notably CDM Watch. See www.cdmwatch.org.