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July 2011

Centre for Climate Change Economics and Policy Working  
Paper No. 63

Grantham Research Institute on Climate Change and the  
Environment

Working Paper No. 53

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# Perverse incentives under the CDM: A comment\*

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July 2011

## Introduction

The Clean Development Mechanism (CDM) provides some basic safeguards to ensure that HFC-23 reductions are additional, primarily aimed at establishing a realistic baseline scenario for HFC-23 projects. However, there have long been doubts about the additionality of HFC-23 projects (Wara, 2007a,b). Now Schneider (2011), in an excellent article in *Climate Policy*, presents compelling empirical evidence that these HFC-23 safeguards have been unsuccessful. In fact, the evidence shows that the CDM appears to have created perverse incentives to increase the HFC-23 production. Schneider provides systematic empirical analysis on a question that so far has been dominated by suspicion and speculation. It is a paper that deserves to be read.

Proposals aimed to mitigate the ‘additionality problem’ often focus on getting the baseline right (Geres and Michaelowa, 2002; Begg and der Horst, 2004). Schneider also argues that “the key deficit of the current methodology is that it implicitly assumes that plants would continue to operate at or above historically observed HFC-23/HCFC-22 ratio” (Schneider, 2011, p. 855). He proposes that CERs should only be issued for a proportion of HFC-23 emissions reductions. However, this comment will argue that the perverse incentives in the CDM are the result of a more fundamental institutional failure. This comment explains the underlying perverse strategic incentives built into the CDM, and re-considers the question of to reform the CDM.

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\*I am grateful to Sam Fankhauser and Carmen Marchiori for their comments. This work is part of the programme of the Centre for Climate Change Economics and Policy, which is funded by the UK Economic and Social Research Council (ESRC) and Munich Re. I would also like to acknowledge the financial support of the Jan Wallander and Tom Hedelius Foundation.

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## The ‘additionality game’

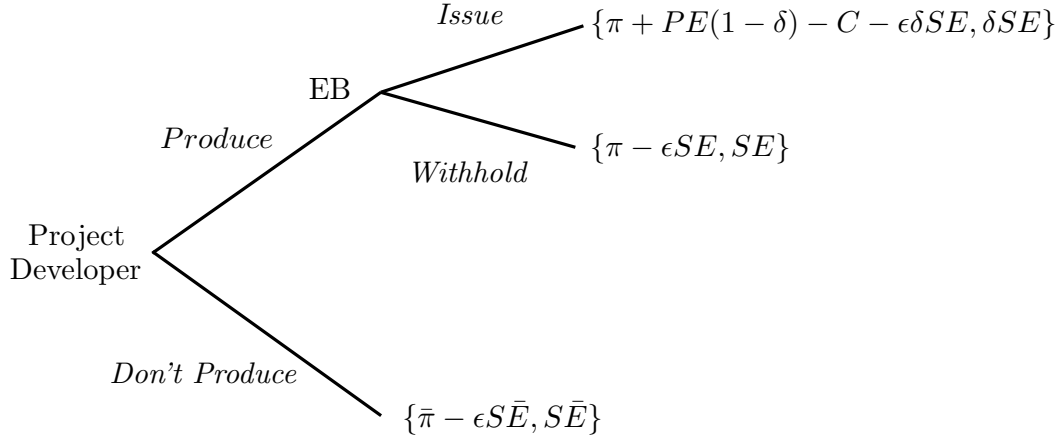
A simple game will help to clearly illustrate the underlying institutional problem in the CDM. Consider a project developer that is deciding whether or not to proceed with a project that will produce  $E$  tons of CO<sub>2</sub> equivalent emissions. A technology is available that would reduce these emissions to  $\delta E$  tons, where  $\delta \in (0, 1)$ . The cost of installing and operating this technology is  $C$ . The project yields a profit of  $\pi$ . The next best use of the project developers resources yields a profit of  $\bar{\pi}$  and  $\bar{E}$  tons of CO<sub>2</sub> equivalent emissions. If the project developer receives any CERs, he can sell these at a price  $P$ . There is a social cost  $S$  per ton of emissions, and the project developer incurs a private cost  $\epsilon S$ , where  $\epsilon \in (0, 1)$ .

Let us now consider the cases where the project is the most profitable use of the developers resources only if it can sell CERs (i.e.  $\pi + PE(1 - \delta) - C - \epsilon SE > \bar{\pi} - \epsilon S\bar{E} > \pi - \epsilon SE$ ), and where emissions from this project, with or without the abatement technology, are higher than from the next best alternative (i.e.  $E > \delta E > \bar{E}$ ). Moreover, although the social cost of the emissions is high enough to justify installing the abatement technology, the developer will not do so unprompted because he bears only a small portion of that cost (i.e.  $SE(1 - \delta) > C > \epsilon SE(1 - \delta)$ ).

This project will *increase* emissions, and the developer would not find it profitable to proceed with it unless he was issued CERs to sell. One might think that the Executive Board (EB) would only ever issue CERs to such a project if it had incorrect information about the baseline. However, as I will show next, the ‘additionality problem’ remains even if the EB knows the baseline. Knowing that the emissions reductions from the technology are not additional, and that emissions in fact *increase*, would not prevent it from issuing CERs.

The ‘additionality game’ is a two-stage game. First, the project developer decides whether or not to start up production of the output and the associated emissions. If he chooses to ‘Produce’, the EB then decides whether or not to issue CERs for the emissions reductions that come from installing and operating the abatement technology. Figure 1 illustrates the sequence of events, left to right, and the payoffs to the project developer and the EB are indicated at each terminal node.

Consider first the decision facing the project developer. He gets a payoff  $\bar{\pi} - \epsilon S\bar{E}$  by directing his resources elsewhere. However, if he produces this output and emissions instead and receives CERs for operating of the abatement technology, he can earn  $\pi + PE(1 - \delta) - C - \epsilon SE > \bar{\pi} - \epsilon S\bar{E}$ . If he does not get the CERs, it would not be worth it. His decision, then, depends on whether he thinks he will receive CERs for the emissions



**Figure 1:** ‘The additionality game’: The project developer moves at the initial node (left), where he can play either *Produce* or *Don't Produce*. If he decides to start production, the EB moves, choosing to *Issue* or *Withhold* CERs for this project. The payoffs to each player are written at the game’s terminal nodes, where the Developer’s payoffs appear before the comma, and the EB’s payoffs after the comma. Solving the game by backward induction, the EB will get a higher payoff from playing *Issue* than by playing *Withhold*, given that the Developer plays *Produce*. Anticipating that the EB will play *Issue* if it plays *Produce*, the Developer prefers to play build the plant. Hence the Subgame-Perfect Nash Equilibrium is given by the pair of strategies  $\{Produce, Issue\}$ , with payoffs  $\{\pi + PE(1 - \delta) - C - \epsilon\delta SE, \delta SE\}$ . This game is modeled on the classic market entry game.

avoided by operating the abatement technology.

The EB knows that this project actually increases emissions, so it would prefer that the project developer plays *Don't Produce*. The EB might even announce that a project of this sort would not receive CERs, but the EB’s announcement would not be credible. If the developer plays *Produce*, emissions will be either  $E$  or  $\delta E$ . Because most of the cost of emissions is not borne by the developer, he does not find the abatement technology worth the investment, and we would end up with emissions  $E$ . On the other hand, as the representative of the public, the EB bears the full social cost of emissions, and would thus prefer that the abatement technology is installed. Issuing CERs for the ‘emissions reductions’  $E(1 - \delta)$  would be sufficient to induce the developer to install the abatement technology, and so the EB will prefer to issue CERs given that the developer plays *Produce*. The project developer anticipates that the EB will issue CERs for the abatement technology, and thus plays *Produce* while the EB rationally acquiesces and plays *Issue*. We thus end up with CERs issued to a project that actually *increases* emissions. Moreover, had the CDM not existed, the developer would not expect to receive CERs, and these emissions would not be produced in the first place. Production

and emissions would have been lower without the CDM. This accords with Schneider’s observation that “the amount of HCFC-22 produced in these cases is determined by the CDM rules and not by other factors, such as market demand.”

Repetition of the ‘additionality game’ is unlikely to resolve the problem.<sup>1</sup> If the developer plays *Always Produce* it is the EB’s best response to play *Always Issue*. In this case, the project developer receives the highest possible payoff in every period. Only if the project developer adopted some other strategy, such that it becomes more likely to play *Don’t Produce* in a particular period if the EB has played *Withhold* previously, the EB can discourage some bad projects by withholding CERs a few times even though this is costly to itself. A lower discount rate and a larger instantaneous gain from preventing these bad projects would allow the EB to recoup these losses more quickly. These factors effectively enhance the value of having a reputation for being tough, and would hence make the threat to play *Withhold* more credible. However, as already noted, the developer achieves the highest payoff in every period by adopting the strategy *Always Produce*, so he would have no interest in adopting a different strategy that might land him in an equilibrium with lower payoffs. Thus, even in the infinitely repeated ‘additionality game’ we are stuck in a  $\{Produce, Issue\}$  equilibrium. This result is independent of how much the EB and the developer discount future payoffs. Repetition would not resolve the problem.

## Conclusion

The CDM would encourage these bad projects when the developer bears only a small proportion of the cost of emissions ( $\epsilon$  is small), when the abatement technology is relatively cheap ( $SE(1 - \delta) > C > \epsilon SE(1 - \delta)$ ) and effective ( $\delta$  is small but still satisfies  $\delta E > \bar{E}$ ). The first condition applies to virtually all greenhouse gas emissions, but the latter two have been especially true of HFC-23 projects. This is what allows the project developer to reap “very high CER revenues” relative to the “low GHG abatement costs” (Schneider, 2011, p. 861). Clearly, many projects will not fit with the assumptions made above. However, for those projects that do, the CDM actually increases emissions. These are exactly the sort of perverse incentives that Schneider (2011) describes.

Schneider correctly identifies the problem, but the proposal to issue CERs for only a proportion of HFC-23 emissions reductions does not get to the root of it. As the ‘additionality game’ illustrates, the perverse incentives related to HFC-23 projects are

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<sup>1</sup>Note that the role of ‘project developer’ will probably be played by a different developer in each iteration of the repeated game.

a consequence of strategic interaction between project developers and the EB. Hence, there are institutional reasons why the CDM is unlikely to be able to credibly commit to reducing the amount of CERs issued for HFC-23 projects. Moreover, the ‘additionality game’ shows that there are more general conditions that underlie the perverse incentives. Going after HFC-23 projects specifically, therefore, does not eliminate the possibility that other projects will emerge with these perverse incentives. For instance, doubts have already been raised about the additionality of Chinese hydropower projects (Haya, 2007). A solution that targets only HFC-23 projects will fail to address the wider problem of perverse strategic incentives created by the CDM.

Schneider (2011) provides an excellent empirical analysis of the perverse incentives in the CDM, but the underlying problem is one of poor institutional design. The rules of the game award ultimate power to project developers instead of the EB. The EB can threaten to withhold CERs, but the developer knows this threat is void. The crucial issue when reforming the CDM is to make sure that the EB can credibly commit to withholding carbon credits. Failing this, it may be preferable to remove this conflict from the CDM altogether by pursuing another of Schneider’s proposals: fund these kinds of emissions reductions directly through a multilateral fund.

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