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The elephant in the room – A comparative study of uncertainties in carbon offsets

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ABSTRACT

The clean development mechanism (CDM) is a flexible mechanism under the Kyoto Protocol, which makes it possible for developed countries to offset their emissions of greenhouse gases through investing in climate change mitigation projects in developing countries. When the mitigation benefit of a CDM project is quantified, measurable uncertainties arise that can be minimised using established statistical methods. In addition, some unmeasurable uncertainties arise, such as the rebound effect of demand-side energy efficiency projects. Many project types related to land use, land-use change and forestry (LULUCF) have been excluded from the CDM in part because of the high degree of statistical uncertainty in measurements of the carbon sink and risk of non-permanence. However, recent discussions within the United Nations Framework Convention on Climate Change (UNFCCC) have opened up for the possibility of including more LULUCF activities in the future. In the light of this discussion, we highlight different aspects of uncertainties in LULUCF projects (e.g. the risk of non-permanence and the size of the carbon sink) in relation to other CDM project categories such as renewables and demand-side energy efficiency. We quantify the uncertainties, compare the magnitudes of the uncertainties in different project categories and conclude that uncertainties could be just as significant in CDM project categories such as renewables as in LULUCF projects. The CDM is a useful way of including and engaging developing countries in climate change mitigation and could be a good source of financial support for LULUCF mitigation activities. Given their enormous mitigation potential, we argue that additional LULUCF activities should be included in the CDM and other future climate policy instruments. Furthermore, we note that Nationally Appropriate Mitigation Actions (NAMAs) are currently being submitted to the UNFCCC by developing countries. Unfortunately, the under-representation of LULUCF in comparison to its potential is evident in the NAMAs submitted so far, just as it has been in the CDM. Capacity building under the CDM may influence NAMAs and there is a risk of transferring the view on uncertainties to NAMAs.

1. Introduction

Changes in land management have great potential for mitigating climate change. The economic mitigation potential of projects in the Land use, Land-use Change and Forestry (LULUCF) sector is estimated to be 3 and 7.2 Gt CO_2-equivalents (CO_2-eq) per year at a carbon price of USD 20 and USD 100, respectively, per tonne CO_2-eq (IPCC, 2014: chapter 11, Fig. 11.3). At the lower cost, forestry constitutes half of the economic mitigation potential and agriculture the other half (ibid). In comparison, the global emissions from fossil fuel combustion and industrial processes were 35.3 Gt CO_2 in 2013 (Olivier et al., 2014). The major part of the potential in the agricultural sector is from changes in land use management and almost 90% of this mitigation potential is from soil carbon sequestration (IPCC, 2007: chapter 8). Despite their considerable potential, LULUCF activities in the Clean Development Mechanism (CDM) are today limited to afforestation and reforestation (A/R) and this has limited participation by the least developed countries in CDM, given the large potential for e.g. soil carbon sequestration in this group of countries (Whitman and Lehmann, 2009). This article discusses the nature and magnitude of uncertainties in CDM based on eight project categories from the CDM pipeline (UNEP, 2015): afforestation and reforestation, renewables, demand-side energy efficiency, CH_4 emission reduction and cement and coal

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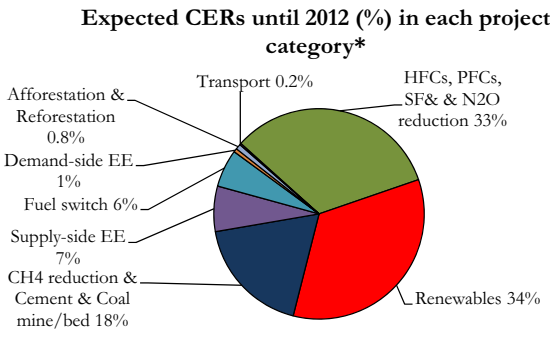

Fig. 1. Share of each CDM category's CER production (UNEP, 2015). Explanation of abbreviations: EE – energy efficiency; HFCs – hydrofluorocarbons; PFCs – perfluorocarbons; SF_6 – sulphur hexafluoride; N_2O – nitrous oxide; CH_4 – methane.

mine/bed, fuel switch, supply-side energy efficiency, HFCs, PFCs, SF_6 and N_2O reduction, and transport (see Fig. 1 for an explanation of abbreviations).

The debate about inclusion of LULUCF projects in the CDM is not new. It was one of the most contentious issues in the negotiations leading up to the implementation of the Kyoto Protocol, which resulted in the agreement reached in Marrakech at COP 7 in 2001 limiting LULUCF project activities to A/R. The agreement was a compromise between the US, that wanted more flexibility in reaching its commitments, developing countries led by Colombia with huge forest resources, and the EU, that wanted to focus on emission reductions (Boyd et al., 2008).

At the Conference of the Parties (COP) 17, the Subsidiary Body for Scientific and Technological Advice (SBSTA) was requested "to initiate a work programme to explore more comprehensive accounting of anthropogenic emissions by sources and removals by sinks from land use, land-use change and forestry (...)" (UNFCCC, 2012a: paragraph 6). The work was initiated during SBSTA 36 and has continued at every SBSTA meeting since then (cf. UNFCCC, 2014a). A decision was taken at COP 20 in Lima requesting the CDM Executive Board (EB) to assess the applicability of previous modalities and procedures to also include revegetation (UNFCCC, 2014b). The decision also included a request to SBSTA to continue its consideration of additional LULUCF activities under the CDM and to provide a draft decision for COP 22 in November–December 2016 (ibid). The timing of this paper corresponds with this on-going discussion.

The future of the CDM is uncertain and it is likely that the mechanism will be altered and may be totally transformed into new climate policy instruments. This is because the Parties have agreed that "developing country Parties will take Nationally Appropriate Mitigation Actions (NAMAs)" and that they should be "supported and enabled by technology, financing and capacity-building" (UNFCCC, 2010). This has been concretised in the establishment of the Green Climate Fund and the recent pledging of more than USD 10 billion for financing mitigation and adaptation activities in developing countries (Green Climate Fund, 2014). Our discussion about uncertainties in carbon offsets would be incomplete if it did not also address the possible future of the CDM and how it could shape future policy around NAMAs.

2. Uncertainties in carbon offset

Despite uncertainties of the mitigation benefits of carbon offsets, the CDM is widely accepted as an imperfect but useful way of engaging non-industrial countries (called non-Annex I countries in the UNFCCC discussions) in mitigation work (Boyd et al., 2009). However, the LULUCF sector currently accounts for only a tiny proportion of CERs generated in the CDM (see Fig. 1).

2.1. The issue of permanence

One reason for there being so few A/R projects in the CDM could be the concerns about non-permanence. The issue of permanence is unique to A/R and other LULUCF projects. This arises from the potential threats to carbon sinks from natural disturbances, e.g. forest fires, pests, or human intervention (e.g. harvests not covered by the project plan). A distinction between temporary CERs (tCERs) and long-term CERs (lCERs) has been used to address this problem for A/R projects in the CDM. However, there are several other ways of mitigating the risk of non-permanence in the LULUCF sector. A technical paper prepared by the secretariat to the UNFCCC based on Party submissions (UNFCCC, 2014c) refers to the following possibilities: a permanence buffer of credits backed up by host country guarantees; insurance; tonne-year crediting; or simply replanting the 'carbon-equivalent' forest in another place. The temporary nature of A/R credits may decrease interest in these types of projects, since the CERs have to be replaced at the end of the period even when the carbon sink is intact. The lack of fungibility between tCERs and lCERs on the one hand, and permanent CERs (from emission reduction) on the other, is one reason why additional approaches to temporary crediting are required (ibid). Temporary credits are also difficult to manage and transfer because of the greater financial risk they entail (World Bank, 2012) since political and economic circumstances may drastically affect future prices. An alternative view on this issue would be that the temporary credits could be the very strength of the LULUCF sector, leading to real and verifiable sequestration visible to the naked eye.

2.2. The rebound effect

The rebound effect may be defined as the lost part of an energy conservation effort (Berkhout et al., 2000). The rebound effect could lead to a number of problems when trying to quantify GHG emission reductions. Some examples are given in Textbox 1.

There are several types of rebound effects, at different levels of the economy, (see Grönkvist (2005) for a review) and rebound effects may increase emissions on a national scale, outside the CDM project boundary. Since the CDM project host countries do not have national emission reduction targets, there is no mechanism to ensure that emissions arising from rebound effects are accounted for.

There are good reasons to believe that rebound effects are comparatively higher in countries with unmet demand where CDM projects are carried out (Roy, 2000). China is the country where by far the most CERs are issued (around 60%), and where more than 50% of the CDM projects are hosted (UNEP, 2015). However, there is a general lack of data for estimating rebound effects in the CDM host countries (Chakravarty et al., 2013). Nevertheless, Lin and Liu (2012) found an economy-wide energy rebound effect in China of 53%.

Despite attempts to bring rebound effects within the CDM into the debate (Grönkvist, 2005), little attention is given to this issue in the scientific literature and in the CDM methodologies. The tools used for establishing baseline emission scenarios within the CDM include nothing about indirect emissions from the projects, since indirect emissions do not meet an important criterion for being counted as "leakage", i.e. being measurable. However, the CDM EB is well aware of the existence of the rebound effect. In 2011, the CDM EB published guidelines on so-called 'suppressed demand' and how to include it in methodologies (UNFCCC, 2012b). Suppressed demand is included in the modalities and procedures