Abstract - Crediting of Temporary Carbon Storage

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The increased concern of global warming impacts has brought along a focus on approaches for mitigation, including the possibility of controlled carbon storage. However, in this relation the issue of permanence of the storage is important, as temporary storage does not have the same climatic benefit as permanent storage. Several methods for assessing the benefit of temporary carbon storage exist, expressing it in terms of carbon credits. Some of these methods are the stock change method, the Colombian approach, the average storage method and the ton year approach. Based on some of these, a suggestion for a standard on the matter of crediting carbon storage in products has been proposed by the BSI, in the PAS 2050 specification. However this specification, along with many other approaches on the matter, is based on a 100 year assessment period of global warming potentials, which has significant importance for the results of crediting temporary carbon storage, as it disregards the long timescale for atmospheric lifetime of CO_2.

Thus, current crediting proposals for temporary carbon storage have here been assessed using a more holistic approach, considering the interactions and relevant timescales for the entire carbon cycle on Earth. In order to do this, a model for the global carbon cycle, including not only the upper climate system part but the entire Earth, has been set up. Further, different case scenarios have been set up in order to assess the different crediting approaches, hereunder the implications of using the 100 year time horizon.

The carbon cycle model reveals timescales of thousands of years for removal of carbon from the near-surface parts, whereas the timescale for e.g. fossil fuel generation is millions of years. Compared to these timescales, the use of the 100 year time horizon for considering climatic benefits related to temporary carbon storage appears hard to justify. The problematic issues regarding the use of the 100 year time horizon is further outlined through the case scenarios, illustrating e.g. how total global warming potentials of projects can be completely hidden through relatively short-term storage when applying some of the crediting approaches, while not providing real climatic benefits. These aspects underlines the insufficiency of the 100 years time horizon when considering GWP benefit potentials, and subsequently the crediting approaches relying on this are considered inadequate. Rather, relating to the timescale for removal from the near-surface carbon cycle, timescales for temporary carbon storage should be at least in the order of magnitude of thousands of years for earning permanent credits and thus crediting methods should reflect this.

However, there is also the risk of crossing dangerous tipping points, e.g. the 2-3^{o}C above pre-industrial levels as estimated by IPCC, which might cause irreversible climate changes. For the purpose of avoiding this, fast climate change mitigation is required and consequently, shorter storage times might still yield climatic benefits. This entails that it might be beneficial to include special crediting for relevant shorter-term storage, during a bridging period, to a more carbon neutral society. A holistic approach for carbon crediting should include both aspects.