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**Sent:** Tuesday, 11 October, 2022 0:31
**To:** Supervisory-Body <Supervisory-Body@unfccc.int>
**Cc:** Matthew Brander <Matthew.Brander@ed.ac.uk>
**Subject:** Call for input 2022 - activities involving removals under the Article 6.4 Mechanism of the Paris Agreement

Dear Members of the Article 6.4 Supervisory Body,

Attached, please find comments from myself and Matthew Brander of the University of Edinburgh on the flaws inherent in tonne-year accounting as an approach to addressing reversals. Please feel free to contact me and Matthew directly with any questions or requests for clarification.

Sincerely,
Derik Broekhoff

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**Response to Call for input 2022 - Activities involving removals under the Article 6.4 Mechanism of the Paris Agreement**

**Response from the Stockholm Environment Institute and the University of Edinburgh**

**October 2022**

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**Summary of Response**

- The Draft Recommendation (Annex 5) and the Information Note (Annex 6) appear to recommend the use of tonne-year crediting for temporarily stored carbon. We emphasize in the strongest possible terms that this approach is inconsistent with ensuring cumulative emissions do not exceed the level entailed by the temperature goal in Article 2.1a of the Paris Agreement.

- Temperature change is driven by *cumulative $CO_2$ emissions* and is *insensitive to the timing* of those emissions (Matthews et al. 2017; Rogelj et al. 2018; Allen et al. 2009). This fact underpins the concept of a 'carbon budget', i.e., a fixed quantity of net additions to the atmospheric stock of $CO_2$ before a given temperature threshold is reached, e.g., 1.5 degrees.

- Tonne-year crediting is inconsistent with the concept of a carbon budget, and therefore the temperature goals of the Paris Agreement, as it discounts or omits reversal emissions, despite the fact that reversal emissions contribute to cumulative atmospheric emissions and temperature change.

- Adopting tonne-year crediting would undermine the integrity of the Article 6.4 Mechanism as it would create credits that do not genuinely represent a 1 $tCO_2$ net removal/reduction (as reversal emissions are discounted or omitted). Users of such credits could falsely report that their contribution to cumulative emissions has been neutralized, even though the physical reality would be a net positive contribution to cumulative emissions.

- The Article 6.4 Mechanism should adopt alternative approaches to account for the reversibility of stored carbon such as temporary crediting.

## 1. Introduction

These comments focus on the question of reversibility, and in particular on the unsuitability of tonne-year accounting as a means to address reversal risk.

Our primary concern is that both the Draft Recommendation (Annex 5) and Information Note (Annex 6) contain misleading statements related to tonne-year accounting, along with mischaracterizations of alternative approaches for managing reversal risk, which may lead to flawed conclusions about how best to manage reversal risk under Article 6.4.

For example, Annex 5 asserts that under a tonne-year accounting approach, "no reversal of carbon stocks can occur" (Annex 5, Appendix 1, paragraph 4(d)(i)(b)). Yet by the definition of a "reversal" offered just one paragraph earlier (Annex 5, Appendix 1, paragraph 3) this is simply not true. Paragraph 3 notes correctly that a reversal occurs when "verified carbon stocks under a removal activity are released back into the atmosphere such that the carbon stocks are decreased below the [previously] verified stocks." This is a physical accounting question, and the answer does not change if one adopts a tonne-year approach to the *crediting* of removals (or other forms of enhanced carbon storage).

The main conceptual question here is whether carbon stored temporarily can be credited on a fractional basis, on the assumption that temporary storage has mitigation value equivalent to the permanent avoidance of a fractional tonne of fossil fuel emissions. As explained below, such equivalency is not tenable if the primary goal of climate policy to achieve the long-term temperature goals of the Paris Agreement. Assertions like "no reversal of carbon stocks can occur" under tonne-year accounting suggest an attempt to "define away" a problem that – in physical and policy terms – cannot be ignored. Unfortunately, these conceptual errors pervade the analysis in Annexes 5 and 6, including when options like temporary crediting or "tonne-based" crediting are evaluated.

Below we discuss the most significant areas where the discussion in Annexes 5 and 6 related to tonne-year accounting is either flawed or incomplete.

## 2. Reversals are a concern for more than just removal activities

A reversal can occur any time a mitigation activity enhances or preserves stocks in a carbon reservoir, relative to a scenario without the mitigation activity (i.e., the activity's baseline scenario). A reversal occurs if the *increase in stock* caused by the mitigation activity *relative to its baseline* is, at a later point time, reduced.

Addressing reversal risk is important for the environmental integrity of a crediting mechanism, because if credits are issued on the basis of net mitigation in an initial time period, but the mitigation is subsequently reversed, then the mechanism will have effectively over-issued credits, which can lead to a net increase in global emissions (Schneider and La Hoz Theuer 2019).

Crucially, reversals may occur for any type of activity that enhances carbon stocks relative to the activity's baseline. This includes removal activities, but also activities that, for example, reduce the rate of forest carbon loss and therefore avoid emissions (Table 1). The issue of reversal risk, while relevant to most removal activities, should therefore be addressed more broadly within the context of potential Article 6.4 mitigation activities that enhance or preserve carbon in reservoirs.

*Table 1. Mathematical illustration of reversals for both removal and emission reduction activities*

**Reversal of Removals**

| | $t_0$ | $t_1$ | $t_2$ |
|---|---|---|---|
| Baseline carbon stocks | 0 | 0 | 0 |
| Actual carbon stocks | 0 | 10 | 5 |
| Net mitigation achieved | - | 10 | 5 |
| Reversal amount (over-crediting) | - | - | 5 |

**Reversal of Emission Reductions**

| | $t_0$ | $t_1$ | $t_2$ |
|---|---|---|---|
| Baseline carbon stocks | 25 | 10 | 5 |
| Actual carbon stocks | 25 | 20 | 10 |
| Net mitigation achieved | - | 10 | 5 |
| Reversal amount (over-crediting) | - | - | 5 |

## 3. Defining permanence

A crucial question for assessing the "permanence" of mitigation is the time horizon over which reversal risk should be considered. That is, does "permanent" mean forever, or something more finite? This question has been the subject of some confusion over the years, in part due to common misunderstandings about the global carbon cycle (Archer et al. 2009; Mackey et al. 2013).

From the perspective of long-term temperature stabilization, however, science has given us a definitive answer: permanent does in fact mean *permanent* (or more precisely, indefinite). Once $CO_2$ is emitted, it effectively raises atmospheric concentrations of $CO_2$ for millennia. Because of this, as numerous studies have established, long-term temperature increase depends primarily on cumulative emissions of $CO_2$, **irrespective of the timing of those emissions** (Allen et al. 2009; Archer et al. 2009; Ciais et al. 2014; Eby et al. 2009; Mackey et al. 2013; Matthews et al. 2009; Matthews and Caldeira 2008). In other words, there is **no advantage to delaying emissions from the standpoint of limiting the amount of global warming we can expect to see.** This fact underpins the notion of a global "carbon budget."

While there are other important considerations related to the impacts of global warming, including the expected rate of warming (which depends on *how quickly* we reach a particular carbon budget), the international community has recognized long-term temperature stabilization as the primary objective of climate change mitigation efforts. The Paris Agreement's temperature goal of 'holding the increase…to well below 2°C …and pursuing efforts to limit the temperature increase to 1.5°C' (UNFCCC 2015) clearly indicates the world community's concern with long-term temperature change, which is driven by cumulative emissions.

When we account for $CO_2$ emission reductions or removals in the context of carbon crediting, therefore, what matters is whether they contribute to staying within a safe global carbon budget. When $CO_2$ reductions or removals are *reversed* - that is, when associated carbon is subsequently released (back) to the atmosphere – it no longer contributes to staying within a global carbon budget, and can no longer be considered an offset to greenhouse gas emissions. This is true regardless of how long the carbon may have been stored before a reversal occurs.

## 4. Flawed assumptions of tonne-year accounting

Tonne-year accounting, as presented in Annex 6, fails to recognize the premise of a carbon budget, instead positing the idea that there could be some duration for which carbon could be "held outside of the atmosphere in order to provide the same mitigation value as that provided by an emission reduction" – referred to as "permanence period" (Annex 6, paragraph 99). From a scientific standpoint, this notion is flawed. The "permanence period" with respect to achieving long-term temperature goals is effectively thousands of years.

The discussion in Annex 6 cites figures from a 2000 IPCC report (paragraph 99), suggesting permanence periods ranging from 42 to 150 years. In that report, however, these figures are cited in *discussing* different tonne-year accounting models, not as an *endorsement* of those models. Critically, the figures are presented after the report makes an essential qualification: "As long as the **policy time horizon is finite** or **a non-zero discount rate is applied to determine the present value of future emissions/ removals**, even short-term sequestration will have some value" (IPCC 2000). We turn to each of these qualifications in turn, which are also advanced as justifications for tonne-year accounting in Annex 6.

### 4.1 Policy time horizon

Annex 6, paragraph 103 asserts that "all climate action is underpinned by policy objectives and goals to be achieved over a finite period of time." While actions must be premised on goals and timelines, it would be a fallacy to conclude that the goals themselves must be time-limited. Such an assertion is straightforwardly inconsistent with the text of the Paris Agreement. Article 2.1(a) states the goal of holding "…the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels." To achieve this goal, Article 4.1 calls on countries to achieve net zero emissions by the second half of the century. The temperature goal itself, however, does not have a time horizon.

In short, the fact that *policies* must be planned over discrete time periods does not mean that the impacts of those policies must only be considered over an arbitrary time horizon and ignored thereafter. Yet this is precisely the assumption behind tonne-year accounting as presented in Annex 6, paragraphs 103-129, which looks only at radiative forcing over an arbitrary time horizon, like 100 years, and ignores any effects that follow.

Moreover, the arguments advanced in Annex 6 for choosing a time horizon are conceptually flawed. Paragraph 107, for example, suggests that the time horizon could be linked to expectations about how long it will take to fully decarbonize the global economy. This is far too simplistic. If we expect the world to decarbonize by 2060, it does not follow that we no longer need to be concerned about reversals of stored carbon after that date. To the contrary, if cumulative emissions up to 2060 were at or near the limit needed to avoid more than 2$^{o}$C of warming, then reversal emissions from temporarily stored carbon would take global temperature change above the Paris Agreement limits. Treating carbon stored for 40 years (starting in the 2020s) as equivalent to "permanent" mitigation in that scenario would not make sense from either a physical or policy perspective.

The authors of Annex 6 also cite the conventional use of 100-year global warming potentials (GWPs) as justification for choosing a 100-year time horizon for permanence (Annex 6, paragraph 104). This justification is also flawed. First, the primary purpose of GWPs is to allow the comparison of different GHGs by converting them to units of $CO_2$e, which necessitates the selection of an arbitrary time period over which integrated radiative forcing is compared. However, in the case of comparing $CO_2$ emissions with enhanced carbon storage, no conversion to a common unit is needed as both are in units of $CO_2$, and there is no necessity to select an arbitrary time period. Second, the choice of a 100 year time horizon for calculating GWPs should not be seen as a deliberate policy choice, but rather an 'inadvertent consensus' (Shine 2009). In fact, the misalignment between GWPs and the Paris Agreement's temperature goal has been cited to justify using alternative methods for comparing different GHGs, notably GTP and GWP*, which reflect the relative contribution of different GHGs to temperature change (Allen et al. 2018; Cain et al. 2019; Shine et al. 2005).

### 4.2 Economic discounting

Another possible way to assign value to temporary carbon storage is to apply principles of economic discounting. The authors of Annex 6 allude to this in paragraphs 108-112. However, economic discounting is a problematic, if not flawed, approach if the primary policy goal is to ensure a safe level of cumulative emissions, as it inherently devalues future emissions. The authors of Annex 6 note that discounting "values earlier mitigation more than later mitigation" (Annex 6, paragraph 112), but in the context of reversible mitigation, the implication is rather that future emissions (and the climate damage such emissions might cause) matter less than current emissions. Taken to its logical extreme, discounting implies that a long-term temperature increase of more than 2°C would be acceptable, as long as it occurs far enough into the future. While this position has its adherents among some economists, it is arguably at odds with the stated objective of the Paris Agreement, which is clear about "holding the increase in global average temperature to well below 2°C" (Article 2.1) as a "long-term temperature goal" (Article 4.1).

The authors of Annex 6 allude to this tension in paragraph 111(c), suggesting that discounting "should be seen only as a method for choosing projects, not as a method for determining our ethical obligations to the future." The problem is that discounting applied to temporary carbon storage *directly internalizes* assumptions about our ethical obligations to future generations in the selection of projects, by devaluing the future impacts of reversals. It is an unavoidable consequence of the approach.

## 5. Appropriate methods for crediting temporary carbon storage

A recent critical evaluation of tonne-year accounting identifies the fundamental mismatch between this accounting method and the goals of the Paris Agreement (Chay et al. 2022):

> Another notable shortcoming [with tonne-year accounting] is that cumulative radiative forcing is not the only climate outcome we might care about. There are other climate impacts which are primarily determined by the absolute amount of $CO_2$ in the atmosphere at a given point in time, rather than the total energy trapped in the climate system over time. **These outcomes include long-term temperature targets like 1.5 or 2 degrees** *[emphasis added]***.** In these cases, storing a ton of $CO_2$ today but releasing it decades from now may simply kick the can down the road. It's absolutely possible that temporary carbon storage looks beneficial through the lens of cumulative radiative forcing, but may be neutral or even counterproductive through the lens of temperature targets after the temporary storage ends.

The core problem with tonne-year accounting is its presumption that temporary carbon storage can be equated with permanent mitigation. In the extreme, it presumes that removing and storing carbon for as little as one year can be treated as equivalent to permanently reducing fossil fuel emissions. This is patently untrue from a physical standpoint; storing carbon for one year does not contribute to limiting cumulative emissions. And it is perverse from a policy standpoint. Even if temporary carbon storage has value – and indeed is a necessary part of global efforts to achieve net zero emissions – it makes no sense for society to "spin its wheels" by treating hyper-transient storage as equivalent to permanent mitigation.

Various critics of economic discounting have offered an alternative framework for choosing among mitigation options: cost-effectiveness analysis (Ackerman and Stanton 2011; Kaufman et al. 2020). Whereas tonne-year accounting is inherently premised on a kind of cost-benefit analysis (valuing near-term benefits over long-term costs), cost-effectiveness analysis asks what the most efficient pathway is to a defined outcome. In the case of climate policy, this outcome would be the long-term temperature goals of the Paris Agreement and the limiting of cumulative emissions (Kaufman et al. 2020).

In this context, temporary carbon storage does indeed have value, but this value comes from "optionality." That is, temporarily storing carbon can help slow the rate of warming, and can buy time until permanent mitigation options (like direct air carbon capture with geologic storage) become feasible, and/or a decision is made to extend temporary (e.g., land-based) carbon storage indefinitely.

### 5.1 Temporary crediting

In theory, **the crediting approach best aligned with capturing option value is temporary crediting.** Under temporary crediting, market actors can choose to "rent" temporary carbon storage until permanent mitigation becomes feasible (replacing temporary credits with permanent ones), or continue to meet their obligations indefinitely through ongoing rental payments to carbon reservoir owners (Bigsby 2009; Marland et al. 2001; Sedjo and Marland 2003). Contrary to what the authors of Annex 6 suggest, temporary crediting does *not* require specification of a time horizon or discount rate (Annex 6, paragraphs 130-131). Under this approach, credits may be issued for each tonne of enhanced or preserved carbon storage achieved by a mitigation activity – and reissued upon expiry for each of those tonnes that remain stored over time. Applying crediting ratios based on "equivalence of the marginal cumulative radiative forcing" (Annex 6, paragraph 131((b)) would be wholly superfluous.

The prices paid for temporary credits will depend on market actors' assessment of the cost and feasibility of permanent mitigation, along with the reversal risk associated with different storage options. All else equal, mitigation options with lower reversibility risk will appear more cost-effective. Temporary crediting approaches have the added benefit of generating a stream of payments to reservoir owners, helping to incentivize ongoing maintenance – a potentially superior approach compared to imposing long-term obligations after a single upfront payment.[1]

In practice, temporary crediting as adopted under the Clean Development Mechanism faced challenges, largely because there was little demand for temporary storage under the Kyoto Protocol's market mechanisms. In the context of a robust international market for achieving net zero emissions by midcentury, however, the value of temporary storage should be much greater.

### 5.2 Monitoring and compensation approaches

Another workable option is **monitoring and compensation approaches**, or what Annex 5 and 6 refer to as "tonne-based crediting" methods (Annex 5, paragraph 4(d)(ii); Annex 6, section 4.5.3.3.) These

[1] Tonne-year accounting also provides for an ongoing stream of revenue associated with stored carbon, but not directly for the maintenance of the carbon. Under the tonne-year approach discussed in Annex 6, ongoing payments per tonne would in fact decline over time, reducing the incentive to avoid reversals.

approaches are not ideal, because they still depend on specifying a "permanence period," which in practical terms cannot be forever (Annex 6, paragraph 98). However, they are not premised on the idea of equating arbitrarily short carbon storage periods with permanent mitigation. Instead, credits are issued only if there are credible guarantees to *compensate* for reversals if they occur at any point during the permanence period.

A key question for monitoring and compensation approaches is how long the permanence period should be, given that a finite commitment creates an open-ended liability at the end of the period. As Murray et al. (2012) put it:

> [a finite permanence period] implicitly creates a societal obligation to deal with the accumulated terrestrial carbon reservoirs whenever the current policy period ends… [Under monitoring and compensation approaches], future policy decisions will presumably need to address whether to pay for continued carbon storage, impose obligations on landowners to continue carbon storage, or make up any subsequent reversals with further de-carbonization efforts (replacement). Thus, the issue is deferred rather than avoided altogether.

Different carbon crediting programs have advanced a variety of justifications for shorter or longer permanence periods. As noted above, rationales based on expectations about when global decarbonization will be achieved are untenable. While there is no scientific answer, a general rule of thumb is "the longer, the better." From a policy perspective, a main goal of having long-term commitments is to reflect the carrying cost of maintaining permanence in the price of a carbon credit. This at least ensures that carbon markets will allocate mitigation investments efficiently, even if reversible mitigation carries an open-ended liability. From a private investment perspective, an obligation to compensate for reversals for 100 years approximates an indefinite commitment, even at low financial discount rates. By contrast, if the permanence period is only 20 years, the cost borne by market actors will be significantly less than the actual cost of maintaining carbon indefinitely. This may lead to more investment in reversible mitigation than would be optimal under a cost-effective approach to achieving the goals of the Paris Agreement.

Notably, tonne-year approaches inherently fail to internalize maintenance costs, since reservoir owners can essentially "walk away" from a mitigation activity at any time, without any penalty for ensuing reversals. Given the significant climate and sustainable development risks associated with over-relying on land-based removals in particular (Dooley and Kartha 2018), policymakers should take pains to avoid approaches that make temporary carbon storage appear more cost-effective than it actually is.

## 6. Evaluating options against the Article 6.4 rules, modalities, and procedures

Unfortunately, the significant conceptual mischaracterizations in Annexes 5 and 6 of all three options for crediting temporary carbon storage – tonne-year accounting, temporary crediting, and monitoring and compensation – lead to some inaccurate conclusions about how well these options align with criteria specified in the Article 6.4 rules, modalities, and procedures (RMP).

A particular source of error is the flawed notion that permanent mitigation equates to "carbon storage for 100 years." For both $CO_2$ emission reductions and removals, the mitigation value consists of their contribution to staying within a global carbon budget. This value is achieved at the time a reduction or removal occurs. The value is negated if, later, the emission reduction or removal is reversed. The conflation in Annexes 5 and 6 of "permanent" mitigation with the duration of carbon storage leads to confounding results when evaluating options against the RMP. Below, we respond to each of the criteria – and associated assessments – presented in Table 4 of Annex 6.

| Criterion from Annex 6, Table 4 | Temporary crediting | Tonne-year crediting | Tonne-based crediting |
|---|---|---|---|
| Real | Contrary to what Annex 6 asserts, temporary credits represent "real" mitigation in the sense that they are issued for *ex post* verified $CO_2$ removals or emission reductions.<br><br>The idea that these credits are not issued "after the actual mitigation is achieved" is based on the faulty premise that "actual mitigation" is based on storage duration, not the reduction or removal itself. While it is important for the mitigation to not be reversed, it is nonsensical to assert that an actual, verified reduction or removal is not "real" mitigation. | Under tonne-year crediting, credits are indeed issued after mitigation has been achieved. Again, however, the "mitigation" is the emission reduction or removals itself, not the "reduction/removal + years of storage." | Under tonne-based crediting, credits are issued *ex post*, after emission reductions or removals have been verified. Again, the idea that these credits are issued *ex ante* (asserted in Annex 6) is based on a conceptually flawed definition of "mitigation." (The discussion in Annex 6 tacitly admits this, in comparing tonne based crediting of removals with crediting of other forms of mitigation.) |
| Transparent | The basis for issuing a temporary credit is the same basis for issuing any type of carbon credit, i.e., 1 credit issued for 1 tonne of $CO_2$-equivalent reductions or removals achieved. This has been the convention in carbon markets since their inception. To say this basis is "not transparent" defies any common understanding of what carbon credits represent. | Transparency is to some extent subjective, but to assert that the basis for tonne-year credits is transparent because "anyone can reproduce the calculations" is far-fetched at best. In the example presented in Annex 6, Figure 3 and Table 2, the multi-decimal ratios used to issue credits are derived from a convoluted combination of atmospheric $CO_2$ decay functions with an arbitrary range of economic discount rates.<br><br>The idea that "1 credit = 1 tonne" is easy to understand and transparent. | The discussion here in Annex 6, Table 4 tries to have it both ways. Assumptions of a "permanence period" are not transparent, yet if the permanence period is aligned with the "time horizon," the credits are somehow transparent.<br><br>Again, the basis for transparency should simply be that 1 credit = 1 tonne. This is true for tonne-based crediting just as it is for temporary crediting. The difference is that it is clear that temporary credits represent potentially reversible mitigation |

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| | | By contrast, the tonne-year credits associated with a year 60 reversal in Figure 3 are based on the idea that "1 credit = the stacked fractional 'mitigation value' of several physical tonnes worth of stored $CO_2$, equivalent to the cumulative radiative forcing avoided over 60 years compared to an arbitrary 100-year time horizon, combined with an economic discount rate applied to the cumulative radiative forcing avoided." To any reasonable observer, this is not remotely "transparent." | (hence their temporary nature). Under the tonne-based approach, this may not always be clear. **Transparency could be improved by requiring these credits to be tagged with information about the date on which the commitment to monitor and compensate for reversals ends.** |
| Conservative | Conservativeness can be interpreted in different ways. To the extent that temporary crediting requires ongoing replacement of credits over time regardless of whether reversals have actually occurred – and does not create any open-ended liabilities with respect to future reversals – the approach can be seen as conservative.<br><br>The discussion in Annex 6 is correct to note that successful application of this approach requires an enforceable obligation on credit users to replace credits (including in voluntary contexts). But that does not mean the approach is itself not conservative. | The discussion in Annex 6, Table 4 here confuses baseline uncertainty and conservativeness with the conservativeness of tonne-years as a crediting approach.<br><br>In any case, to the extent tonne-year crediting equates arbitrarily short carbon storage periods with permanent mitigation – an equivalence at odds with the science of achieving long-term temperature stabilization – it is not at all conservative. | The discussion in Annex 6 is essentially correct that the conservativeness of tonne-based crediting is directly correlated to the length of the "permanence period" adopted – i.e., the length of time over which monitoring and compensation for reversals will be implemented. However, it should be noted that tonne-based crediting is less conservative than temporary crediting regardless of the length of the permanence period, because it still allows for open-ended liability related to future reversals after the period ends.<br><br>The discussion of baseline uncertainty here is irrelevant (it would apply |

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| | | | regardless of the crediting approach or whether a mitigation activity involves reversible mitigation.) |
| Credible | It is not at all clear here why the Annex 6 authors believe the "credibility of [temporary credits] is low." To the extent that the temporary nature of the credits signifies the potential reversibility of the mitigation achieved, these credits should be seen as highly credible.<br><br>The overall credibility of this approach, however, depends on the credibility of institutional guarantees and ongoing enforcement to ensure that credits are replaced upon expiry. | The scientifically unjustified practice of equating arbitrarily short carbon storage periods with "permanent" mitigation is not credible. | As discussed above in section 5.2, the credibility of this approach should be judged by the degree to which it internalizes the carrying cost of maintaining carbon storage indefinitely. The longer the commitment period, the more credible this approach is – leaving aside the open-ended liability created at the end of the commitment period.<br><br>As with temporary crediting, however, credibility also depends on institutional guarantees and ongoing enforcement to ensure that reversals are compensated. |
| Additionality | The discussion here in Annex 6 is full of unstated (and questionable) assumptions about credit prices and incentive structures for activities of different scale and duration.<br><br>In any case, questions of additionality are somewhat orthogonal to the crediting approach. The question is whether the crediting approach alters incentives in a way that could increase risk of non-additionality. This could be a risk for temporary crediting, because it turns what would be a single upfront payment into a stream of payments, | Tonne-year crediting could entail higher non-additionality risk than other approaches, because it credits carbon storage over arbitrarily short time periods. For example, because no long-term commitment is involved, and neither credit buyers nor sellers face any liability for reversals, there could be an increased risk of proponents enrolling short-term "business-as-usual" growth and harvesting activities. | Non-additionality risk may be comparatively lower under tonne-based crediting approaches because of the long-term commitments involved, which may deviate from business-as-usual activity. However, the decrease in risk would be at least somewhat proportional to the length of the commitment period. |

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| | potentially weakening the incentive for truly additional activities (although in a robust market, future payment streams could be monetized upfront). As with all carbon crediting approaches, robust additionality tests would be needed. | | |
| Avoid leakage | Leakage risk would not be affected by the crediting approach used. | | |
| Encourage broad participation | The discussion here in Annex 6 is generally accurate. Note, however, that aggregation approaches are possible under all three crediting options. | | |
| Recognize suppressed demand | The type of crediting approach used has no bearing on recognition of suppressed demand. | | |
| Address reversals | The discussion here in Annex 6 is premised on some debatable assumptions. The reference to Annex I parties is obsolete and specific to temporary crediting as practiced under the CDM. As a general approach to crediting reversible mitigation, temporary crediting fully covers reversal risk. It is true that this requires governance and enforcement to ensure that all credit users (e.g., Parties or voluntary actors) replace credits upon their expiry. This holds true regardless of the crediting period for a particular mitigation activity. The obligation to replace credits should extend indefinitely, or until credits are replaced with permanent mitigation. | As the discussion in Annex 6 here flatly concedes, tonne-year crediting is premised on the idea that reversals do not *need* to be addressed. As explained above, this simply cannot be reconciled with the Paris Agreement's long-term temperature goals. Tonne-year crediting therefore does not meet this criterion of the RMP. | The discussion in Annex 6 here is accurate as far as it goes. As explained above, however, tonne-based crediting still allows for open-ended liability for reversals after the permanence period expires. Thus, what the authors of Annex 6 refer to as "exceptional" cases should really be thought of as inevitable. Tonne-based crediting addresses reversals by ensuring compensation for a finite period, but needs to be undertaken with full recognition of these longer-term liabilities. |

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