Climate Policy

ISSN: 1469-3062 (Print) 1752-7457 (Online) Journal homepage: https://www.tandfonline.com/loi/tcpo20

Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement

Axel Michaelowa, Lukas Hermwille, Wolfgang Obergassel & Sonja Butzengeiger

To cite this article: Axel Michaelowa, Lukas Hermwille, Wolfgang Obergassel & Sonja Butzengeiger (2019) Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement, Climate Policy, 19:10, 1211-1224, DOI: 10.1080/14693062.2019.1628695

To link to this article: https://doi.org/10.1080/14693062.2019.1628695

Published online: 13 Jun 2019.

CLIMATE POLICY
2019, VOL. 19, NO. 10, 1211–1224
https://doi.org/10.1080/14693062.2019.1628695

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement

Axel Michaelowa [a,b], Lukas Hermwille [c,d], Wolfgang Obergassel[c] and Sonja Butzengeiger[a]

[a]Perspectives Climate Research, Freiburg, Germany; [b]Department of Political Science, University of Zurich, Zürich, Switzerland; [c]Wuppertal Institute for Climate, Environment and Energy, Wuppertal, Germany; [d]Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, Amsterdam, Netherlands

ABSTRACT

The Paris Agreement requires mitigation contributions from all Parties. Therefore, the determination of additionality of activities under the market mechanisms of its Article 6 will need to be revisited. This paper provides recommendations on how to operationalize additionality under Article 6. We first review generic definitions of additionality and current approaches for testing of additionality before discussing under which conditions additionality testing of specific activities or policies is still necessary under the new context of the Paris Agreement, that is, in order to prevent increases of global emissions. We argue that the possibility of 'hot air' generation under nationally-determined contributions (NDCs) requires an independent check of the NDC's ambition. If the NDC of the transferring country does contain 'hot air', or if the transferred emission reductions are not covered by the NDC, a dedicated additionality test should be required. While additionality tests of projects and programmes could continue to be done through investment analysis, for policy instruments new approaches are required. They should be differentiated according to type of policy instrument. For regulation, we suggest calculating the resulting pay-back period for technology users. If the regulation generates investments exceeding a payback period threshold, it could be deemed additional. Similarly, carbon pricing policies that generate a carbon price exceeding a threshold could qualify; for trading schemes an absence of over-allocation needs to be shown. The threshold should be differentiated according to country categories and rise over time.

Key policy insights

- Without additionality testing, market mechanisms under the Paris Agreements might lead to an international diffusion of 'hot air'. To avoid this, an independent assessment of NDC ambition is in order. Otherwise, activities under the mechanisms need to undergo specific additionality tests.
- Additionality testing of projects and programmes should build on the experience developed under the Kyoto Protocol mechanisms.
- Bold approaches are needed for assessing additionality of policies. To avoid cumbersome assessment of all activities triggered by such policies, highly aggregated approaches are suggested, ranging from payback period thresholds for technologies mandated by regulation to minimum price levels triggered by carbon pricing policies. Over time, the stringency of threshold values should increase.

ARTICLE HISTORY
Received 14 August 2018
Accepted 4 June 2019

KEYWORDS
UNFCCC; Paris Agreement; market-based mechanisms; carbon markets; additionality; environmental integrity

CONTACT Lukas Hermwille lukas.hermwille@wupperinst.org Wuppertal Institute for Climate, Environment and Energy, Döppersberg 19, Wuppertal, 42103, Germany; Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, De Boelelaan 1085, Amsterdam, 1081 HV, Netherlands

This article has been republished with minor changes. These changes do not impact the academic content of the article.

1. Introduction

The Paris Agreement (UNFCCC, 2016b) has brought about a sea change in global climate governance. Two aspects are particularly important. Firstly, achieving the long-term goals of the Paris Agreement, in particular the well below 2°C limit (Article 2.1a) and the goal to achieve greenhouse gas neutrality in the second half of this century (Article 4.1), will require a fundamental transformation of our economies and societies (Hermwille, 2016; Kinley, 2017; Kuramochi et al., 2018; Obergassel et al., 2016). Secondly, the Paris Agreement is universal, without a fundamental legal differentiation between developed and developing countries. All countries alike have an obligation to develop and communicate increasingly more ambitious Nationally Determined Contributions (NDCs) for mitigation. While there is no legal obligation to actually achieve the mitigation goals defined by the NDCs, countries are obliged to 'pursue domestic mitigation measures', with the aim of achieving their NDC objectives (Article 4.2).

Article 6 of the Paris Agreement enables Parties to cooperate in the implementation of their NDCs in order to 'allow for higher ambition (…) and to promote sustainable development and environmental integrity' (Article 6.1). It does so by specifying two avenues:

- Article 6.4 establishes a new mechanism 'to contribute to the mitigation of greenhouse gas emissions and support sustainable development'. This mechanism will be subject to international oversight and, at the time of writing, formal modalities and procedures are being negotiated.
- Article 6.2 allows countries to voluntarily engage in 'cooperative approaches that involve the use of internationally transferred mitigation outcomes [ITMOs] towards nationally determined contributions'. While a set of guidelines is being developed at the time of writing, Article 6.2 envisages no formal international oversight.

While such market-based mechanisms can be effective mitigation instruments, they can also threaten the integrity and efficacy of global climate action if used inappropriately.

Additionality has become a key concept in order to ensure that inappropriate use is avoided or at least minimized. In a nutshell, the concept requires any mitigation activity that is considered for a market-based mechanism to demonstrate that the corresponding emission reductions would not have happened in the absence of the support from the market-based mechanism. Additionality is key to ensuring that no fictitious carbon units, i.e. units that do not represent real emission reductions, compromise global carbon markets. If countries or any other entity use such units to comply with their mitigation obligations (offsetting), this would result in an overall increase of emissions instead of a reduction. Additionality is hence a safeguard for environmental integrity. While the mechanisms established by Articles 6.2 and 6.4 differ substantially from each other, the requirement for environmental integrity mandated by Article 6.1 applies to all mechanisms under Article 6.

The aim of this article is to develop recommendations for how additionality can best be ensured under the new framework conditions established by the Paris Agreement. We take into consideration earlier work by Fuessler, Herren, Kollmuss, Lazarus, and Schneider (2014) who discuss the link between stringency of NDCs and baseline setting as well as additionality determination on a 'micro' basis, and go beyond Schneider and La Hoz Theuer (2019), who discuss generic approaches for ensuring environmental integrity under Article 6, but do not provide concrete recommendations on additionality determination. Our paper should be seen as companion to Müller and Michaelowa (2019) who discuss accounting under Article 6, La Hoz Theuer, Schneider, and Broekhoff (2019) who propose to address the risk of 'hot air' transfers through limits to international transfers (which we think can be avoided by credible additionality testing), and Spalding-Fecher, Sammut, Broekhoff, and Füssler (2017) who were the first to address methodological details regarding crediting of policy instruments.

One key difference between Paris Agreement Article 6 and the mechanisms under the Kyoto Protocol is that projects/programmes under the latter did not have to take into account new national mitigation policies involving financial support for their additionality determination (UNFCCC, 2010a, 2010b).[1] The dynamic nature of the Paris Agreement, however, and the mandate to increase ambition over time, suggest that this practice cannot continue.

The article will therefore first take a step back and review generic definitions of additionality (Section 2). Section 3 asks what can be considered an appropriate baseline against which to determine additionality. The NDCs are a natural starting point, but as we shall demonstrate there are severe limitations to this approach. Subsequently, in Section 4, we propose a stepwise procedure for assessing whether additionality needs to be tested, or whether the NDC is seen as going beyond 'business as usual'. Section 5 discusses how a robust business as usual determination at the national level could look like. Section 6 finally operationalizes various approaches for additionality demonstration at different scales of action – projects, programmes and different types of policies. Section 7 concludes.

2. Generic definition of additionality

2.1. The core concept of additionality

The Oxford Dictionary defines 'additional' as 'added, extra, or supplementary to what is already present or available.' No common understanding of the precise meaning of additionality and how it can be implemented most effectively has yet been achieved in the climate change and development communities despite over two decades of debate. There is a wide body of literature discussing additionality (see e.g. Gillenwater, 2012 and Schneider & La Hoz Theuer, 2019 for an overview) which we will draw upon regarding specific conceptual issues.

At a basic conceptual level 'additionality is about assessing causation. It is about deciding if a proposed activity is being caused to happen by a policy intervention' (Gillenwater, 2012, p. 3). Looking at a basic definition, a cause 'is the sum total of the conditions positive and negative taken together … which being realized, the consequent invariably follows' (Mill cited in Davidson, 1967, p. 692). However, when assessing additionality in the context of market-based mitigation, it is impractical to take into account 'the sum total' of potentially infinite necessary conditions, even the most circumstantial ones. Instead, assessing additionality requires identifying unmet necessary conditions which by means of the respective policy intervention will be resolved. This requires assessing (1) whether the respective policy intervention in principle addresses the unmet condition and (2) whether it is fit to resolve the deficit.

At the root of this is a fundamental dilemma. The first component of this dilemma is to identify unmet conditions. The larger the deficit, the easier it is to identify with confidence an unmet condition. However, the larger the deficit, the more powerful a policy intervention must be to be able to make a significant contribution to remedying the same deficit. The same is true vice-versa: in cases where a condition is just short of being met, it is fairly easy to demonstrate that the policy intervention can actually contribute to crossing the threshold. However, given that there is typically no clearly defined threshold, it may be challenging to determine whether the condition is actually met or unmet in the first place. This is compounded by the general problem of the unobservable counterfactual and multiple factors influencing human behaviour (Gillenwater, 2012).

2.2. Additionality in practice

We now move from the conceptual to the practical level of additionality assessments. Of particular interest are approaches that look at the properties of an individual project and assess whether the project's output is additional. In order to assess such 'project additionality', a baseline scenario (also called a business-as-usual (BAU) scenario or reference scenario) and a project scenario need to be developed. Key aspects of 'project additionality' are related to the financial elements. Investment additionality, for example, is deemed to be satisfied if the profitability of a climate project is lower than in the BAU case or when it is lower than a pre-defined hurdle rate (e.g. with regard to internal rate of return or payback period) (Greiner & Michaelowa, 2003). An alternative, standardized approach to project additionality is to check whether the technology is not used to a significant degree in the BAU case (World Bank et al., 2004). Here, standardized parameters such as market penetration rate thresholds have been proposed (Kartha, Lazarus, & LeFranc, 2005) and later used under the Clean Development Mechanism (CDM).

An early literature review of baselines and various approaches for selecting the right baseline scenario is provided by Michaelowa and Fages (1999) and Gustavsson et al. (2000). Additionality in relation to a single economically rational investor is analysed by Bode and Michaelowa (2003). Gillenwater (2012) highlights that reliance

on expert judgments for additionality assessments is not inherently problematic if judgment biases are handled appropriately. What is clearly problematic are unclear and disputed definitions of additionality and baselines, as biased private assumptions will then flow into the assessments.

As project developers have an incentive to game the parameters in order to gain more emission units (Michaelowa, 1998a), testing of 'project additionality' is generally difficult. Although the different investment-related additionality tests discussed above are labour- and cost-intensive, they are more accurate than the barrier tests that were used in the early days of the CDM, where project developers described qualitatively which barriers would prevent the implementation of their activities (SEI, 2011).

All these concepts were combined in the additionality test procedures under the CDM where, for large projects, investment testing was the method of choice after initial problems with barrier testing. Attempts to introduce performance benchmarks as a replacement for investment testing stalled as it became clear that such benchmarks can only be applied in very homogeneous (sub)-sectors. In the last years, for small-scale projects, more and more standardized approaches (such as positive lists of project types automatically deemed as additional) have emerged. However, positive lists – which are also used widely on the voluntary carbon markets – are a very crude instrument that cannot convincingly check additionality of technologies whose economic attractiveness can differ significantly. For example, despite the recent cost decrease of solar PV, which makes it the lowest cost power generation option under many circumstances, the CDM Executive Board could not agree to remove it from the positive list.

Recently, the new concepts of 'paradigm shift' and 'transformational change' have emerged (Boodoo, Mersmann, & Olsen, 2018; Mersmann & Wehnert, 2015; Olsen & Fenhann, 2015), posing additional challenges to the concept of additionality. The questions implied in additionality are: What is BAU? And how does the proposed activity go beyond BAU? Whereas the questions to ask to assess transformational change are: What ought to become BAU? And how can the project/activity help get us there? In that sense assessing the transformational potential of a proposed activity tries to assess whether it serves as a leg-up to a transformational development pathway. Potentially, this kind of thinking could complement or even substitute additionality demonstration. However, operationalizing the transformational change criterion has proved to be challenging (see for example ICAT, 2017).

3. The trouble with NDCs

A key challenge under the new Paris Agreement framework is that the determination of whether or not activities are additional will need to take into account existing and new mitigation efforts of the host countries. The term 'baseline' is of central interest here. However, the term can refer to three different but potentially overlapping concepts which must not be confused: Firstly, in the context of additionality determination for credited activities, 'baseline' refers to a reference scenario against which additionality of the activity is assessed. In relation to the definition of additionality cited in Section 2.1, the baseline represents 'what is already present or available'; Secondly, many market-based mitigation instruments also require a *crediting baseline* or *baseline emissions* to determine the amount of emission reductions or avoided emissions. This crediting baseline may not necessarily be identical to the reference scenario applied for additionality determination; Finally, 'baseline' may refer to country-level or sectoral BAU emission projections used in the context of an NDC, and not related to a specific activity.

Historically, a project-specific BAU scenario has often been used as an activity baseline. However, under the Paris Agreement, all parties are obliged to develop NDCs and to increase the level of ambition over time (Article 4.3). Using BAU as baseline is hardly compatible with the requirement to increase ambition. This section explores what alternatives may exist.

The first reference point for exploring this issue is the countries' NDC targets. But in many cases, using the NDC targets and corresponding policies and measures as a reference level for additionality determination cannot be considered sufficient for both practical and political reasons. The first round of (intended) NDCs prepared in the run-up to the 21st Conference of the Parties (COP 21) in 2015 in Paris displays a great diversity in terms of the types of mitigation contributions/targets, time frames and reference years included, and essentially every aspect of these (UNFCCC, 2016a). At the previous COP 20 in Lima in 2014, negotiations on a common

format and information requirements for (i)NDCs had failed (Ott et al., 2014). The resulting disparate structure with very different types of mitigation pledges – ranging from economy-wide, absolute multi-year emission budgets to lists of sub-sectoral activities whose outcomes are not framed in GHG-related terms – and the resulting lack of clarity and comparability of NDCs makes for a difficult assessment of what is 'extra' and what is not. This remains the case after the decisions taken at COP 24 in Katowice in 2018 on the 'Paris Rulebook'.

The level of ambition is an even more fundamental problem. If one applied the approach used by Joint Implementation (JI) under the Kyoto Protocol, the NDC emission target defines the emissions level from which emissions credits are deducted, assumed to be below the country-level BAU. There is no direct link between the emissions level of the NDC and the micro-level baseline for creation of emissions credits by an activity. In theory, project-level additionality demonstration could be waived, as no government would have an incentive to sell non-additional mitigation. It is important to stress that, in this case, crediting of non-additional activities would not lead to an increase of global emissions. However, if BAU emission projections of NDCs are overestimated, that is, a higher than realistic level of emissions is assumed (intentionally or not) and the NDC target is less ambitious than the 'real' BAU, global emissions would increase through crediting of non-additional activities. This risk is real, as shown during the first commitment period of the Kyoto Protocol. Here, in the case of JI, the economic downturn and corresponding reduction of emissions experienced by the states of the former Soviet Union led to huge amounts of 'hot air'[2] compared to the former BAU projection. Kollmuss, Schneider, and Zhezherin (2015) conclude that the environmental integrity of 80% of emission reduction units issued under JI is questionable, and that JI may consequently have enabled global greenhouse gas emissions to be about 600 million tCO_2e higher than they would have otherwise been. The 'hot air' issue has resurfaced also under the Paris Agreement. Schneider et al. (2017) found that the current round of NDCs contain a considerable potential of 2.2–3.5 Gt CO_2eq of 'hot air', mainly by BAU overestimation and targets that are less stringent than the real BAU. However, ambitious NDCs also exist so the critical question is to differentiate between 'hot air' generating NDCs and ambitious ones.

Many NDCs put forward by developing countries include an unconditional component (to be met with domestic resources) and a more ambitious, conditional one (requiring support through international finance). An important question now is whether the more stringent conditional NDC target, or the less stringent unconditional one, should be used as baseline. Should this depend on the actual availability of international climate finance? The problem is that this will only be known ex post, and thus such a rule could not be applied ex ante. What is the situation for those countries where support is explicitly expected to be generated and channelled through market-based cooperative climate action (Obergassel & Gornik, 2015)? This again suggests that the unconditional target should represent the baseline. However, no easy solution is in sight for those countries that did not indicate what part of the NDC is supposed to be achieved unconditionally and which part may be contingent on financial flows from developed countries. In such cases, it might be possible to consider the actual policies and measures implemented in the context of the NDC as the baseline, i.e. the emissions level that will (likely) be achieved with those policies and measures. It might be argued that the actual emission levels can only be determined ex-post, but of course reasonable estimates could be applied, including sensitivity analysis for key parameters. However, this might be considered unfair given that the level of ambition of NDCs varies significantly (see discussion above).

Given that the first round of NDCs falls far short of the ambition set out in Article 4.3 – a point explicitly 'noted with concern' in the decision adopting the Paris Agreement (Fawcett et al., 2015; UNFCCC, 2016c, para. 17, see also 2016a) – it could be argued that project-level additionality testing should only be waived if NDC targets are consistent with a well below 2°C or even 1.5°C pathway. While this may be theoretically compelling, it is methodologically challenging. Who is to determine what such a pathway should look like? It is also politically challenging, because NDCs are deliberately and explicitly nationally determined. It is hardly plausible that Parties would accept an independent assessment, a top-down imposed benchmark that goes beyond what they have determined for themselves as a sovereign nation. What is more, a 2°C – let alone a 1.5°C – pathway would most likely be so aggressive and ambitious that there is virtually no mitigation potential left that could be transferred to another country. The most stringent macro baseline against which to assess additionality is a country's 'highest possible ambition', as required by the Paris Agreement (Article 4.3). Narrowly interpreted, it would mean that there is nothing that is additional. However, this seems neither realistic nor practical, especially

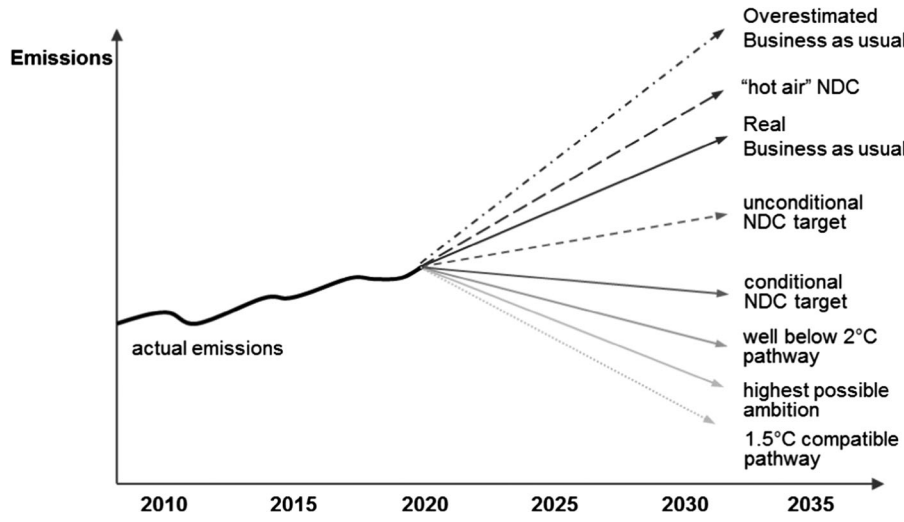

Figure 1. Illustration of various potential reference levels for additionality determination.

given that the interpretation of 'highest possible' may have many shades and depend on the country-specific political economy of climate change mitigation (Figure 1).

A further problem is that only a minority of countries have expressed their NDC targets encompassing all sectors and all GHGs. Approximately 6.1 Gt CO_2eq corresponding to 12–14% of projected emissions in 2030 are not covered by targets under current NDCs (Schneider et al., 2017).

These emission sources are principally outside of the Paris mitigation system and – like for developing countries under the Kyoto Protocol – there is no inherent incentive for host countries to ensure the additionality of activities. The additionality of emission credits or ITMOs from mitigation in sectors not covered by NDCs should therefore be ensured by testing at the activity level.

The situation gets more complex if and when non-covered sectors are brought 'under' an NDC through future revisions of NDCs. This would lead to a situation where the seller country needs to decide whether to continue selling the credits or to use the mitigation to reach the NDC target. This situation would lead to a loss of revenue for the seller country, and therefore it has been argued that it provides a negative incentive to expand the NDC coverage.

4. A stepwise procedure for additionality testing depending on NDC ambition

Despite the difficulties with using NDCs as reference for additionality determination, there is probably no way around doing so. NDCs are fundamental to the Paris Agreement. Any approach for additionality determination has to find a pragmatic approach to deal with NDCs and their deficiencies. Following the discussion in Section 3, it can be argued that either NDCs must be tested for the adequacy of their baseline definition and ambition level, or additionality-testing must be conducted for all activities individually.

However, additionality testing at the activity level is often technically challenging and associated with high transaction costs. Under which circumstances could such testing be waived? In this section a generic, stepwise decision-making procedure (see Figure 2 below) is proposed, followed by consideration of the central element of the procedure, namely, centralized additionality testing.

The first step of the procedure assesses whether the activity is covered by the NDC or not. If this is the case, the first precondition for a waiver of additionality testing is fulfilled, but then further conditions need to be checked that are related to the 'hot air' risk. The second condition is that there is an external check of the realism of BAU estimation and a frequent update of this estimate. If this condition is fulfilled, the final check looks at whether the NDC contains 'hot air', or not. Only if the latter is confirmed, can additionality testing be waived.

We now look at each of the steps in detail.

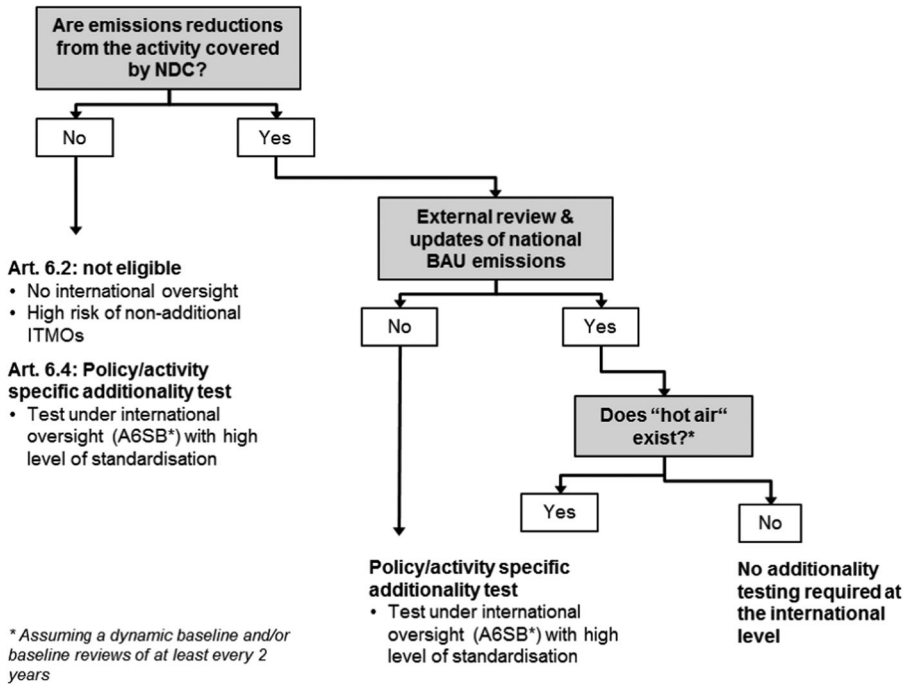

Figure 2. Decision making tree for additionality testing of Article 6.2 and 6.4 activities. *A6SB = Article 6 Supervisory Body (see section below).

As discussed in Section 3 above, the additionality of emission reductions that are outside of the Paris mitigation system should be assessed at the activity level. Therefore, we need to check whether the activity's emissions are within the scope of the NDC target. Depending on the degree of international oversight, Article 6.2 and 6.4 activities may have to be treated differently.

If Article 6.2 is devoid of international oversight, the risk of governments agreeing on a transfer of non-additional units is very high, as shown by the experience from JI highlighted above. Thus, we recommend that activities in sectors outside of NDCs not be eligible under Article 6.2.

Article 6.4 activities will be subject to international oversight in a way similar to the CDM, raising the possibility of mandating stringent additionality rules for activities outside NDCs, as further laid out below. It should be noted that international oversight does not necessarily guarantee environmental integrity. There is a substantial body of research that finds that the additionality of many projects approved under the CDM is questionable, despite its extensive system of international oversight (see e.g. Schneider, 2009; Spalding-Fecher et al., 2012). Still, international oversight at least increases the chance of ensuring a minimum level of quality. The further development of the Article 6 rules provides an opportunity to learn from the experiences of the Kyoto Protocol mechanisms.

Given the risk of 'hot air' transfers, a system of external reviews of BAU emission projections and NDC ambition by an international body should be established. We propose a new 'Article 6 Supervisory Board' (A6SB) that would be reporting to the Parties of the Paris Agreement. This can be done either for the entire NDC scope or for specific sectors depending on the scope of, and information contained in, the NDC.

If a country agrees to such an external review and the review finds that the NDC generates 'hot air', we suggest that activity-specific additionality testing (see Section 5) is required. If projected NDC emissions are lower or, at most, as high, as projected BAU emissions, then the need for additionality testing at the international level might be waived as the country would have an incentive to allow only exports of actual emission reductions. Even if an activity is not additional, the host country would still have to compensate for this by making corresponding adjustments to its own emissions accounting, thereby ensuring integrity. If a country refuses the external review, then for any Article 6.2 and 6.4 action, we consider that an activity-specific additionality test is inevitable for safeguarding the mechanisms' integrity. Such activity-specific additionality testing will

be dealt with in Section 6. We now discuss the key challenges encountered in BAU determination and ways to address them.

5. Challenges in BAU determination and how to deal with them

Defining BAU at the country level could make use of economic/energy modelling, which has been routinely done in the past. The problem is that BAU forecasts strongly depend on the assumptions used and have often proven remarkably off the mark, especially if they cover long time periods. This is due to unforeseen changes in technology that influence prices of different fuels and types of energy, shifting shares of economic sectors in the total economy, as well as unexpected economic crises. The former is illustrated nicely through the unexpected reduction in costs of solar photovoltaics, which have made that technology competitive much earlier than expected only a few years ago. The latter is illustrated by the financial and economic crisis of 2008, which led to much lower levels of industrial production for a number of years than projected before 2008. This wreaked havoc in the EU emissions trading scheme because the allocation of allowances had been made on the basis of the pre-2008 forecasts, and thus the system became heavily overallocated.

Simplified approaches for country-level BAU determination proposed in the past (see the discussion in Danish Energy Agency et al., 2013) include:

- Extrapolation of historical emissions trends. This approach suffers from its inability to consider surprises (see discussion in the preceding paragraph). It would thus be appropriate in the short, but not the long term, and only until a 'surprise' has manifested itself;
- Use of benchmarks (e.g. t CO_2e/USD GDP) that can initially be derived through economic modelling as well as technology-specific studies (Holz, Kartha, & Athanasiou, 2018). This suffers from the challenge of disaggregation. A unique benchmark for all countries cannot take into account differences in country factor endowments, renewable energy potential, economic structure etc. Taking each country's unique situation into account would lead to a country-specific benchmark, which would require country-specific studies and, hence, time, resources and effort.

A possible solution to the challenge of the increasing inaccuracy of BAU forecasts over longer periods of time is to apply a 'dynamic' baseline approach, where the formula to calculate BAU emissions projections is defined ex-ante, but the parameters that enter the calculation are only quantified ex-post. We suggest testing dynamic baselines during the first revision of the NDCs. Alternatively, country-level BAU estimates should be frequently revised – e.g. at least every two years. If the dynamic baseline shifted in a way that 'hot air' could be generated after the shift, it would mean that additionality testing would have to be undertaken for activities that previously had been exempt.

To bring in an additional layer of complexity, it is necessary to decide whether BAU forecasts are done at a national level or at a sectoral level. Ideally, the calculation of the BAU emission baselines for each sector that will host an Article 6.2 or 6.4 activity would be done in a centralized manner, using the same methodology and approach. Hence, if a Party (voluntarily) made use of Article 6.2 or 6.4, it would (voluntarily) make a request to the A6SB to define its BAU emissions according to a standard methodology. The same standard methodology should ideally be applied to all countries that plan to apply Article 6.2 and 6.4 in that sector, and it should apply as many common parameters (e.g. country-specific population growth, GDP data, emissions intensity factors) as possible.

This centralization of the determination of NDC baseline levels would build on experiences with CDM rules, and would create more trust among all countries that the results are not biased. Determining whether a country's NDC includes 'hot air' implies a judgement of its level of ambition and might therefore be politically sensitive.

6. Additionality tests for different scales of activities

If additionality needs to be determined at the policy/activity level due to the outcome of the stepwise assessment procedure described in Section 4, the approach to be taken is strongly dependent on the scale of an

intervention, which can take the form of a specific project, a programme of activities or a policy instrument. This section discusses various approaches for the different scales.

6.1. Project-based activities and programmes

For project-based activities and programmes, over ten years of experience have been gathered with the Kyoto Protocol Mechanisms. While there is a lot to learn from this experience, there are also limits to the applicability of the tried and tested approaches in the new legal framework of the Paris Agreement, in particular the need to take into account existing and new mitigation policies of the host countries, including NDCs. Also, recent developments have proven the limitations of the existing methods. For example, given the rapid increases in attractiveness of low-carbon technologies, e.g. photovoltaic and wind power plants, doubts have been raised about the additionality of related projects (Cames et al., 2016). Improved additionality tests on the project and programme level should therefore better capture such highly dynamic developments. We suggest that a thorough investment test with standardization of input parameters should be mandatory for all projects and programmes except the very smallest ones.

6.2. Policy instruments

Under the CDM and de facto also under JI, national policy instruments were not eligible for generating emission credits. This may change now under Article 6. With regard to crediting of government policies there is widespread consensus that attributing causality to government policies is highly complex because many different factors – such as social trends, high-level policies and macroeconomics – can influence the programme outcomes (House, 2001; Mayne, 2001; Mohr, 1999; White, 2010). In order to assess the effects attributable solely to the policy instrument itself, it is therefore crucial to find appropriate ways to determine causality (Davidson, 2000). The World Bank's Partnership for Market Readiness (2017) discusses generic approaches for setting sectoral or national-level baselines but does not assess policy additionality. If countries are not willing to prevent 'hot air' generation and thus do not agree on dynamic baselines or frequent updates of BAU projections (at least every 2 years) with standardized procedures as proposed above, the only other option to ensure environmental integrity is to implement policy-specific additionality tests.

We classify policy instruments into the categories of regulation, carbon pricing and direct financial support (e.g. feed-in tariffs or subsidies). There are also other categories of instruments relating to research, information and know-how transfer. However, the impacts of such 'soft' instruments are particularly difficult to assess and will therefore not be further discussed here. For each of the three main categories, we discuss potential inroads to additionality testing. The key criteria applied here are the costs of the mitigation measures triggered by the policies, which can be carried either by the mitigating entities (in the case of regulation or carbon taxes/emissions trading) or by the government budget (in the case of subsidies), and the political economy of the introduction of a policy instrument.

In principle, non-monetary co-benefits of the policies are also relevant. Policies can make political sense even in the absence of climate change concerns as they generate sustainable development co-benefits, such as improved health due to lowered air, water and soil pollution. For example, in China a main reason for introduction of an emission trading scheme is the popular pressure to reduce the extreme levels of urban air pollution (Kahn, 2017). In that case, the policy would be additional once the costs of the scheme exceed the co-benefits. However, it is usually rather difficult to measure and monetize the co-benefits. Moreover, personal experience of one of the authors with the development of over a dozen Nationally Appropriate Mitigation Actions (NAMAs) in developing countries between 2010 and 2018 shows that policymakers often do not believe in the actual generation of the co-benefits. We thus do not further pursue the approach of co-benefit testing of policies for additionality assessment.

6.2.1. Regulation

Regulation often addresses mitigation which in principle would be profitable for an entity (so-called economic 'no-regret options') but is not undertaken in the BAU situation due to incentive problems, such as the well-

known 'tenant – owner' dilemma preventing efficiency improvements in buildings, or lack of information about technology performance and failure risk. In contrast to that, carbon pricing aims to alter price ratios and thereby mobilize mitigation that has costs under current market conditions and thus would not be undertaken under BAU even in the absence of information or incentive problems. As far as a country benefits from the mobilization of 'no-regret options' through the removal of incentive-related barriers, such regulatory instruments should in our view not be deemed additional unless real barriers are demonstrated, e.g. access to finance in a particular foreign currency. In cases of regulation that mandates a certain efficiency of a technology, a pragmatic approach would, for example, be to assess the payback period that would lead to investment into that technology.

Academic literature (e.g. Jacobsen & Anderberg, 2005; Liu & Gao, 2016) and industry practice agree that 4–5 years – i.e. an internal rate of return of around 20% per year – would be a typical threshold. While this rate of return is way above interest rates on capital markets, industries apply these high rates due to perceptions of risk. Experience with regulation in industrialized countries shows that opposition by industrial lobby groups is relatively low if regulation harnesses 'no-regret options' but increases steeply if going further (Mathys & de Melo, 2011; Michaelowa, 1998c). We thus propose to introduce a payback period threshold for additionality testing of regulation. In order to increase ambition, the payback period threshold could be lengthened over time, implying more stringent regulatory pressure. It could also be made dependent on regulations practiced in countries of a comparable level of development. Eventually, the threshold could be equivalent to that defined by capital market interest rates.

6.2.2. Carbon pricing

Instruments that generate an explicit or implicit carbon price are diverse, ranging from ETS and offset schemes to carbon taxes. Usually, the stringency of the system is reflected by the price level. However, systems can still have positive prices even if there is no immediate scarcity as shown in the EU ETS when banking of units into the future is allowed.

While carbon pricing schemes can be designed in a way to fully 'recycle' revenues, they will mobilize opposition by those entities that have to pay the carbon price. This is especially the case when the price cannot be 'dodged' as in the context of a carbon tax without exemptions. Thus, historically it has been difficult to introduce carbon taxes that cover the entire economy (see Bruvoll & Larsen, 2004 for Norway). Even in rich and progressive countries like Sweden, it took more than a decade after the introduction of the carbon tax to expand its coverage to industry. In all countries, the initial level of the carbon tax universally was low and could only be increased in steps over time (OECD, 2018).

Similarly, emission trading systems often do not have very stringent caps, which corresponds with a relatively low price level. Almost all current ETS have been overallocated (Hanoteau, 2014; Hermwille, Obergassel, & Arens, 2015; Narassimhan, Gallagher, Koester, & Rivera Alejo, 2018).

We therefore assume that lobbying against a carbon pricing system is proportional to the price level. On this basis we propose a price-threshold system for additionality testing: carbon pricing is not additional in a given country/sector if the average price over more than a year lies below X €/t CO_2. In order to account for national circumstances, in particularly different stages of development, differentiated price thresholds could be determined instead of applying a uniform price threshold across the globe. These thresholds would have to be negotiated and determined at the international level.

But at what level should these thresholds be set? Historical experience shows that carbon prices of up to 10 €/t CO_2 are politically feasible even in emerging economies such as China (ETS), India (coal tax), Chile, Mexico and South Africa (carbon tax) (see price/tax levels in World Bank, 2018; most prices are close to 5 €). Political opposition gets stiff at prices above 15 €/t CO_2 as seen in Australia and the EU; no emerging economy system has a carbon price at that level. Taking this experience as a reference point, carbon pricing thresholds of at least 5 €/t CO_2 for developing countries and 10 €/t CO_2 for developed countries could be warranted. However, as discussed above, current practices cannot be considered as an adequate reference point if we take the 1.5°C goal seriously. Price thresholds would have to be significantly higher and, most importantly, increase over time.

Many stakeholders propose that Article 6.2 should allow generation of ITMOs through linking of ETS. Given the proliferation of overallocated ETS, we propose that for ETS regardless of their price a further test of the initial

allocation is undertaken. ETS with an overallocation would not be seen as additional and could not generate ITMOs.

6.2.3. Direct financial support

Instruments for direct financial support, such as feed-in tariffs for renewable energy or grants for low-carbon investment, are easier to implement than carbon pricing schemes for political economy reasons (Michaelowa, 1998b). Subsidies usually benefit a very specific group of actors that lobbies for the introduction of the subsidies. Historic experiences show interdependency of large-scale mitigation subsidies and sufficiently strong lobby groups on the part of mitigation technology producers. The cases of wind and solar energy in Denmark, Germany (see Michaelowa, 2005 for wind) and Spain are typical.

A similar reasoning applies to grants or public budget allocations to large infrastructure projects where construction lobbies benefit. Classically, investment costs for urban mass rapid transport systems are very high and never justified by climate change mitigation alone (Gruetter, 2007).

Direct financial support instruments can have very different designs so it is not easy to choose a clear indicator for their additionality. A starting point may be to calculate an implicit carbon price and then apply the thresholds defined in the section on carbon pricing above.

7. Conclusions and recommendations

Ensuring that only activities that are truly additional to the host countries' contributions are approved under Article 6 is key to ensuring the environmental integrity of the Paris Agreement. In theory, the host countries should have an incentive not to export non-additional reductions. In practice, many countries' NDCs contain 'hot air'; these countries therefore may not care whether or not activities on their territory are additional, as illustrated by the history of JI.

We therefore recommend that activity-level additionality testing can only be waived if the host country agrees to an independent assessment of its NDC and this assessment finds that the NDC does not contain 'hot air'. If these two conditions are not fulfilled, we recommend specific additionality testing for all activities. The same is the case for activities not covered by the seller's NDC.

If activity-level additionality testing is required, we recommend that additionality testing should be tailored to the type of activity that is proposed. We suggest that ITMOs/emission credits can be generated provided:

(a) Projects pass an investment test with standardized input criteria, comparable to the checking of a loan application by a financial institution.
(b) Programmes pass an investment test (as defined in the preceding criterion) for a typical activity under the programme. In case of significant changes of input criteria over time, the investment test needs to be repeated.
(c) Payback periods for regulation-driven technologies exceed a pre-defined threshold level. The threshold level initially could reflect standard industry practice but be strengthened over time to converge towards capital market interest rates.
(d) Carbon pricing schemes generate a price exceeding predefined thresholds over a certain period of time. Thresholds should be differentiated according to country groups and rise over time.
(e) 'Cap and trade' systems are not overallocated.

Notes

1. This led to an acrimonious debate, with Cames et al. (2016) and He and Morse (2013) arguing that the majority of renewable energy projects under the Kyoto Protocol's Clean Development Mechanism were not additional due to their high economic attractiveness. However, that attractiveness was mainly due to the incentives provided by new national mitigation policies. Interestingly, regulatory policies mandating certain technologies like landfill gas collection always had to be considered in additionality testing as long as they were generally enforced.
2. 'Hot air' is generated when a national emission target is less stringent than the real BAU path. The easiest way to 'produce' 'hot air' is an overestimate of the BAU. A simple example: A country with 2015 emissions of 50 million t CO_2e claims that BAU

emissions for 2030 are 100 million t CO_2e, and then defines an NDC target of 80 million t CO_2e. However, the real BAU for 2030 is just 70 million t CO_2e. In 2030, the country thus creates 10 million t CO_2e of 'hot air'. Russia and Ukraine had Kyoto targets of 0% reduction, while the BAU path was about 40 and 60% below 1990 levels in the 2000s, respectively (Kollmuss et al., 2015).

Acknowledgements

This article builds on research carried out in the context of the projects listed under 'funding'.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

Perspectives Climate Research would like to thank the German Ministry of Education and Research for funding the project 'Transformative Ambitionssteigerung – Der Beitrag effektiver Klimapolitikinstrumente (TABEK)' (01LS1621A) in context of which this article was written. Wuppertal Institute expresses its gratitude to the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety of Germany which funded the research project 'Maßnahmen zur Weiterentwicklung von CDM und Neuen Marktmechanismen' (AZ 45134-8/1.77). University of Zurich acknowledges funding from the Swiss Network for International Studies (SNIS) for the project "Designing Effective Regulation for Carbon Markets at the International, National and Regional Level".

ORCID

Axel Michaelowa http://orcid.org/0000-0001-5053-3700
Lukas Hermwille http://orcid.org/0000-0002-9811-2769

References

Bode, S., & Michaelowa, A. (2003). Avoiding perverse effects of baseline and investment additionality determination in the case of renewable energy projects. *Energy Policy*, *31*, 505–517.
Boodoo, Z., Mersmann, F., & Olsen, K. H. (2018). The implications of how climate funds conceptualize transformational change in developing countries. *Climate and Development*, 1–14. doi:10.1080/17565529.2018.1442788
Bruvoll, A., & Larsen, B. (2004). Greenhouse gas emissions in Norway: Do carbon taxes work? *Energy Policy*, *32*, 493–505.
Cames, M., Harthan, R., Füssler, J., Lazarus, M., Lee, C., Erickson, P., & Spalding-Fecher, R. (2016). *How additional is the clean development mechanism?* Freiburg: OEKO-Institut.
Danish Energy Agency, OECD, UNEP Risø Centre. (2013). *National greenhouse gas emissions baseline scenarios. Learning from experiences in developing countries*. Copenhagen: Danish Energy Agency.
Davidson, D. (1967). Causal relations. *The Journal of Philosophy*, *64*, 691–703.
Davidson, J. (2000). Ascertaining causality in theory-based evaluation. *New Directions for Evaluation*, *87*, 17–26.
Fawcett, A. A., Iyer, G. C., Clarke, L. E., Edmonds, J. A., Hultman, N. E., McJeon, H. C., … Shi, W. (2015). Can Paris pledges avert severe climate change? *Science*, *350*, 1168–1169.
Fuessler, J., Herren, M., Kollmuss, A., Lazarus, M., & Schneider, L. (2014). *Crediting emission reductions in new market based mechanisms – Part II: Additionality assessment & baseline setting under pledges*. Zurich: INFRAS.
Gillenwater, M. (2012). *What is additionality? Part 1: A long standing problem* (Discussion Paper No. 001). Silver Spring, MD: GHG Management Institute.
Greiner, S., & Michaelowa, A. (2003). Defining investment additionality for CDM projects—practical approaches. *Energy Policy*, *31*, 1007–1015.
Gruetter, J. (2007). *The CDM in the transport sector*. Eschborn: GIZ.
Gustavsson, L., Karjalainen, T., Marland, G., Savolainen, I., Schlamadinger, B., & Apps, M. (2000). Project-based greenhouse-gas accounting: Guiding principles with a focus on baselines and additionality. *Energy Policy*, *28*, 935–946.
Hanoteau, J. (2014). Lobbying for carbon permits in Europe. *Louvain Economic Review*, *80*, 61–87.
He, G., & Morse, R. (2013). Addressing carbon offsetters' paradox: Lessons from Chinese wind CDM. *Energy Policy*, *63*, 1051–1055.
Hermwille, L. (2016). Climate change as a transformation challenge. A new climate policy paradigm? *GAIA – Ecological Perspectives for Science and Society*, *25*, 19–22.
Hermwille, L., Obergassel, W., & Arens, C. (2015). The transformative potential of emissions trading. *Carbon Management*, *6*, 261–272.
Holz, C., Kartha, S., & Athanasiou, T. (2018). Fairly sharing 1.5: National fair shares of a 1.5°C-compliant global mitigation effort. *International Environmental Agreements: Politics, Law and Economics*, *18*, 117–134.
House, E. (2001). Unfinished business: Causes and values. *American Journal of Evaluation*, *22*, 309–315.

Initiative for Climate Action Transparency (ICAT). (2017). *Transformational change Guidance, first Draft*. Washington, DC: Author. Retrieved from http://www.climateactiontransparency.org/icat-guidance/transformational-change/

Jacobsen, N., & Anderberg, S. (2005). Understanding the evolution of industrial symbiotic networks: The case of Kalundborg. In M. van den Bergh (Ed.), *Economics of industrial ecology: Materials, structural change, and spatial scales* (pp. 221–236). Cambridge: MIT Press.

Kahn, D. (2017, August 14). *China is about to have the world's biggest carbon market*, Climatewire. Retrieved from https://www.eenews.net/stories/1060058665

Kartha, S., Lazarus, M., & LeFranc, M. (2005). Market penetration metrics: Tools for additionality assessment? *Climate Policy*, *5*, 147–165.

Kinley, R. (2017). Climate change after Paris: From turning point to transformation. *Climate Policy*, *17*, 9–15.

Kollmuss, A., Schneider, L., & Zhezherin, V. (2015). *Has joint implementation reduced GHG emissions? Lessons learned for the design of carbon market mechanisms* (SEI Working Paper No. 2015-07). Stockholm: Stockholm Environment Institute.

Kuramochi, T., Höhne, N., Schaeffer, M., Cantzler, J., Hare, B., Deng, Y., … Blok, K. (2018). Ten key short-term sectoral benchmarks to limit warming to 1.5°C. *Climate Policy*, *18*, 287–305.

La Hoz Theuer, S., Schneider, L., & Broekhoff, D. (2019). When less is more: Limits to international transfers under Article 6 of the Paris Agreement. *Climate Policy*, *19*, 401–413.

Liu, X., & Gao, X. (2016). A survey analysis of low carbon technology diffusion in China's iron & steel industry. *Journal of Cleaner Production*, *129*, 88–101.

Mathys, N., & de Melo, J. (2011). Political economy aspects of climate change mitigation efforts. *The World Economy*, *34*, 1938–1954.

Mayne, J. (2001). Addressing attribution through contribution analysis using performance measures sensibly. *The Canadian Journal of Program Evaluation*, *16*, 1–24.

Mersmann, F., & Wehnert, T. (2015). *Governance and action: Design criteria for transformational climate finance* (Capacity Building for a transformational use of climate finance). Wuppertal: Wuppertal Institute.

Michaelowa, A. (1998a). Joint implementation. The baseline issue: Economic and political aspects. *Global Environmental Change*, *8*, 81–92.

Michaelowa, A. (1998b). Impact of interest groups on EU climate policy. *European Environment*, *8*, 152–160.

Michaelowa, A. (1998c). Climate policy and interest groups—A public choice analysis. *Intereconomics*, *33*, 251–259.

Michaelowa, A. (2005). The German wind energy lobby: How to promote costly technological change successfully. *European Environment*, *15*, 192–199.

Michaelowa, A., & Fages, E. (1999). Options for baselines of the clean development mechanism. *Mitigation and Adaptation Strategies for Global Change*, *4*, 167–185.

Mohr, L. (1999). The qualitative method of impact analysis. *American Journal of Evaluation*, *20*, 69–84.

Müller, B., & Michaelowa, A. (2019). How to operationalize accounting under Article 6 market mechanisms of the Paris Agreement. *Climate Policy*. doi:10.1080/14693062.2019.1599803

Narassimhan, E., Gallagher, K., Koester, S., & Rivera Alejo, J. (2018). Carbon pricing in practice: A review of existing emissions trading systems. *Climate Policy*, *18*, 967–991.

Obergassel, W., Arens, C., Hermwille, L., Kreibich, N., Mersmann, F., Ott, H. E., & Wang-Helmreich, H. (2016). Phoenix from the ashes: An analysis of the Paris agreement to the United Nations framework convention on climate change – Part I. *Environmental Law and Management*, *27*, 243–262.

Obergassel, W., & Gornik, M. (2015). *Update on the role of market mechanisms in intended nationally determined contributions*. Wuppertal: Wuppertal Institute.

OECD. (2018). *Effective carbon rates 2018: Pricing carbon emissions through taxes and emissions trading*. Paris: OECD.

Olsen, K., & Fenhann, J. (2015). *Transformational change for low carbon and sustainable development*. Copenhagen: Technical University of Denmark.

Ott, H. E., Obergassel, W., Arens, C., Hermwille, L., Mersmann, F., & Wang-Helmreich, H. (2014). Climate policy: Road works and New Horizons – An assessment of the UNFCCC Process from Lima to Paris and beyond. *Environmental Liability*, *22*, 223–238.

Partnership for Market Readiness. (2017). *Establishing scaled-up crediting program baselines under the Paris Agreement: Issues and options* (Partnership for Market Readiness Technical Note, No. 15). Washington: World Bank.

Schneider, L. (2009). Assessing the additionality of CDM projects: Practical experiences and lessons learned. *Climate Policy*, *9*, 242–254.

Schneider, L., Füssler, J., La Hoz Theuer, S., Kohli, A., Graichen, J., Healy, S., & Broekhoff, D. (2017). *Environmental integrity under Article 6 of the Paris Agreement*. Berlin: Umweltbundesamt.

Schneider, L., & La Hoz Theuer, S. (2019). Environmental integrity of international carbon market mechanisms under the Paris Agreement. *Climate Policy*, *19*, 386–400.

SEI. (2011). *Carbon offset research & education. Additionality*. Stockholm: Stockholm Environment Institute.

Spalding-Fecher, R., Achanta, A. N., Erickson, P., Haites, E., Lazarus, M., Pahuja, N., … Tewari, R. (2012). *Assessing the impact of the clean development mechanism*. Report commissioned by the High-Level Panel of the CDM Policy Dialogue. Luxembourg.

Spalding-Fecher, R., Sammut, F., Broekhoff, D., & Füssler, J. (2017). *Environmental integrity and additionality in the new context of the Paris Agreement crediting mechanisms*. Oslo: Carbon Limits.

UNFCCC. (2010a). Clean development mechanism executive board meeting 52, Proposed agenda: Annotations, Annex 3, The application of E+/E- policies in the assessment of additionality, Working paper for policy discussion by the Executive Board. Retrieved from https://cdm.unfccc.int/EB/052/eb52annagan3.pdf

UNFCCC. (2010b). Clean development mechanism executive board meeting 53 report, Annex 32, Information note on the implementation of E+/E- in the context of projects on the agenda of the fifty third meeting of the CDM Executive Board. Retrieved from https://cdm.unfccc.int/Reference/Notes/reg/reg_note06.pdf

UNFCCC. (2016a). Aggregate effect of the intended nationally determined contributions: an update (Document FCCC/CP/2016/2). Bonn.

UNFCCC. (2016b). Paris Agreement. Bonn.

UNFCCC. (2016c). Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015 (No. FCCC/CP/2015/10/Add.1). Paris.

White, H. (2010). A contribution to current debates in impact evaluation. *Evaluation*, *16*, 153–164.

World Bank. (2018). *State and trends of carbon pricing 2018*. Washington, DC: World Bank.

World Bank, Ministry of Science and Technology, P.R. China, German Technical Cooperation Unit, Federal Ministry of Economic Cooperation and Development, Swiss State Secretariat for Economic Affairs. (2004). *Clean development mechanism in China* (2nd ed.). Washington, DC: World Bank.