CARBON MECHANISMS REVIEW

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Ready for take-off?

Article 6 moves to implementation; COP30 eyes technical review

Governing the Transition

Analyzing the shift from Kyoto’s CDM to the Paris Agreement Crediting Mechanism (PACM)

content

Winter 2025

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editorial

Dear Reader!

Article 6 is on the road to implementation stage. Not only did last year's UN climate summit adopt crucial decisions governing the PACM, more and more countries or jurisdictions have announced that they intend to purchase ITMOs. Switzerland has been active in this regard for quite a while, but also Norway, Sweden and most recently the EU voiced their purchasing intentions.

Therefore, the question of project quality gains more and more traction. With our "Carbon Market Criticisms" series, CMR intends to contribute to this debate.

In this issue, the series has a focus on removal activities and the corresponding debate on permanence and reversals. I invite you cordially to take part in the debate.

In the issue, we also update you on SPAR6C's capacity building activities focused on research and knowledge sharing, we analyse the state of play of the CDM transition, and assess the PACM's sustainable development tool – again, an important element of project quality.

On behalf of the editorial team,
I wish you an inspiring read!

Christof Arens
Editor-in-chief

Wuppertal Institut

Carbon Mechanisms Review (CMR) is a specialist magazine on cooperative market-based climate action. CMR covers mainly the cooperative approaches under the Paris Agreement's Article 6, but also the broader carbon pricing debate worldwide. This includes, for example, emission trading schemes worldwide and their linkages, or project-based approaches such as Japan's bilateral offsetting mechanism. CMR appears quarterly in electronic form. All articles undergo an editorial review process. The editors are pleased to receive suggestions for topics or articles.

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On the Criticism of Market Mechanisms

CMR series continues with a discussion on non-permanence and reversals in the context of removal activities

The issue of non-permanence has emerged as a pivotal integrity challenge for both Article 6 and voluntary carbon markets. The recently adopted PACM Reversal Standard establishes a framework, but delegates operational specifics (risk assessment, buffer design, length of post crediting monitoring, insurance utilization) to subsequent methodological advancement. The regulations pertain to monitoring periods, insurance provisions, and instruments employed for hedging against the reversal of stored removal quantities. It is imperative that clarity is provided on the issues under discussion to determine whether nature-based credits can remain a credible and investable component of global carbon markets. As the controversy shows, a one-size-fits-all approach is not adequate, a differentiated treatment of NBS compared geological removals is needed and can be achieved through the development of the methodologies.

Following the establishment of methodological and removal standards at COP29 in Baku, Article 6.4 UNFCCC institutions, the SBM and the Methodologies Expert Panel (MEP) were expected to deliver on the standard setting on the risks of non-permanence and reversals ahead of COP 30 in Belém. However, following the release of their proposals this summer, a contentious debate has emerged concerning the potential adverse implications for nature-based solutions. It is evident that the establishment of a fully detailed standard in Belém is not yet a realistic expectation; however, a gradual approach is being adopted. Several technical aspects require further consideration or, at the very least, a higher degree of consensus. To facilitate the implementation of the SBM decisions on reversal risks in October, the PACM is of course formally authorized to process activity proposals including removal activities. However, most methodologies and operational elements (e.g. project submissions, registries) are not yet available.

It is acknowledged that this delay will be regarded as a strain by many practitioners. However, this is a logical consequence of the methodological approach to regulating all kinds of activities, including technical and nature-based ones, under a single regulatory framework. It is evident that the additional time required is a considerable burden for project developers and investors. However, the chosen path will help to avoid jeopardizing environmental integrity. Concurrently, the trajectory of advancement will be facilitated by the evolution and integration of distinct methodologies, empowering their practical implementation at the local level.

This issue's removal focus of the CMR's "Carbon Market Criticisms" series starts with a general overview of the most salient challenges pertaining to the advancement of removal-related methodologies.

1. Definition and threshold of "permanence"

- There is no agreed minimum duration of greenhouse-gas storage that qualifies as "permanent."
- Debate: Should "permanence" continue to be treated as a binary quality (permanent / non-permanent) or rather as a continuum of durability depending on reversal risk and storage type?
- Implication: Without a clear definition, equivalence between carbon credits (used for offsetting or mitigation contribution) cannot be consistently assessed.

2. Appropriate use of nature-based credits

- Can nature-based credits with higher reversal risk (e.g. forestry, soil carbon) credibly be used for offsetting fossil emissions?

Competing views:

– *Integrity view:* Only "like-for-like" – fossil emissions must be offset by equally permanent removals.
– *Flexibility view:* If reversals are managed and compensated over long timescales, credits can be considered sufficiently permanent.
– This determines whether NBS credits remain eligible for offsetting or are reclassified for "mitigation contribution" purposes only.

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3. Balancing integrity with access to finance

- Rigid permanence criteria (e.g. 100-year monitoring) could exclude nature-based solutions (NBS) from international mechanisms such as the PACM.
- Question: How can risk-proportionate, feasible rules preserve access for NBS without compromising market integrity?

4. Post-crediting monitoring duration

- Under the new UNFCCC *Reversal Standard,* the post-crediting monitoring (PCM) period must be proposed at methodology level.
- Key uncertainty: What constitutes an adequate PCM period?

– ICVCM: 40 years
– Climate Action Reserve: 100 years
– PACM: flexible, to be justified by methodology proponents

- Clarification is needed on whether PCM can end early (e.g. if insurance or guarantees cover reversal risks).

5. Design of reversal risk assessment

The PACM Reversal Risk Assessment Tool is under development, but:

– How will it quantify different risk sources (natural, human, governance)?
– Will results be activity-specific or based on standardized default values?
– How often must risk ratings be updated?

- Credibility depends on empirical grounding and transparency of the tool's parameters.

6. Adequacy of buffer pools

- Buffers are the dominant risk-management tool but under-capitalized relative to long-term risks.

Clarification Needs:

- Should buffer contribution rates be fixed (e.g. ≥20 %) or risk-based?
- How can be ensured that buffers remain solvent over 100 years?
- Should global or regional buffer systems (or funds) replace project-level pools?

7. Role of insurance and third-party guarantees

- The PACM *Reversal Standard* allows insurance or third-party guarantees to replace long monitoring or buffer obligations.

Open Questions:

- Who will provide such insurance and at what cost?
- What standards must policies meet to be accepted by the Supervisory Body (SBM)?
- Can insurance meaningfully address systemic (e.g. climate-driven) reversal risks?

8. Classification of reversals

- Inconsistent definitions across programs of avoidable / intentional vs unavoidable / unintentional reversals.
- Needed: A harmonized framework defining liability, compensation rules, and the use of buffer credits for each category.

9. Transition from project- to system-level solutions

Should the PACM or UNFCCC establish a global reversal detection and compensation fund, financed via:

- Mechanism fees or share-of-proceeds,
- Buyer levies, or
- Contributions from projects with reversal risk?

- Such a fund could address long-term reversals from activities that stop monitoring.

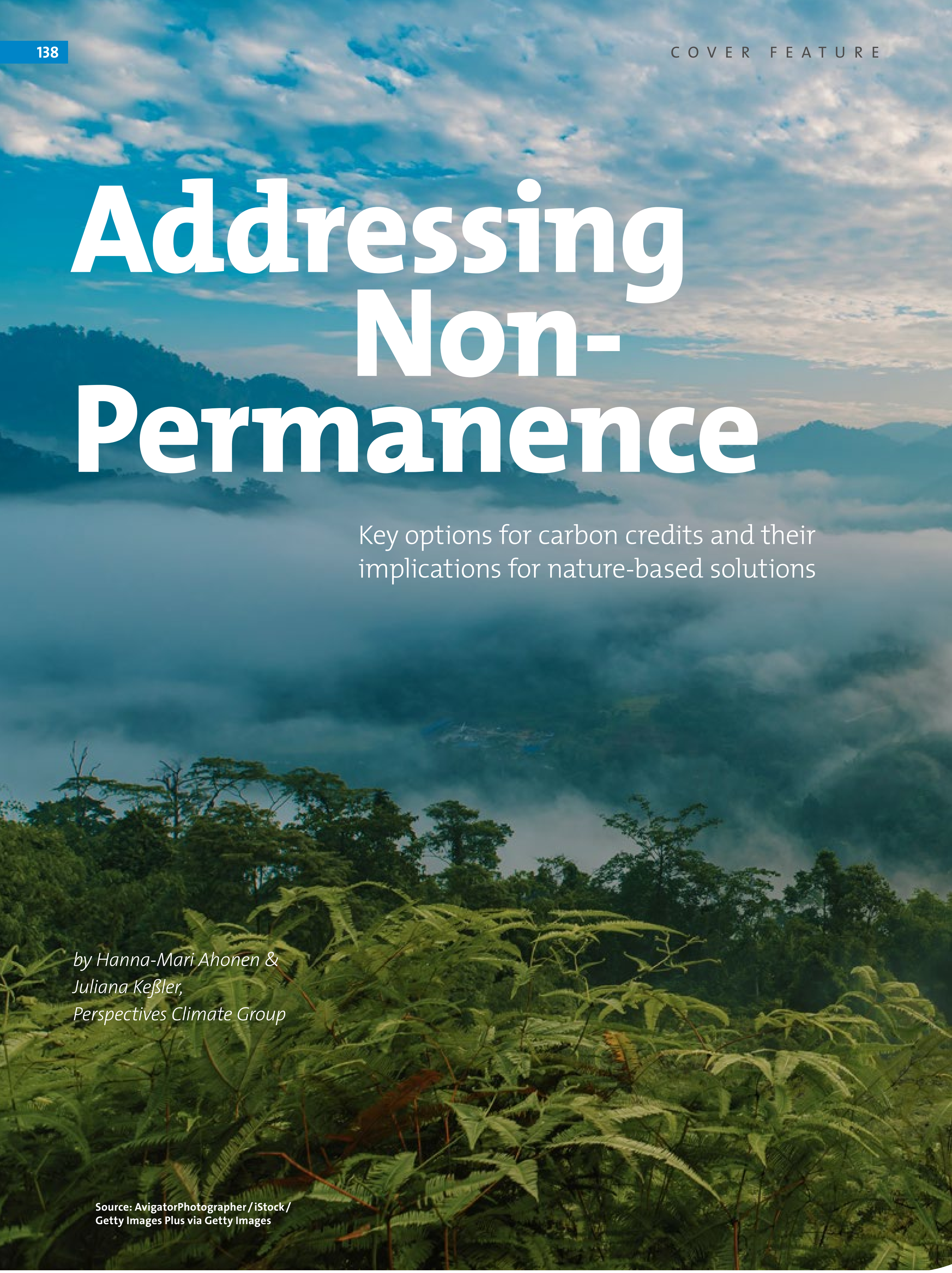
10. Differentiation of credit types and use cases

Strong demand-side need to clarify the use cases for durable vs temporary credits:

- *Offsetting claims* → only permanent units (ITMOs).
- *Mitigation contribution claims* → shorter-lived or reversible units (MCUs).

- Without such differentiation, markets risk confusion and double-counting of "climate claims."

Against this background, we have invited experts in the field to share reflections on the current status of the permanence discourse. In the following article, views shared by carbon market experts during a recent workshop of the Carbon Market Mechanisms Working Group will be presented and discussed.
A special thanks goes out to Hanna-Mari Ahonen and Juliana Keßler of Perspectives Climate Group for compiling and analysing the results.



Addressing Non-Permanence

Key options for carbon credits and their implications for nature-based solutions

by Hanna-Mari Ahonen & Juliana Keßler, Perspectives Climate Group

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Addressing non-permanence – the risk that achieved emission reductions or removals are later reversed – is a central integrity challenge in carbon credit markets. Across carbon markets, permanence is generally defined as ensuring that emission reductions or removals "are sustained over time periods meaningful for mitigating climate change" (ICVCM, 2025). Well-established carbon credit criteria require mitigation outcomes to be permanent, and where reversals are possible, appropriate mechanisms must be established to address and compensate for them. There is currently no agreed minimum duration for greenhouse gas (GHG) storage to be considered permanent. A reversal refers to the release of stored GHGs back into the atmosphere, whether due to natural disturbances or human activities.

Some market stakeholders have advocated for referring to "durability" instead of "permanence". Durability refers to the "longevity of a carbon pool and the stability of its stocks, given the management and disturbance environment in which it occurs" (SBTi, 2024) while permanence implies that storage is either permanent or not. While permanence is treated as a binary condition for the issuance and use of resulting carbon credits, its underlying elements – the durability of storage, which reflects the duration and level of reversal risks – exist along continuums.

Different mitigation activities have varying reversal risks. Activities that do not involve any GHG storage – and thus have no reversal risks – generate permanent emission re-ductions. Examples include activities that reduce or displace fossil fuel use (e.g., renew-able energy, e-mobility) or destroy industrial gases or methane. Storing GHGs in geolog-ical formations is considered to have a lower reversal risk, whereas "nature-based" stor-age in trees or soils is vulnerable to fires, pests, or management failure, thus carrying a higher risk (IPCC 2019), some referring to it as material risk of reversal (ICVCM 2024). A recent study found that wildfires affected 18 % of forestry projects in the voluntary carbon market (VCM) in 2024 (Kelley *et al.,* 2025).

Ever since the Kyoto Protocol introduced the Clean Development Mechanism (CDM) to generate "real, measurable and long-term" mitigation benefits, permanence has been a central quality criterion for carbon credits used for offsetting, whether for compliance or voluntarily. The detailed requirements for permanence for carbon credits have evolved over time and continue to evolve under the CDM's successor – the Paris Agreement Crediting Mechanism (PACM) – and other carbon crediting programmes, as well as international initiatives, such as the Integrity Council for the Voluntary Carbon Market (ICVCM) and the EU Carbon Removals and Carbon Farming (CRCF) certification framework.

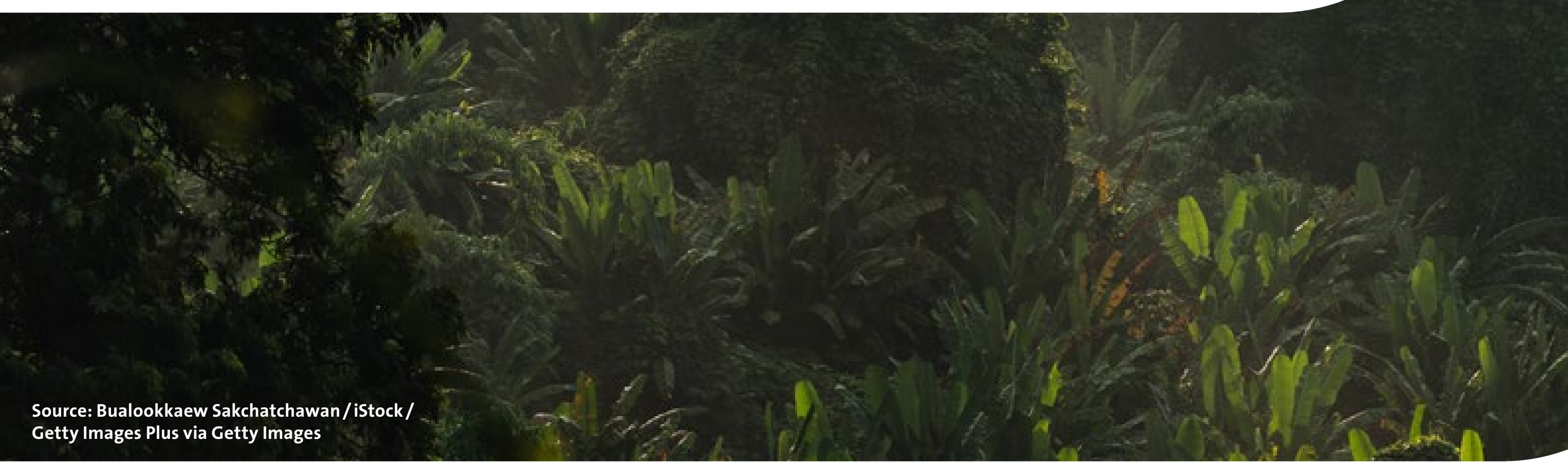
The PACM aims to be the new international benchmark for high-integrity carbon credits. The PACM's Removals Standard includes general requirements for activity participants to address non-permanence by preventing and minimising the risk of reversals and fully remediating the reversal of removals or emission reductions for which carbon credits have been issued under the PACM (UNFCCC, 2024) . These requirements are further elaborated in the standard for addressing non-permanence and reversals in mechanism methodologies (hereafter referred to as Reversal Standard), which was adopted by the mechanism's Supervisory Body (SBM) in October 2025. During public consultations of the draft standard, stakeholders raised concerns that stringent requirements for post-crediting monitoring would effectively exclude nature-based solutions (NBS) from generating carbon credits under the PACM. The adopted version of the Reversal Standard delegates many decisions, such as the requirements for the post-crediting period monitoring, to the methodology level. This means that the Methodological Expert Panel (MEP) and the SBM will consider specific requirements – for example, for core parameters, percentages and time periods – based on proposals made by methodology proponents in their methodology submissions. Consequently, discussions on how to implement the PACM's requirements for addressing reversals will continue at the activity type level, as methodology proposals are submitted.

This article reflects on the current status of the permanence discourse and incorporates views shared by carbon market experts during a recent workshop of the Carbon Market Mechanisms Working Group (CMM-WG).

Why addressing non-permanence matters

Permanence has long been one of three fundamental integrity pillars for carbon credits, alongside additionality and robust quantification. These criteria were developed in the context of using carbon credits for offsetting, that is, counterbalancing emissions elsewhere so that, in aggregate, there is no net increase in global emissions. For offsetting to truly counterbalance emissions elsewhere, the carbon credits used must be based on mitigation that is additional, accurately quantified, equivalent in terms of climate impact and duration, and not double-counted. If reversals occur without compensation, the counterbalancing effect associated with the carbon credits is also reversed. In case of compliance use, this would lead to higher global net emissions, and in case of voluntary offsetting, this would render the voluntary offset claim untrue and misleading. Some compliance schemes, such as the EU Emissions Trading System, have opted to exclude carbon credits from the forestry sector due to reversal risks, while others, like California's cap-and-trade scheme, permit their use under specific local conditions.

There are diverging views on whether carbon credits with reversal risks can credibly be used for offsetting. Some experts are of the view that, provided that reversals are prevented and



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compensated over sufficient timescales, associated carbon credits can be deemed permanent and used for offsetting. Other experts emphasise the like-for-like principle: permanent emissions (e.g., from fossil fuels) should only be offset with equally permanent mitigation outcomes, and carbon credits based on shorter-term emission reductions or removals should only be used for offsetting short-lived emissions. According to this principle, nature-based carbon credits with material reversal risks are unsuitable for offsetting fossil emissions but could be used for other purposes, such as contributions to global mitigation. For the latter, a different unit would be needed as it is substantively different from a permanent unit with not permanence risk.

Beyond offsetting, carbon credits can also be used for mitigation contributions, where entities finance mitigation without claiming that an equivalent amount of their own emissions is counterbalanced as a result. In such cases, the like-for-like principle does not apply, and the durability of the mitigation is less critical since it is not used to offset an equivalent amount of (permanent) emissions. Instead, it represents a credible, albeit potentially non-permanent, contribution to collective mitigation goals. Under the Paris Agreement, mitigation contributions could be funded through climate finance or by purchasing so-called Mitigation Contributions Units (MCUs) which are carbon credits issued under the PACM that are not authorised under Article 6.2 as internationally transferred mitigation outcomes (ITMOs).

Addressing non-permanence: Existing approaches

Comprehensive management of non-permanence involves four steps: (1) assessing reversal risks, (2) implementing risk mitigation measures, (3) monitoring and reporting of GHG storage, during and beyond the activity's crediting period, and (4) compensating for occurred reversals. Thereby, practices vary across existing carbon crediting programmes but are converging around some shared elements.

Risk assessment and management

Programmes usually distinguish between geological and biological storage activities and categorise risks as natural or human induced. The risk assessment serves to quantify an activity's reversal risk, and it determines contributions to risk management approaches (e.g., buffer pools[1]). Generally, programmes either apply a dedicated risk assessment – usually at the reservoir-level – or set a fixed rate for contributions. ICVCM requires at least 20 % buffer pool contributions (fixed rate), or proportional reserves based on risk assessments. Crediting programmes apply markedly different approaches to risk assessment, and the empirical foundations of these assessments remain weak. A current practice among programmes is to update this assessment on a regular basis, i.e. every five years.

1 A portion of issued credits is withheld in a collective reserve, managed by the crediting programme and drawn upon if reversals occur

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Buffer pools are the dominant approach for managing reversals (FAO, 2024; Hickey, Jenkins and Allen, 2025). In the case of pooled buffers, the liability for reversals is shared proportionally among participants. Under the PACM, the Removals Standard requires activity participants to use the Reversal Risk Assessment Tool – which is currently under development – to calculate a percentage-based risk rating which, in turn, is used to determine the total number of carbon credits to be contributed to a Reversal Risk Buffer Pool Account.

Risk management also involves risk mitigation through the development and implementation of management plans to reduce identified risks, often reviewed at the validation stage. Measures can, for example, include fire management, governance safeguards, or improved monitoring. Some crediting programmes (e.g., Gold Standard, Verified Carbon Standard) exclude activities above certain risk thresholds.

Monitoring and reporting

The monitoring frequency requirements vary across carbon crediting programmes, with reporting typically required to cover up to five years. The PACM Reversal Standard (UNFCCC 2025a) allows reporting intervals between one and five years, depending on risk and activity type. If reporting is discontinued, a common practice among many programmes is to require full compensation for all affected mitigation outcomes.

The duration of post-crediting monitoring (PCM) is the key crunch issue. ICVCM currently requires 40 years from the start of the crediting period, which could imply in some cases (e.g., activity with 15-year crediting period, renewable twice) that there is no PCM required. In some of its protocols[2], the Climate Action Reserve applies a 100-year PCM period after the last issuance of carbon credits, which has been highlighted as best practice in the market (see FAO 2024). The UNFCCC secretariat's information note on elements related to non-permanence and reversals (UNFCCC 2025b) that was jointly adopted with the PACM's Reversal Standard specifies that the PCM period is to start on the first day after the end of the last active crediting period. The duration of the PCM period must be proposed in methodologies and approved by the SBM. Monitoring and reporting obligations may be ended if all potential reversals for issued carbon credits have been mitigated, if an SBM-approved insurance policy, guarantee, or third-party guarantee sufficiently covers reversal risks, or if, after the minimum PCM period, the activity participant demonstrates a negligible risk of reversal. The Reversal Standard provides for simplified post-crediting monitoring for low-risk projects.

Compensation and management

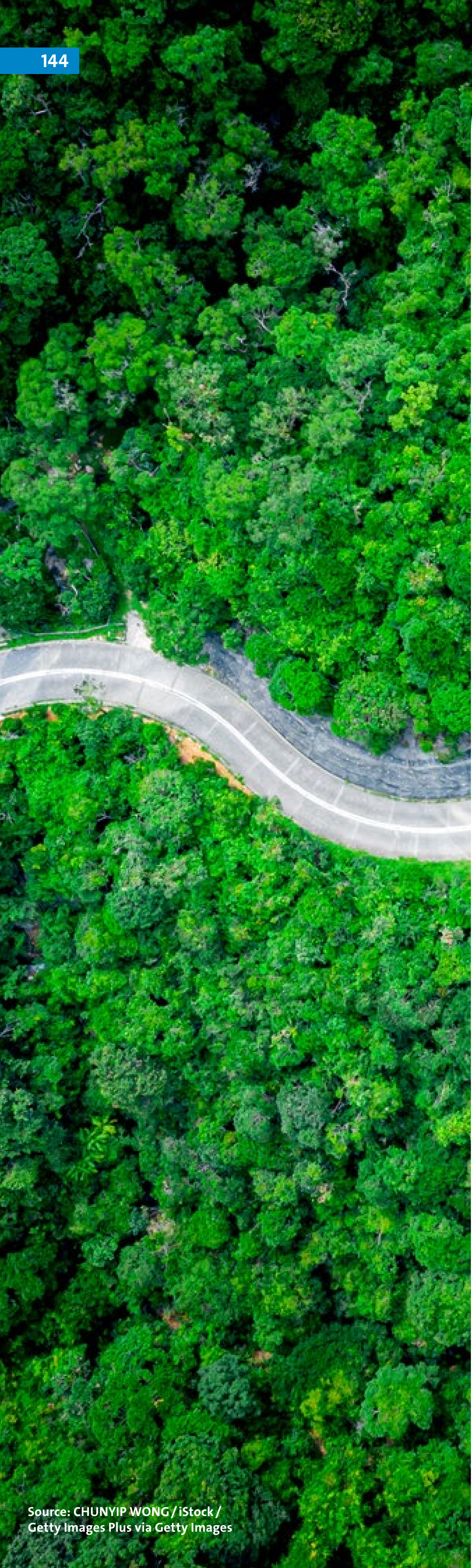
As noted above, buffer pools are the most common mechanism for managing reversal risk. When a reversal occurs, an equivalent number of credits is retired from the buffer to compensate for the loss. Buffer pools are typically designed to address unavoidable reversals to maintain long-term solvency, while developers must directly compensate avoidable ones. The classification of reversal risks – into avoidable/intentional and unavoidable/unintentional categories – varies slightly among programmes. Only a few crediting programmes permit buffer credits to be used for avoidable reversals, and when they do, they usually require the pool to be fully replenished subsequently. Despite such safeguards, most buffer pools remain undercapitalised relative to the risks they face over a 100-year period (Hickey, Jenkins and Allen, 2025)

Another compensation approach involves the use of insurance products, though their use is currently not common due to cost and coverage limitations. Some programmes, such as the American Carbon Registry, allow insurance as an alternative to buffer contributions if actuarially justified, while others, like Isometric, require both mechanisms. The PACM's Reversal Standard allows for the use of insurance policies, guarantees, and third-party guarantees to terminate monitoring and reporting in the PCM period. Further work on these mechanisms is ongoing. However, it remains to be seen how readily such instruments will become available and to what extent they will be adopted. According to the Reversal Standard, a third party can also overtake the PCM from the activity participant, subject to SBM and host country approval.

Temporary crediting

Temporary crediting provides an alternative to the four steps outlined above. Under the CDM, afforestation and reforestation projects could generate temporary or long-term credits with expiry dates and the requirement for replacement after a set period. The EU CRCF adopts a similar approach for temporary removals from carbon farming or storage in products, whereby units expire at the end of the monitoring period, unless their validity is extended.

2 E.g., U.S. Forest Protocol, U.S. Urban Forest Management Protocol



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Options and implications for nature-based solutions

The role of nature-based solutions in mitigation

There is broad agreement that NBS are essential for achieving global goals on climate mitigation, biodiversity protection, and sustainable development. The Paris Agreement explicitly encourages Parties to conserve and enhance natural sinks such as forests and wetlands. However, there are divergent views on whether nature-based carbon credits are appropriate for offsetting, in light of their reversal risks and measurement uncertainty.

To date, carbon credit markets have been an important means to channel funding for NBS. Many carbon crediting programmes (e.g., Verified Carbon Standard, Gold Standard for the Global Goals, Climate Action Reserve) issue such credits and many compliance schemes (e.g., CORSIA[3], California ETS) allow (limited) use of such credits for compliance. Under the CDM, afforestation and reforestation activities were eligible to generate specific types of (temporary and long-term) carbon credits, but there was limited demand for these credit types. The NBS community now hopes that the PACM will provide a credible framework for issuing carbon credits also for NBS activities.

NBS proponents emphasise that NBS activities have an important near-term role in reducing tipping-point risks, which complements the longer-term efforts to scale up activities that generate durable removals. Scenario analyses suggest that early investment in NBS, coupled with gradual substitution by durable removals after mid-century, could reduce overshoot and associated climate damages (Streck *et al.*, 2025).

3 Carbon Offsetting and Reduction Scheme for International Aviation

Supply-side options

Supply-side proposals from the NBS community emphasise flexible, risk-proportionate approaches to addressing non-permanence. Proposals include a flexible threshold for "negligible" reversal risk, limiting post-crediting monitoring obligations, and expanding reliance on pooled buffers or insurance. Advocates call for a pragmatic interpretation of the like-for-like principle that allows nature-based credits to coexist with durable removals while maintaining transparency about their durability.

One possibility to support PACM activities in addressing non-permanence would be through a global fund for reversal detection and compensation, which would undertake global monitoring to detect reversals from activities that have ceased monitoring and invest in compensatory credit purchases (for cancellation) when reversals are detected. This fund could be financed by, e.g., a general fee charged under the PACM, either from all activity developers or those with reversal risks; or an acquisition fee for credit buyers; or contributions to the general UNFCCC budget.

Demand-side options

Demand-side measures are less explored but equally important. These include differentiating use cases for credits based on durability: permanent credits for offsetting, and shorter-lived credits for mitigation contributions, for example for funding "beyond value chain mitigation" or delivering public international climate finance. This approach could safeguard the integrity of offsetting while enabling carbon credit markets to also mobilise finance for nature. The Science Based Targets initiative (SBTi), Gold Standard, and World Wildlife Fund (WWF) encourage companies to include NBS activities in their funding for beyond value chain mitigation. Such funding should complement, rather than substitute ambitious value chain emission reductions. The Gold Standard and WWF have also developed complementary corporate "nature responsibility frameworks" to guide meaningful support for ecosystem-based mitigation.

Public policy could promote demand for temporary credits by recognising and providing guidance for the differentiation of unit types and use cases based on, inter alia, their durability. In the EU, for example, there have already been proposals to define two distinct claims based on carbon credits: contribution and offsetting ("compensation") claims, in the Green Claims Directive. The negotiations on this draft Directive are, however, currently facing headwinds. Furthermore, the EU is in the process of considering possible use cases for CRCF units, including the incorporation of permanent removals into the EU ETS. By adopting clear guidance on contribution and offset claims and appropriate use cases for temporary credits, the EU could provide a much-needed boost for the demand for nature-based credits, including temporary CRCF units. Policies that encourage – or even mandate – specific targets for supporting nature, biodiversity and resilience could also drive much-needed finance for nature-based solutions, through increased demand for nature credits or other means. Even for contributions, however, incentives need to be put into place for sustaining the mitigation and co-benefits for as long as possible. Obviously, legal obligations are more powerful than voluntary motivations in driving demand.

Outlook

Addressing non-permanence remains one of the most technically and politically debated issues in carbon credit markets. The challenge lies in balancing environmental integrity with feasibility, equity and access to finance across activity types and geographies.

Rigid permanence requirements risks limiting funding to already underfinanced nature-based activities, while overly flexible rules could erode already fragile confidence in carbon credit markets. A robust risk management toolkit, complemented with differentiated approaches – including differentiated unit types and use cases to reflect differences in durability while keeping integrity intact – offer a path forward. If carbon finance is to be used to fund NBS also in the future, carbon crediting programmes must find ways to address non-permanence in ways that are both robust enough to maintain trust in carbon market integrity and practical enough to work also for NBS. Policymakers and programme administrators should differentiate requirements for different use cases – offsetting versus contribution – rather than applying a one-size-fits-all permanence approach that requires carbon credits to be "offset-grade" even when they are not used for offsetting. While clear guidance could go some way towards stimulating demand for contributions, for example based on nature-based credits, the most powerful way in which governments could drive such demand would be to introduce obligations to contribute to (global and/or local) climate and nature goals through such credits.

Under the PACM, the outstanding issues in addressing non-permanence will ultimately have to be addressed. In this context, the role of host countries and other entities in addressing non-permanence – for example through global funds or insurance initiatives – deserve further attention.

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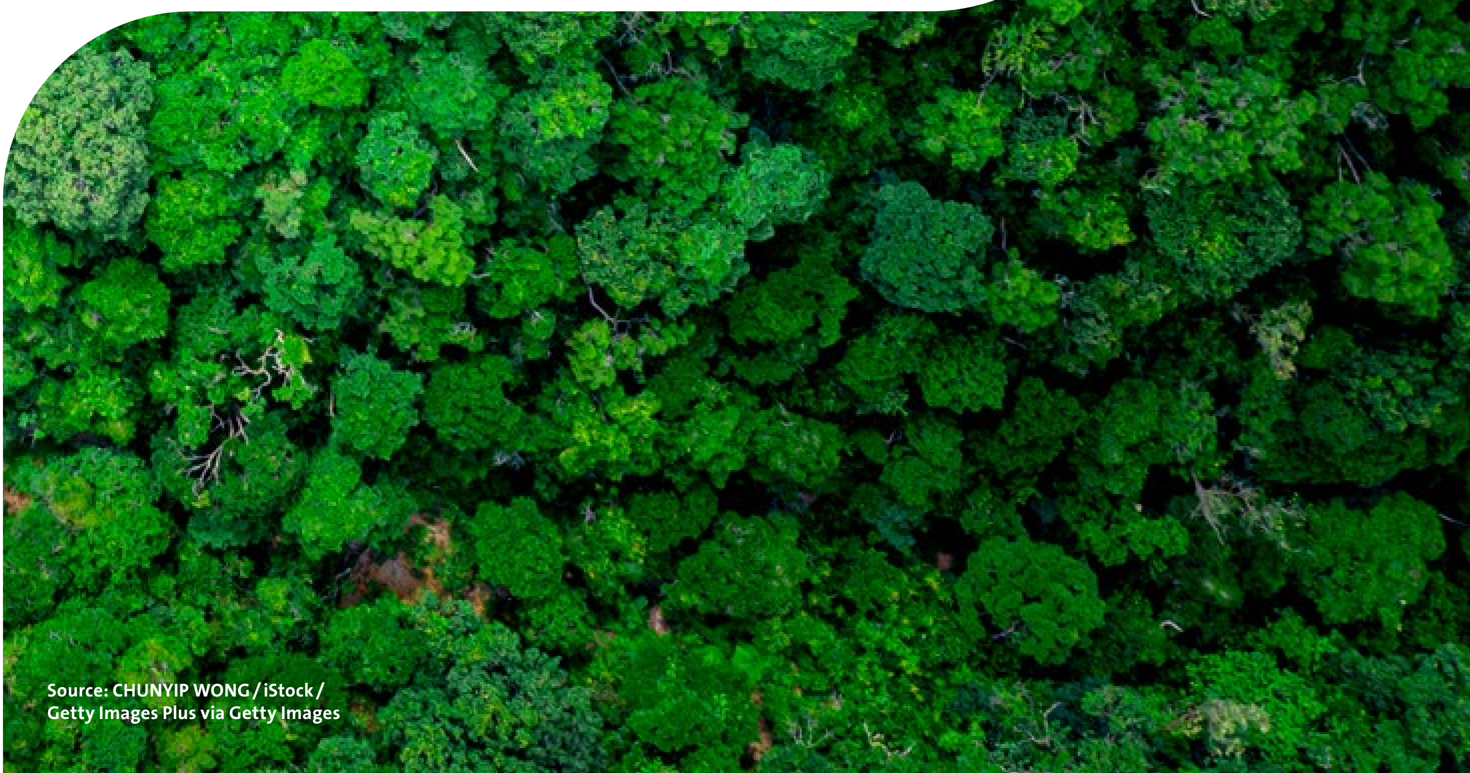

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From Research to Readiness

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Building National Capacity for Article 6 through Academic Networks in SPAR6C Countries

by Dr. Shazia Ilyas, Forman Christian College (A Chartered University), Lahore, Pakistan; Dr. Justine Ngoma, Copperbelt University, Kitwe, Zambia; Dr. María del Pilar García Pachón, Universidad Externado de Colombia, Bogotá, Colombia; Dr. Tiraphap Fakthong, Thammasat University, Bangkok, Thailand; Dr. Judith Vergara Garavito, Universidad EAFIT, Medellín, Colombia; Dr. Allison Sterling, UNEP-CCC

The Supporting Preparedness for Article 6 Cooperation (SPAR6C) Program, launched in 2022, supports four host countries (Colombia, Pakistan, Thailand, and Zambia) to increase their readiness for participation in the international carbon market under Article 6 of the Paris Agreement. The Community of Practice for Article 6 Implementing Countries (CoP-ASIC) is a cross-cutting component of the program focus on research and knowledge sharing. A key objective of the CoP-ASIC is to develop national capacity and expertise in carbon markets and Article 6 within participating host countries (cp. also CMR 04/2024). The national knowledge networks were not part of SPAR6C's original design; rather, they emerged as a solution to bridge the research community, policy makers, and practitioners, while simultaneously supporting local capacity building. In particular, the program was designed to welcome 40 graduate students (10 from each country) over 3 years in the Research Mentorship Program (RMP).

The RMP is designed to fast-track graduate students into careers by providing training in Article 6 topics, one-on-one consultations to advise students how to apply Article 6 to their specific research topic, opportunities to present their work at national and international events, and a six-month internship to put their knowledge into practice and build local capacity. At the inception of SPAR6C, university tours were conducted in each of the four countries to promote the program and to identify how best to attract and support talented students.

During these tours to academic institutions across the countries, a picture began to emerge:

1. A clear need for more connection between academia and their respective national governments and policy makers to support evidence-based decision making.

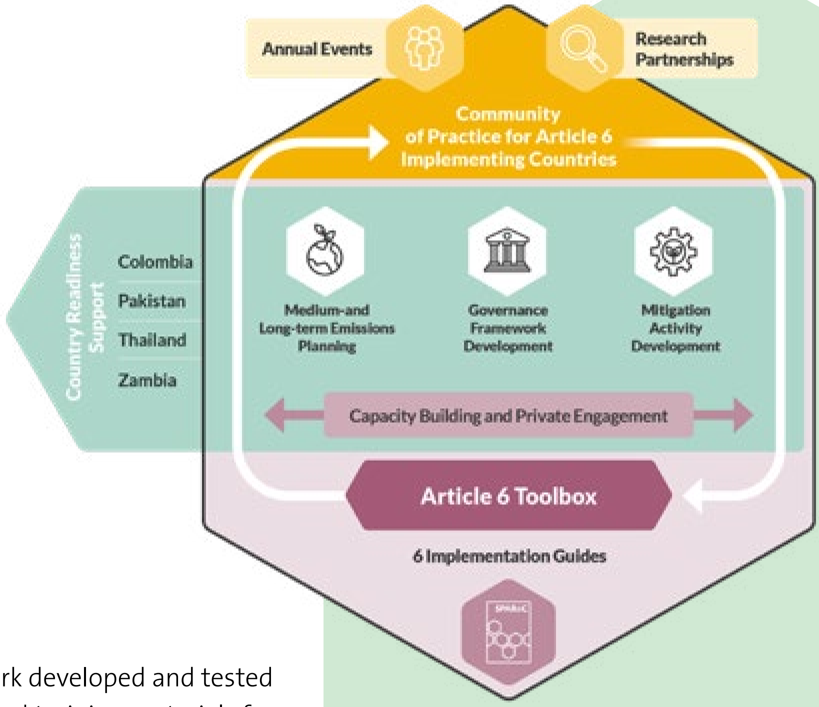
2. A need to de-silo the research landscape and work in a more transdisciplinary way.

3. A need to connect more closely with the evolving implementation of cooperative approaches (Article 6.2) and the Paris Agreement Crediting Mechanism (Article 6.4).

Therefore, the CoP-ASIC has set up transdisciplinary national knowledge networks in each of the four countries Thailand, Colombia, Pakistan and Zambia. Membership in the networks is open to all interested national academics and practitioners. Government representatives are also invited to join. Depending on the country, meetings are held annually (Pakistan) or bi-annually (Thailand, Colombia, and Zambia). Virtual meetings are also held throughout the year, and dedicated communication boards are active with updates on SPAR6C, the RMP, carbon market news, and the accomplishments of network members.

For SPAR6C CoP-ASIC, the networks are instrumental in promoting the RMP in the members' respective institutions, and the network members have continued to provide a huge amount of support in the selection and supervision of the RMP students. Beyond that, the networks are designed to evolve towards autonomy, enabling them to develop their own teaching and training materials for Article 6 and potentially attract external funding through consultancy agreements and research grants. They also have the potential to provide timely, science-based data and analysis to national governments to help them navigate Article 6 and so provide an opportunity for lasting impact beyond the SPAR6C program.

The national networks have had some notable successes and filled crucial knowledge gaps in Article 6 readiness and implementation.



In Colombia, the network developed and tested game-based teaching and training materials for Article 6. Professors from Colombia also coordinated the publication of a research volume entitled Carbon Markets: An Interdisciplinary Analysis1, which brought together a diverse group of academics, market experts, and government representatives to collaboratively explore key dimensions of carbon market development. In Pakistan, the network is enthusiastically focusing on integrating the carbon market and Article 6 related topics in higher education through developing teaching guides and course materials for students at all levels of higher education: bachelors, masters, PhD, and professional training. In Thailand, some in the network have supported SPAR6C with analysis on Green Innovation Drivers as technical consultants. In Zambia, the network entered into a formal agreement with the Ministry of Green Economy and Environment, and co-produced a strategic research agenda for the country, focusing on international carbon markets and Article 6. Thus, the national networks are proving essential not only essential to making the RMP function effectively, but have already demonstrated their broader value through their own accomplishments.

1 Available online at https://editorial.tirant.com/co/libro/mercados-de-carbono-analisis-interdisciplinar-maria-del-pilar-garcia-pachon-9788410959224

The SPAR6C Program

SPAR6C is a 5-year program designed to support governments of host countries to develop medium- and long-term emissions planning, a governance framework, and mitigation activities so that they are better prepared to navigate the market mechanisms outlined in Article 6 of the Paris Agreement. The Community of Practice for Article 6 Implementing Countries (CoP-ASIC) is a cross-cutting work package of the SPAR6C Program, designed as a platform for generating, sharing and implementing knowledge across the SPAR6C countries (Colombia, Pakistan, Thailand, and Zambia). The CoP-ASIC has three interrelated components: the annual event, the Research Mentorship Program (RMP), and the national knowledge networks (local impact).

The SPAR6C Program is funded by the German Federal Government (formerly the Federal Ministry for Economic Affairs and Climate Action – BMWK) through the International Climate Initiative (IKI). Implementation is led by the Global Green Growth Institute (GGGI), with support provided by Carbon Limits, UNEP Copenhagen Climate Centre (UNEP-CCC), Kommunalkredit Public Consulting and GFA Consulting. CoP-ASIC is co-led by UNEP-CCC and GGGI.

Picture: Participants at the 3rd annual CoP-ASIC event in Bogotá, Colombia, Source: Oscar Cortés / Santa Publicidad / GGGI

Tapping into the future potential of local research communities

The 3rd annual event of the SPAR6C CoP-ASIC was held in Bogotá, Colombia, 15–19 September 2025. The event brought together over 80 participants, including representatives from the SPAR6C host country governments from Colombia, Pakistan, Thailand, and Zambia, as well as guests from Mexico, the Dominican Republic, Argentina, and Paraguay. SPAR6C also welcomed practitioners and experts from around the world within the consortium and partner organizations. The annual event program was structured to facilitate the sharing of experiences across countries, and to provide essential training in project development, the project cycle, project negotiation, and the incorporation of sustainable development into projects. Participants were very satisfied with their experience, reporting a high level of learning and engagement.

The event also welcomed 15 international graduate students and five professors from SPAR6C countries who represented their countries' national knowledge networks. The involvement of academics and the research community are seen as a vital component of SPAR6C and the implementation of Article 6. Therefore, one of the themes explored in-depth at the event was the role of research and the academic community in supporting host countries in their Article 6 strategies and implementation.

Academic representatives from each of the networks were invited to design and host a session to discuss the role of academia in supporting Article 6. The session had three parts: 1) Research needs and the technical support that academia could offer, 2) Accomplishments of national networks, and 3) A panel discussion to invite reflection and uncover deeper insights.

Research needs for Article 6 were grouped in large, cross cutting themes. These themes were distilled from the various research projects completed by the 2nd cohort of the RMP participants, who, immediately prior to this session, presented individual research posters to the event participants. The cohort of RMP

Picture: Award ceremony of the 15 students of the Cohort 2025, Source: Oscar Cortés / Santa Publicidad / GGGI

participants also presented a synthesis of all their individual research topics, refined into actionable and policy relevant points around a series of cross-cutting themes.

These cross-cutting themes were used as a point of departure to elaborate on how research could help host countries navigate Article 6. They presented potential contributions from academic institutions on the following themes:

- **Monitoring, Reporting, and Verification (MRV) and high-integrity registry systems:** e.g., develop sector specific digital MRV tools, conduct pilot studies to test MRV protocols, and improve data accuracy for transparency and integrity. Train professionals and students in MRV systems and carbon accounting.

- **Additionality and market design: e.g., provide** policy analysis and recommendations for carbon market governance, based on economic development plans and to align this with the Nationally Determined Contributions (NDCs).

- **Social inclusion and environmental safeguards:** e.g., assess the impact of carbon market projects on local communities, utilizing Environmental and Social Impact Assessment (EISA) expertise, develop robust frameworks for equitable benefit-sharing and social safeguards.

- **Sectoral innovation and technology pathways:** e.g., identify high-potential sectors for carbon market participation with baseline studies and impact assessment, co-develop innovative, low-carbon technologies suitable for priority sectors, collaborate with industry and funding agencies to scale up clean technologies, involving Public-Private Partnerships (PPPs) for incubation and acceleration. Sectors and technologies raised as examples included methane control, transport, nature-based solutions, climate smart agriculture, and frontier technologies in carbon removals and utilization.

- **Financing and investment:** e.g., support policy design for attracting climate finance and private investment, train professionals in climate finance, carbon markets, and investment structuring, contribute to tools like additionality calculators and MRV-linked finance models.

The session concluded with a panel discussion, inviting the perspective of technical experts from each of the four SPAR6C countries. The discussion focused on the role of academia in supporting governments, the translation of research into policy and local solutions, and the opportunities and challenges for collaboration in implementing Article 6 of the Paris Agreement.

The discussion emphasized academia's value as an independent actor that can provide trusted, science-based evidence and strategic input to governments and the private sector to leverage ecological and economic benefits, especially helping countries meet their NDCs. It was posited by several speakers that academia also has a unique role in piloting and optimizing frontier technologies, as well as scaling technologies, thereby reducing investment risk to the private sector. Furthermore, the discussants stressed the importance of sector-level data (tier 2 factors, cost–benefit analysis, investment needs) to inform decisions on mitigation measures and project eligibility, and academia's potential to create these datasets.

The panelists also described the increasing demand for carbon credit training, with universities offering continuous capacity-building and short-term courses for working advanced students, working professionals, and government officials. Panelists shared experiences working with the national knowledge networks to create accessible knowledge platforms, capacity-building materials, and multi-stakeholder dialogues to ensure information is usable beyond academia.

It was stressed that translating research into policy and local solutions requires deliberate efforts to bridge the gap between technical

Picture: Panel discussion on the role of academic research in Article 6 project development and implementation.
Source: Oscar Cortés / Santa Publicidad / GGGI

Source: Stephan Zirwes / iStock / Getty Images Plus via Getty Images

outputs and decision-making. Building trust with policymakers was highlighted as essential, requiring researchers to simplify outputs and adapt timing to political needs. This represents an opportunity for academia to leverage its neutrality to build confidence between government, private sector, and communities.

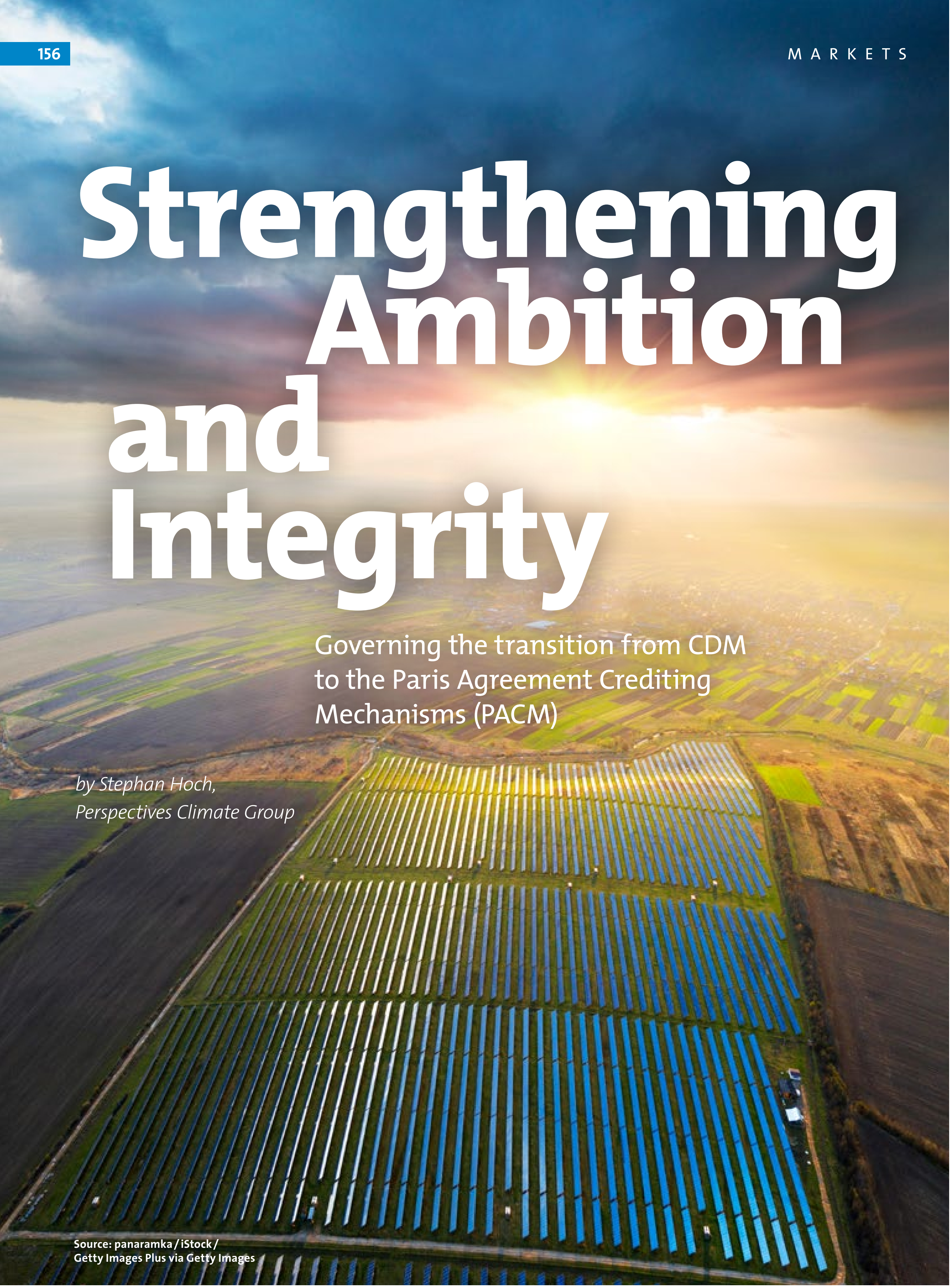
Challenges Yet to Overcome

While academia has strong technical expertise, collaboration across countries often remains fragmented, highlighting the need for more inclusive research networks and platforms. In all the SPAR6C countries, the networks are still new, still growing, and still finding effective modes of contribution. For now, the contributions of the network are generally in-kind, and there is no financial support for members to join. While some consultancy contracts have been completed by network members, there is a challenge that consultancy firms can offer lower prices for this type of work than academic institutions can. One of the key points made at the panel discussion was the adage "you often get what you pay for," meaning that important, unbiased, rigorous analysis often requires the expertise of academic institutions. Finally, as SPAR6C enters its final years of implementation, the networks recognize the need to develop their own research agendas and to attract external funding so that they can continue beyond the program. One viable pathway for this is a link to the development of training modules, which generates income

from government and the private sector, that can in turn be used as a seed grant to develop and test new research ideas that can feed into larger research proposals.

Conclusion

As SPAR6C advances towards the implementation of mitigation activities for the carbon market under the mechanisms outlined in Article 6 of the Paris Agreement, the research needs and the role of national knowledge networks are becoming increasingly clear. Academia and the research community are indispensable in developing long-term national capacity by educating and training the next generation of experts. Nationally embedded knowledge in this field provides timely, expert and unbiased analysis to support strategy, policy and safeguards under Article 6, and fosters an innovative, transdisciplinary landscape for solution-based research to climate change mitigation. The inclusion of academia through the creation of national knowledge networks has proven invaluable for developing national capacity and supporting host countries in Article 6 strategies and governance. Our experience in SPAR6C has shown that this is a replicable model for other countries and, moreover, that the inclusion of academic institutions is not a luxury but a necessity for countries to effectively participate in the carbon markets established under Articles 6.2 and 6.4 of the Paris Agreement.



Strengthening Ambition and Integrity

Governing the transition from CDM to the Paris Agreement Crediting Mechanisms (PACM)

by Stephan Hoch,
Perspectives Climate Group

Source: panaramka / iStock / Getty Images Plus via Getty Images

Governing the transition from the Kyoto Protocol's Clean Development Mechanism (CDM) to the Paris Agreement Crediting Mechanism (PACM) effectively is a test for whether international carbon markets can enhance mitigation efforts in support of the Paris Agreement. While the CDM has generated more than 10.000 mitigation activities, it has also faced criticism for a lack of additionality, overcrediting and insufficient contributions to sustainable development (Cames et al 2016). The PA Article 6 rulebook provides significant governance improvements (Hoch et al 2025), in particular the A6.4 Rules, Modalities, and Procedures (RMP) agreed at COP26 in Glasgow. The RMP also define the guardrails for the transition of CDM activities, certificates and methodologies to the PACM.

This transition is an imminent step in the broader shift towards implementation of international carbon markets in support of the Paris Agreement, which carries both risks and opportunities. On the one hand, the transition of CDM activities promises a "fast start" for PACM implementation, providing a rapid build-up of the activity portfolio. Applying the more stringent Article 6.4 rules to transitioning CDM activities provides a window of opportunity to filter out non-additional activities and tighten baselines. Moreover, building on the methodologies, infrastructure and support structure in the UNFCCC Secretariat allows harnessing more than 20 years of CDM experience. On the other hand, there are valid concerns about the environmental integrity of some CDM activities. It would be a significant early blow to the acceptance of the PACM if non-additional activities moved over to the new mechanism. Therefore, it is a crucial challenge for the CMA, the Article 6.4 Supervisory Body of the PACM (SBM) as well as host countries to collectively govern the transition from CDM to PACM responsibly so that only activities that meet all new Art.6.4 requirements transition and deliver the mitigation and sustainable development benefits they are supposed to achieve.

This article reviews the current state of play of the transition from CDM to PACM, ahead of the deadline for host countries to provide approval for transition requests by 31 December 2025. The key purpose is to inform the ongoing debate about how to implement the transition effectively.

UNFCCC rules governing CDM transition

CDM transition is a cross-cutting issue in which both the Paris Agreement and Kyoto Protocol bodies (CMA and CMP) are involved. The CMA is tasked with providing guidance to the SBM for elaborating the rules for PACM, whereas the CMP provides guidance to the CDM Executive Board (EB). During COP 26 in Glasgow, the A6.4 RMP were agreed which include substantial provisions for ambition raising, e.g. by setting stricter requirements for baseline methodologies, additionality and sustainable development (UNFCCC 2021). The RMP also established the criteria for CDM transition. CDM activities registered after 2012 can transition if project participants (PP) have applied by 31 December 2023, receive host country approval prior to 31 December 2025, and meet all A6.4 requirements. Activities can operate with existing CDM methodologies until the end of their crediting period, or at the latest until the end of 2025. From January 2026, the switch to an A6.4 methodology must be made. If the crediting period has ended and there is no available PACM methodology, transitioning activities may apply interim solutions to be provided by the SBM. Furthermore, the CMP delivered guidance to the CDM EB to continue to process CDM applications until the Article 6.4 mechanism is fully operational.

Subsequently, the Supervisory Body developed the CDM Transition Standard and the related Transition Procedure which detail key steps summarized in Box 1. The effective date of activity transition will be January 1, 2021, which allows the issuance of mitigation vintages between 2021–2025. COP27 also introduced a new type of A6.4 certificate called "Mitigation Contribution Units" (MCU), which do not require host party authorization as they cannot be transferred internationally. MCUs can be used for results-based climate finance (if cancelled) or domestic use in the host country e.g. for nationally determined contribution (NDC) targets or domestic carbon pricing instruments. Being able to choose flexibly between shares of A6.4ERs and MCUs from transitioning activities gives host countries flexibility to address concerns or perceptions regarding environmental integrity and to achieve domestic goals. Moreover, CDM forestry activities, which had initially been excluded, were allowed to request transition until 31 December 2025. In a political compromise, pre-2020 Certified Emission Reductions (CERs) from activities registered from 2013 onwards could be used for the first NDCs, provided they are being transferred to the PACM registry and identified as pre-2021 units (UNFCCC 2021).

CDM Transition Procedure

- The CDM transition procedure and standard state that all requests must undergo stakeholder consultation within 28 days and receive host country approval by 31 December 2025, which will be published on the UNFCCC website.
- In case activities continue to use CDM methodologies, project participants need to submit additional documentation within 180 days of the host Party approval through an addendum to the activity design document.
- Once transition fees have been paid, the UNFCCC Secretariat performs a completeness check within seven days, and a substantive check within 21 days.
- Upon conclusion of the substantive check, the secretariat notifies the host Party and the SBM to initiate the review process by the host Party or the SBM within 28 days.
- If no review of the request for transition is requested, it shall be approved by the SB.

Source: UNFCCC 2024

CDM transition activity portfolio: what's at stake?

Global activity portfolio

From the global portfolio of eligible CDM activities, only half have submitted a transition request. Taking a look at activity categories, 42 % of eligible project activities have requested transition, while three quarters of eligible CPAs have done so. Since the deadline has passed, these numbers are final, meaning that a sizable share of potentially eligible activities and associated CER supply will not be carried over into the PACM.

Source: Oscar Gutierrez Zozulia / iStock / Getty Images Plus via Getty Images

Table 1: Eligible CDM activities that did and did not request transition

Count of PA / PoA / CPA	Transition Request			share that requested transition
	yes	no	grand total	
CPA	954	310	1264	75 %
PA	1389	1944	3333	42 %
PoA	119	15	169	70 %
				52 %

Source: UNEP CCC 2025a

Main activity types include solar (261), clean cooking (215), bioenergy (126), mixed renewables (55), rice cultivation (43), electric mobility (42), hydropower (41), landfill gas (38), and tree planting (29) (UNEP CCC 2025a). This means that while the largest shares of activity types have been associated with concerns about low additionality (renewables) and overcrediting (clean cooking), there is a diverse portfolio of activities that have advanced in the transition process.

Table 2: Summary of transitioning activities and potential certificates 2021–2025 ktCO2e

Region	Region		**Registered**		**Pending Host Country approval**	
Region	PA/PoA/CPA	Potential Reductions	PA/PoA/CPA	Potential Reductions	PA/PoA/CPA	Potential Reductions
Africa	634	124.182	24	8.157	476	102.031
Americas	289	151.742			256	140.187
Asia	1.528	698.652	69	118.650	1.367	528.180
Europe	2	1.145			2	1.145
multiple	5				1	
Oceania	4	1.388			4	1.388
Total	**2.462**	**977.110**	**93**	**126.807**	**2.106**	**772.932**

Source: Author's analysis based on UNEP CCC 2025a

When taking a closer look at the activities that requested transition, table 2 shows that the predominant share of activities and the associated mitigation potential is still awaiting host country approval less than three months prior to the final deadline. Only a small number of activities have already been fully registered under PACM. Notably, both India and China, which host the dominant share of activities requesting transition, have so far not indicated their intention to provide approval. Beyond that, there is a balanced geographic distribution of active transition requests, with a considerable number of activities in Africa and LDCs (see Table 3).

The role of host countries is decisive for CDM transition

Host Parties have the formal responsibility to provide approval of activity transition requests. While most Parties now have an A6.4 DNA in place, there are still some countries that have not completed this initial step. What may emerge as a bottleneck is that host parties need to submit their Art. 6.4 participation requirements to UNFCCC prior to participating in the PACM. This is a mandatory step before they can provide approval for CDM activity transition.

Table 3: Countries with transition requests

Count of PA/PoA/CPA	**Transition Request**		**share with transition requests**
Host Country	**yes**	**no**	
India	593	545	52 %
China	527	808	39 %
Kenya	135	30	82 %
Brazil	128	45	74 %
Uganda	125	17	88 %
Madagascar	74	3	96 %
Viet Nam	73	95	43 %
Chile	68	25	73 %
Myanmar	68	1	99 %
Malawi	60	3	95 %
Nigeria	58	15	79 %
Rwanda	48	17	74 %
Philippines	41	7	85 %
Nepal	36	1	97 %
Bangladesh	33	31	52%
South Africa	28	30	48 %
Sri Lanka	24	7	77 %
Ghana	24	9	73 %
Colombia	23	35	40 %
Pakistan	23	13	64 %

Source: UNEP CCC 2025a

Until October 2025, only 23 countries have done so. Among the countries with the largest transition portfolios (see Table 3), China, Colombia, Malawi, Nigeria, Philippines, South Africa, and Viet Nam, as well as many others with fewer transitioning activities have not yet submitted their PACM participation requirements (UNEP 2025a), potentially preventing them from approving transition in time.

Even if participation requirements have been submitted, the window for transition approval is rapidly closing. While the required UNFCCC form is simple, the transition procedure does not specify how countries must evaluate transition requests. Since authorized international transfers of A6.4ERs from transitioned activities require corresponding adjustments, a key question is how to evaluate the impact on the host country NDC. Activities with low additionality do not achieve real mitigation outcomes.

Similarly, activities with overcrediting risks may contribute to host country overselling, which means that the host government may have to shoulder costlier mitigation options. As the deadline is approaching, it is unclear if further countries are preparing their participation requirements and host country approvals. While it is reasonable to expect a last-minute push to meet the deadline, it is also probable that some countries will decide not to approve transition or miss the deadline for other reasons.

Carbon credit supply from CDM transition

In the run-up to COP26 negotiations, there were concerns about potentially more than 300 million pre-2020 CERs flooding the market and undermining NDC ambition and ITMO prices, with substantially higher volumes after 2020 (Ishikawa et al 2020). However, actual issuances have been much lower at 94.9 million pre-2020 CERs, primarily from renewable energy and waste, of which 22 % have been voluntarily canceled (UNEP CCC 2025b). Even issued CERs may remain unused as some are owned by Parties that may not intend to use them for compliance purposes (Michaelowa et al 2021).

Similarly, overall post-2020 A6.4ER volumes from potentially eligible CDM activities are likely to be lower than expected. 568 million A6.4ERs will not be issued since PPs have not requested transition. Current projections from activities requesting transition may be up to 977 million credits between 2021–2025 (see tables 2 and 4). Any issuance, however, depends on them fully meeting PACM rules.

Table 4: A6.4ER potential from eligible activities

Potential reductions from eligible projects (PA / CPA) in ktCO2e that did and did not submit a request for transition (cumulatively until 2025)	**ktCO2e**	**Transition Request**			**share with transition requests**
		yes	**no**	**Grand Total**	
	CPA	357.271	31.258	388.529	92 %
	PA	619.839	536.770	1.156.608	54 %
	Grand Total	**977.110**	**568.027**	**1.545.137**	**63 %**

Source: UNEP CCC 2025a

Source: wonry / iStock / Getty Images Plus via Getty Images

Actual A6.4ER issuances from fully transitioned activities will thus be substantially lower, as these estimates are taken from CDM activity design documents and therefore represent a theoretical maximum. Some A6.4ER potential will not materialize as activities may not receive host country approval. Other activities may underperform in terms of verified mitigation outcomes.

Further contributing factors are regulatory efforts during transition to address overcrediting risks. For instance, clean cooking activities need to update key baseline parameters such as the fraction of non-renewable biomass (fNRB). The CDM EB has recently updated regional and national fNRB default values that are much lower than previous ones (UNFCCC 2025d). Subsequently, A6.4SBM17 clarified that additional documentation during transition should include the re-evaluation of fNRB values and leakage factors, resulting in a substantial reduction of future carbon credit yields. Activity participants may either use the latest available fNRB default values or propose new values.

The latter option, however, would require additional validation. This example demonstrates an interesting interplay between the CDM and PACM governing bodies that strengthens the integrity of clean cooking activities. As a result of these and other measures, the UNFCCC Secretariat estimates that only circa 40% of the potential A6.4ERs from transitioning CDM activities may materialize based on historical issuance success and political signals from host countries (UNFCCC 2025c). This may amount to circa 400 million potential A6.4ERs between 2021–2025.

Finally, approval of activity transition does not prejudge host party authorization of resulting A6.4ERs for ITMO transfers. Authorization should be provided as early as possible but can be done until the first issuance. If authorization was withheld, mitigation outcomes from transitioned activities could still be used as MCUs. Therefore, host countries should filter out non-additional activities that do not contribute to the NDC during the transition process. However, if in doubt, host countries may consider approving transition requests to meet the deadline and apply further scrutiny prior to providing authorization. Therefore, only a share of these potential A6.4ERs may ultimately become ITMOs, with the remainder being available for domestic purposes.

Bottlenecks in updating methodologies risk slowing down the PACM

Beyond the transition of activities and certificates, CDM methodologies need to be updated to comply with more stringent Art.6.4 requirements. The Art.6.4 RMP specify that fully transitioned activities need to switch to PACM methodologies at the latest by January 2026. There are more than 200 CDM methodologies, although few have been used frequently. Since the Art.6.4 methodology guidance was approved, the revision process has been underway but takes time. The A6.4 SBM and Methodology Expert Panel (MEP) have prioritized revising widely used methodologies for grid-connected renewable energy (ACM0002, AMS-I.D); thermal energy production (AMS-I.C); landfill gas (ACM0001); and clean cooking (AMS. II-G, AMS-I.E). In addition, methodological tools (e.g. to establish additionality, leakage, or permanence) are being updated (UNFCCC 2025e). Still, the first PACM methodology is only expected to be approved at SBM 19, ahead of COP 30. The schedule for revising further methodologies is unclear but will certainly extend over several years. The Supervisory Body business plan for 2026–27 foresees 45 annual methodology outputs, which include tools and new methodologies (UNFCCC 2025a).

Consequently, there will be “gap period” in which many fully transitioned activities will not be able to switch to a PACM methodology because these will not be available yet. This injects a high degree of uncertainty into business models and is not conducive to building confidence in the PACM. The capacity of the MEP and UNFCCC Secretariat to revise CDM methodologies is thus a key bottleneck for transitioning activities to fully comply with the Art.6.4 RMP. Moreover, this delays the development of new PACM methodologies for innovative activity types. The UNFCCC Secretariat is not to blame for this situation, given the lack of resources available for operationalizing the PACM. However, investing into revising existing methodologies and developing new ones is crucial for timely and effective CDM transition as well as for enabling new high integrity activity types.

Based on experience with the CDM (Michaelowa et al 2017), the PACM can be expected to raise significant resources for the UNFCCC Secretariat through administrative fees and share of proceeds. However, these resources will only accrue once A6.4ERs are issued. The CDM trust fund still has resources from CDM fees even though amounts vary according to different scenarios (UNFCCC 2024). Whether to transfer these resources to the Adaptation Fund or to make them available for the PACM has been controversially discussed in CMP negotiations. Considering these bottlenecks, it would be sensible to dedicate CDM resources to accelerate the revision of PACM methodologies, which in turn will supply the Adaptation Fund with a higher share of proceeds than the CDM.

Finally, the A6.4 RMP allow host countries to simplify methodologies through sector-specific standardized baselines. This concept has been well-tested in the CDM and should become a focus of capacity building efforts once PACM methodologies become available, as they allow for further NDC alignment and can reduce data gathering needs and associated uncertainties for PPs.

Conclusions and recommendations

The rules for the transition from CDM to PACM are well-designed, but this analysis points to open questions whether they are being implemented effectively. More resources from both public and private sectors should be invested in high integrity PACM methodologies and pilot activities to fully implement the hard-won improvements in Art.6.4 rules. This is crucial for strengthening the supply and integrity of Article 6.4 carbon credits both from transitioning and new activities. The lack not only of host country approvals for transition but even the more general PACM participation requirements indicates that more capacity building is required. As the deadline for host country approval approaches, the following recommendations emerge:

- Countries with few CDM activities that meet all Art.6.4 requirements, especially LDCs, require more support for PACM participation requirements and assessing transition requests prior to the deadline. The normative foundation of both the UNFCCC and Paris Agreement has historically led to concerns about the equitable distribution of the benefits of the CDM. Therefore, the successful transition of activities in these countries is particularly relevant for the legitimacy of the PACM.

- Conversely, emerging economies with large CDM portfolios and a high share of activities with risks of additionality or overcrediting may consider either not approving transition, or to take seriously the opportunity to strengthen baseline parameters during the additional documentation step in the transition process.

- Moreover, countries may also consider not authorizing a share of certificates from existing non-vulnerable activities for international transfer but using them as MCUs for their own NDC or domestic carbon pricing instruments.

- The position of India and China on these points will be crucial for the overall transition from CDM and PACM due to the scale of their portfolios. Brazil as a historical champion of both the CDM and Article 6 has an opportunity to use the spotlight of COP30 to set and promote good practice in CDM transition to PACM that can be emulated by others.

Ackknowledgements

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The new benchmark?

Analysing the PACM's sustainable development tool

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After the COP29 decided on major outstanding issues, the Paris Agreement Crediting Mechanism (PACM) is entering its implementation phase. Practical questions on how to implement good and credible activities on the ground enter centre stage. One important pillar of quality is contributions to sustainable development (SD), along with safeguards against negative impacts. The SBM, the PACM's oversight body, consequently made assessing monitoring as well validating and verifying SD impacts of all PACM activities mandatory.

The PACM SD tool, approved at SBM14 in October 2024, thus introduces provisions for environmental and social integrity for the PACM under Article 6.4 of the Paris Agreement. The tool was welcomed by many observers, who voiced the expectation that it would become a major milestone in aligning international carbon markets with sustainable development priorities, enhancing the quality of international carbon market activities in general. Against this background, we analysed in a recent policy paper if and to what extent the PACM SD tool can be characterised as a 'new benchmark' for the carbon market. In the following, a short digest of the paper will be presented.

Comparing SD assessments

To address this question, we compared the PACM's SD tool with selected crediting standards of the voluntary/compliance carbon markets in a structured desktop analysis and a scoring of the analysed SD provisions. The following carbon crediting schemes were chosen: Gold Standard for the Global Goals (GS4GG), Climate Action Reserve (CAR), American Carbon Registry (ACR) and Verified Carbon Standard (VCS). These four programmes already meet a certain standard, as they are considered CCP-eligible by the ICVCM (ICVCM, 2025). They also are the major schemes in terms of market share (Climate Focus, 2025). Regarding VCS, we used the Sustainable Development Verified Impact Standard (SD VISta) for the analysis, a complementary crediting standard to VCS, due to its focus on sustainable development.

The data used for this analysis are the crediting standard manuals and other official documents published by the standards that refer to the broader issue of SD benefits and safeguards. These documents include SDG impact tools and environmental and social impact assessment templates.

The analysis is based on a set of nine qualitative elements derived from existing literature and expert knowledge (Arens et al 2015, Day et al. 2020, ICAT, 2020, Olsen et al 2018, Wissner et al 2022). Each element guides the desktop analysis and enables comparison of the respective outcomes.

1. **SD indicators provided:** Do the analysed provisions provide indicators for SD?
2. **Maps host country SD priorities:** Do the analysed provisions map host country SD priorities?
3. **Neg. impacts on SDGs**: Do the analysed provisions assess negative impacts on SDGs?
4. **Baselines used:** Do the analysed provisions require the use of baselines for assessing SD and safeguards?
5. **Safeguards / do no harm:** Do the analysed provisions include safeguards or do no harm approaches?
6. **Stakeholder consultation:** Do the analysed provisions require stakeholder consultation?
7. **Grievance:** Do the analysed provisions include grievance mechanisms?
8. **Follow-up / monitoring:** Do the analysed provisions include a follow-up / monitoring after the project has been approved?
9. **Validation / verification:** Do the analysed provisions require validation and verification?

Based on this analytical framework, we compared the PACM SD tool with existing SD provisions and unpack the new elements of the SD tool, the "benchmark", in a two-step approach. Firstly, we conducted a quantitative assessment of the standards, and secondly, we analysed qualitatively some of the elements that constitute the "new benchmark".

The quantitative comparison provided an overall score for each standard, calculated by adding up the assessment results obtained for each element set out in the analytical framework. An assessment score of "Yes" is awarded a score value of 1, "Yes, with limitations" earns a score value of 0.5, and "No" is awarded a value of 0. This quantitative approach enabled us to score analysed crediting standards in terms of their SD provisions and situate the newly established A6.4 tool within the pre-existing standards.

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Results

Quantitative Analysis

The analysis shows that while there are significant differences in some areas, the standards are closely aligned on specific elements: all five standards require the use of safeguards and a "do no harm" approach to project activities.

Taking a closer look, the quantitative analysis shows that most standards respond to the majority of the elements analyzed, with the PACM SD tool (Total score 7.5) and GS4GG (6.5) scoring best, followed by SD VISta (6). One outcome of the quantitative analysis is that the PACM SD tool displays added value through the way it integrates host country sustainable development priorities. The PACM SD tool requires activity-level SD indicators, but it does not provide them, and activity participants have to develop them bottom-up. Therefore, this assessment element is scored "No" for the SD tool.

The GS4GG, in turn, does not address negative impacts on SDGs (nor do the other standards) but fulfils all other criteria fully or with limitations.

Overall, the big picture reveals that all five standards analyzed cover the majority of the elements. The main differences between them lie in their specific approaches to providing sustainable development indicators and whether they explicitly evaluate negative impacts on Sustainable Development Goals.

However, the CAR (Climate Action Reserve) and ACR (American Carbon Registry) standards score lower than the others because they do not include key components: first, they do not include MRV of the SD impacts; second, these standards do not work with a baseline, which makes assessing the SD impacts more difficult. Last but not least, CAR and ACR also do not assess negative impacts on SDGs.

Table 3: Overview of analysed elements and main results.

	1. SD indicators provided?	2. Maps host country SD priorities?	3. Neg. impacts on SDGs?	4. Baseline used?	5. Safeguards/ do no harm?	6. Stakeholder consultation?	7. Grievance?	8. Monitoring/ reporting of SD?	9. Validation/ Verification?	Scoring Summary
SD tool	No (0)	Yes (1)	Yes (1)	Yes, with limitations (0.5)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	7.5
GS4GG	Yes, with limitations (0.5)	Yes, with limitations[2] (0.5)	No (0)	Yes, with limitations (0.5)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	6.5
SD VISta	No (0)	Yes, with limitations[3] (0.5)	No (0)	Yes, with limitations[3] (0.5)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	6
CAR	Yes (1)	Yes, with limitations[2] (0.5)	No (0)	No (0)	Yes (1)	Yes, with limitations[4] (0.5)	Yes (1)	No (0)	Yes, with limitations[6] (0.5)	4.5
ACR	Yes (1)	Yes, with limitations[2] (0.5)	No (0)	No (0)	Yes (1)	Yes (1)	Yes, with limitations[5] (0.5)	No (0)	No (0)	4

Source: Author's analysis based on UNEP CCC 2025a

1 Unlike the other standards, the A6.4 SD tool requires project proponents to develop activity-level SD indicators. These specific indicators are not provided by the tool. By contrast, the other standards mostly provide generic indicators, as provided by UN Stats, rather than indicators at the project level. Therefore, a "no" evaluation for the SD tool does not necessarily represent a negative assessment.
2 ACR, CAR and VCS offer a higher flexibility for project proponents with regard to the mapping of host country SD priorities.
3 GS4GG does not explicitly request project proponents to map host country SD priorities, but it refers explicitly to national SDG targets and indicators.
4 CAR does not automatically include proactive stakeholder consultations, only the case when there are environmental or social impacts on the local community that "may not be appropriately handled by other existing government structures" (CAR, 2024, 45f).
5 The ACR requires project proponents to have grievance redress mechanisms in place, but does not specify how such a mechanism should work.
6 While CAR includes information on safeguards and SD assessment in the verification process, it does not require project design validation.

Qualitative Analysis

The qualitative assessment shows that the assessment of positive and negative SD impacts is a distinct element of the PACM SD tool. Activity developers using this tool must screen all 17 SDGs to identify both positive and negative "direct" and "significant" impacts caused by the activity, covering impacts that last for at least the entire crediting period. This rigorous approach is designed to analyze synergies and trade-offs, aiming to promote net positive climate and development impacts.

If negative impacts are detected, they must be included in the tool's risk assessment and environmental and social management plan, or activity-level SD indicators must be defined to minimize and mitigate them. This stands out because other standards typically focus on "co-benefits" and only assess negative impacts within the context of safeguards or "do no harm" analyses, potentially overlooking trade-offs.

All analyzed crediting standards require indicators for SD assessment, though they derive these in different ways. The SD tool utilizes a

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bottom-up approach, requiring project proponents to develop activity-level indicators specific to their project for SDG targets. In contrast, the VCS/SD VISta and CAR employ a top-down approach, referring to the more generic SDG indicators provided by UNStats. The Gold Standard for the Global Goals (GS4GG) offers 142 default monitoring indicators but also allows project developers to propose new ones. ACR requires measuring and disclosing only positive impacts, providing a template that captures only one target for each SDG.

Regarding safeguarding, all crediting standards include indicators. However, the SD tool and GS4GG provide detailed catalogues of assessment questions intended to prevent social or environmental harm. For the SD tool, if mitigation is needed, activity-level environmental and social indicators must be designed for monitoring over the crediting period. CAR, ACR, and VCS/SD VISta require risk assessments and mitigation measures, but their safeguarding guidelines are less detailed, relying on forms or guiding questions rather than a full set of assessment questions.

All standards require regular monitoring and a verified update on safeguarding measures. For the SD tool, monitoring of safeguards is structured similarly to SD assessment. However, SD impact assessment is not uniformly included in monitoring requirements. While the SD tool and GS4GG require verified information on SD assessments for regular reporting, CAR and ACR do not include updates on SD assessments in their monitoring requirements. Standards that allow for bottom-up indicator development, like the SD tool and GS4GG, tend to integrate SDG assessment into their monitoring and reporting.

Validation and verification processes also vary: The SD tool, GS4GG, and SD VISta incorporate SD assessment into both validation and verification. CAR requires periodic third-party verification, including verification of the Environmental and Social Safeguards Assessment form and the SDG Reporting Tool, but does not require validation for the project design itself. For ACR, it remains unclear whether SD assessment is included in the verification requirements.

Conclusion

The PACM SD tool sets a “new benchmark” in the following ways:

1. **Assessment of both positive and negative SDG impacts:** While all analysed crediting standards include safeguards and “do no harm” provisions, the PACM SD tool uniquely requires project proponents to assess both potential positive and negative direct impacts on all 17 Sustainable Development Goals (SDGs) in a structured manner. This goes beyond merely preventing harm, aiming for a comprehensive analysis of the total net impact on the SDGs, including synergies and trade-offs, which other standards often overlook by focusing primarily on co-benefits. This structured approach helps ensure all potential im-pacts are adequately covered.

2. **Structured mapping of host country SD priorities:** The SD tool mandates a structured assessment of the host country’s SD objectives and priorities using a specific form. Activity participants must identify relevant national strategies, SDG targets, and indicators related to the A6.4 activity. This is a more rigorous and less flexible approach than offered by other standards like ACR, CAR, and VCS/SD VISta, which provide project proponents with higher flexibility. This structured method can lead to a more complete integration of host country SD priorities into projects and increase project developers’ aware-ness of these priorities.

3. **Bottom-up development and translation of SD indicators:** Unlike some crediting standards that provide top-down SDG indicators (e.g., CAR, ACR, SD VISta/VCS), the PACM SD tool requires project proponents to develop activity-level indicators specific to their project by translating national or regional SDG indicators to the project lev-el. This “bottom-up” approach demands additional effort from developers but ensures that indicators are specific, measurable, and aligned with the project, there-by facilitating the inclusion of SD assessments in monitoring and reporting. It re-mains unclear whether this feature will become part of the “new benchmark” or evolve into a version of the SD Tool that includes partly top-down indicators—both options have pros and cons.

In addition to these distinctive features, the PACM SD tool meets common practices and, in many aspects, aligns with best practices of the VCM:

- **Safeguards and “do no harm” principles:** The tool includes comprehensive environmental and social risk assessments against eleven elements, with detailed guiding questions, similar to other robust standards like GS4GG.

- **Stakeholder consultation:** All analysed standards involve stakeholder consultation, but the SD tool integrates safeguards, SD assessment, and monitoring plans into this process, requiring completed forms to be shared with stake-holders for feedback.

- **Grievance mechanism:** While the SD tool itself does not include its own grievance mecha-nism, the broader A6.4 crediting mechanism does, aligning with best practices in the VCM.

- **Validation and verification:** The SD tool explicitly details the roles of Designated Operational Entities (DOEs) in validating risk assessments, management plans, and SD impact assess-ments, as well as verifying ongoing indicator monitoring. This is a practice also found in GS4GG and SD VISta, which incorporate SD assessment into their validation and verification processes.

- **Use of baselines:** The SD Tool requires project proponents to develop baseline values in order to monitor SD assessment over the crediting period, which project developers must to refer to when assessing the potential environmental and social impacts of their activity. This involves understanding the conditions that would most likely occur in the absence of the project activity.

Overall, the PACM SD tool is considered an assessment tool with the potential to elevate the standards for evaluating the impact of carbon market projects on sustainable development. However, its comprehensiveness, particularly with regard to the development of activity-level SD indicators, may lead to additional transaction costs.

Observations and recommendations for further development

The PACM SD tool thus stands out as an assessment tool that has the potential to raise the bar in assessing sustainable development impacts in market-based interventions. However, only time will tell whether this ambitious approach does work out in practice. Further re-finements will be needed, combined with a close look at transaction cost in order to strike the right balance between robustness and feasibility. The following observations from this analysis may thus serve as initial ideas for the discussion of the tool's further development:

1. **Develop sector-specific indicators:** In its cur-rent form, the PACM SD tool leaves it up to project participants to develop indicators for SD assessment. While this might be useful for many as it allows to develop case-specific indicators and prevents the tool to become a "tick-box exercise", other project developers might benefit from some more guidance in this regard. Based on experience and data from the voluntary market, sector-specific indicators for the most relevant activity categories could be developed and its use made optional.
2. **Make use of digitization potential:** Currently, the A6.4 tool is based on Excel-sheets, which can be time-consuming to use and cumbersome in the handling. As Gold Standard's new digital impact tool shows, there is potential in user-friendly digital assessment interfaces. Also, options for digital MRV should be explored, cp. the ongoing activities by the Sustainable Development Initiative (SDI) as well as Gold Standard. One important ad-vantage of digitization is that it enables connectivity and comparability between systems and carbon crediting programmes, which in turn can support convergence of best practice in SD assessment (see below).
3. **Consider user-friendly, non-technical language:** The UNFCCC process is full of acronyms and has developed a specific type of jargon over the years which can be difficult to under-stand, especially for newcomers. At the same time, (new) private-sector engagement is an explicit wish of all actors in the process. It should therefore be considered to develop user-friendly training material, brochures in non-technical language, and/or video tutorials to facilitate the application of the SD tool.

Convergence of best practice SD assessment in both voluntary and compliance markets should be sought on a global scale. The Integrity Council for the Voluntary Carbon Market (ICVCM), for example, launched in 2024 the core carbon principles and assessment framework criteria to set industry best practice for integrity and quality of carbon credits with sustainable development impacts and safeguards being one of the core carbon principles. The further development of these best practice elements is foreseen by ICVCM in the form of a continuous improvement work program. The first review of the PACM SD tool, scheduled for spring 2026, would thus be a good opportunity for further action towards alignment and convergence across standards and markets with regard to SD assessment globally.

Further information

This article is based on a recent Carbon Mechanisms Research paper:

Arens, C., & Schell, J. (2025). The Article 6.4 Sustainable Development tool – A new benchmark for assessing sustainable development impacts in carbon markets?

Download at:
https://www.carbon-mechanisms.de/SD_Tool

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Article 6 in NDC 3.0

Read the October 2025 update on how the countries that submitted NDC 3.0 are approaching international market cooperation through Article 6. It examines whether countries intend to use carbon markets, the roles they foresee for themselves, and how they address issues like environmental integrity and sustainable development impacts. Download at: **https://www.carbon-mechanisms.de/en/publications/details/update-die-rolle-von-artikel-6-in-ndc-30**

Linking Article 6 and the New Collective Quantified Goal (NCQG)

This recent analysis provides a conceptual framework on the link between Article 6 and the NCQG, examining how different types of Article 6-related resource flows and benefits could be categorized and potentially counted contribute toward the USD 300 billion and USD 1.3 trillion targets. Download at: **https://www.carbon-mechanisms.de/en/publications/details/the-role-of-article-6-in-contributing-to-the-ncqg**

Glossary

All Carbon Market terms and abbreviations are explained in detail in our online glossary. View it here: **www.carbon-mechanisms.de/en/glossary**