

ENVIRONMENT DIRECTORATE

The interplay between voluntary and compliance carbon markets: Implications for environmental integrity

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Keywords: carbon credits, voluntary carbon market, compliance carbon market, environmental integrity, Article 6, net zero, supply, demand, carbon tax, emissions trading system, ETS, climate change, climate mitigation, greenhouse gas emissions.

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Abstract

This paper investigates the interplay between voluntary and compliance carbon markets, with a focus on the environmental integrity implications, in particular mitigation of greenhouse gases. It explores different types of carbon credit markets and the different ways that these markets can, and could, interact. Furthermore, the paper examines how developments in voluntary and compliance carbon markets can impact the mitigation effectiveness of carbon credit markets, including on both the supply and demand sides. The analysis finds that while carbon credit markets could unlock mitigation ambition and action, they also have significant environmental integrity risks that merit government attention. The paper suggests some guiding principles for governments in identifying how to engage with different carbon markets, and recommends that they take strategic, focused and collaborative action. The paper also highlights potential policies that could enhance environmental integrity across carbon markets. In addition to domestic carbon markets, governments could monitor how international and self-regulatory carbon market frameworks evolve. Governments can also assess the role that carbon credit markets play in achieving their climate objectives, and identify opportunities to enhance their mitigation effectiveness.

Keywords : carbon credits, voluntary carbon market, compliance carbon market, environmental integrity, Article 6, net zero, supply, demand, carbon tax, emissions trading system, ETS, climate change, climate mitigation, greenhouse gas emissions.

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Résumé

Ce rapport examine l'interaction entre les marchés du carbone volontaires et les marchés du carbone obligatoires, en mettant l'accent sur les enjeux d'intégrité environnementale, en particulier l'atténuation des gaz à effet de serre. Il décrit différents types de marchés de crédits carbone et explore les différentes façons dont ces marchés peuvent interagir, ou pourraient interagir. De plus, l'article examine comment les évolutions dans les marchés du carbone volontaires et obligatoires peuvent avoir un impact sur l'efficacité des marchés de crédits carbone à contribuer à l'atténuation des gaz à effet de serre sur le plan de l'offre et de la demande. L'analyse montre que bien que les marchés de crédits carbone puissent débloquer l'ambition et l'action en matière d'atténuation, ils présentent également des risques significatifs pour l'intégrité environnementale qui nécessitent l'attention des gouvernements. L'article propose des suggestions de principes directeurs pour les gouvernements afin d'identifier comment s'engager de manière stratégique, ciblée et collaborative avec différents marchés du carbone. L'article met également en évidence des politiques qui permettraient de renforcer l'intégrité environnementale des marchés du carbone. En plus des marchés du carbone domestiques, les gouvernements pourraient surveiller l'évolution des cadres internationaux et privés des marchés du carbone. Les gouvernements pourraient également évaluer le rôle que jouent les marchés de crédits carbone pour leurs objectifs climatiques et identifier des opportunités pour renforcer leur efficacité en matière d'atténuation.

Keywords : crédits carbone, marché volontaire de carbone, marché obligatoire de carbone, intégrité environnementale, Article 6, zéro émission nette, offre, demande, taxe carbone, système d'échange de quotas d'émission, SEQUE, changement climatique, atténuation du changement climatique, émissions de gaz à effet de serre.

Classification JEL : F55, G14, H23, Q52, Q54

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Executive Summary

Carbon credit markets allow for verified mitigation outcomes to be transferred from one party to another. Their use can help countries and companies progress towards net-zero targets. Carbon credit markets reward greenhouse gas (GHG) emission reductions or removals, unlike permit markets, which disincentivise emissions. By providing GHG mitigation activities with an additional revenue stream, carbon credit markets could encourage greater mitigation. However, this requires carbon credit markets to operate with environmental integrity – i.e. that carbon credit transfers lead to more GHG mitigation than would have happened in their absence.

Carbon credit markets are diverse, and the line between voluntary carbon markets (VCMs) and compliance carbon markets (CCMs) is sometimes blurred. Carbon credit markets consist of a wide range of mitigation activities, crediting mechanisms, trading platforms and buyer groups. These market segments can partially overlap and exercise mutual influence (interplay). This paper explores this interplay among carbon credit markets, as well as related potential environmental integrity risks, and suggests how governments can focus their efforts in a rapidly changing carbon credit market environment.

As well as changing rapidly, carbon credit markets are expected to grow. Overall, carbon credit markets are very small compared to permit markets. VCMs account for most carbon credit market activity. Governments currently exercise limited influence over VCMs, but these markets have recently received greater attention from regulators. Both VCMs and CCMs are expected to grow as many countries and companies plan to use carbon credits towards their GHG mitigation commitments. Notably, several countries plan to use carbon trading under Article 6 of the Paris Agreement to support mitigation targets set out in their nationally determined contributions (NDCs). As VCMs and CCMs grow, so could the extent to which they interact.

For carbon credit markets to contribute to climate goals, they must operate with greater environmental integrity throughout the carbon credit lifecycle. This requires several conditions to be in place for the generation of carbon credits, their trading environment, and their use, as explored in this paper. Environmental integrity risks, and existing frameworks to manage these risks, vary significantly within and between VCMs and CCMs.

Carbon credit markets currently experience considerable environmental integrity challenges, although they vary by market segment. On the supply side, independent assessments have estimated that a large share of carbon credit supply is of low quality, although the quality varies by market segment. On the demand side, carbon credits have sometimes been used to support misleading claims about the buyer's climate performance. At the market level, the limited scale of carbon trading has been a barrier to developing advanced market infrastructure and governance.

New environmental integrity frameworks have the potential to drive improvements. Efforts to enhance environmental integrity are underway through multilateral frameworks, market-led initiatives and governmental policies. Notably, the multilateral Paris Agreement Crediting Mechanism (PACM) and several market-led initiatives are developing tools, guidance and certifications that have the potential to

drive improvements. Furthermore, governments can develop additional safeguards and provisions to enhance environmental integrity in government-administered markets.

The paper presents a suite of considerations for how governments can create the conditions for greater environmental integrity in carbon markets:

- **Support the development of high-integrity carbon credit market segments**, given that enhancing environmental integrity can be commercially challenging. Ambitious environmental integrity provisions can reduce the profitability of carbon credit-generating activities. Targeted government support may be needed to scale high-integrity carbon credit supply and to ensure strong demand and price premiums for this supply. Governments can refer to a wide range of multilateral, market-led and domestic frameworks to align their support to carbon credit markets with international best practices on environmental integrity. Alternatively, governments can develop their own environmental integrity frameworks. To minimise market fragmentation, governments could co-ordinate their integrity enhancement efforts and refer to common frameworks. Agreeing ambitious integrity provisions under PACM will be key, but the mechanism will take time to become fully operational.
- **Develop strategic priorities for carbon credit market engagement**. Policy making for carbon credit markets can require significant technical expertise, administrative capacity and ongoing operational costs. To focus limited resources, governments could develop and execute clear strategies for how carbon credit markets support their GHG mitigation objectives. This would require governments to evaluate the current and expected role of both VCMs and CCMs nationally, identify priority actions to improve the mitigation performance of carbon credit markets, and consider how these actions relate to wider carbon credit market developments.
- **Draw on a wide range of policy approaches to influence the integrity of supply, demand and the market across VCMs and/or CCMs**. To enhance the integrity of supply, governments could develop supply (e.g. through governmental crediting mechanisms) or facilitate supply (e.g. through enabling conditions for high-integrity supply). This could be coupled with policies that generate demand for high-integrity supply (e.g. through compliance instruments) and influence voluntary demand (e.g. through guidance to corporate carbon credit buyers). Governments could also support initiatives that help to enhance market integrity (e.g. initiatives that improve standardisation and transparency) or regulate markets, where relevant (e.g. to enhance governance and oversight).
- **Provide clear market signals to support long-term planning for high-integrity market activity**. Investments in carbon credit-generating activities can have high upfront costs and long lead times. Clear signals from governments about the future of carbon credit markets are needed to reduce risks and unlock investment for high-integrity activities. In particular, governments could clarify how carbon credit markets should align with pathways towards net-zero emissions.

1. Introduction

Carbon credit markets¹ can incentivise climate action by allowing for the transfer of carbon credits and money from one party to another to encourage activities that mitigate greenhouse gas (GHG) emissions.² While in the context of carbon markets, carbon credit markets are smaller than permit markets (such as the EU Emissions Trading System), they offer a flexible mitigation instrument that can complement existing climate policies. On the supply side, carbon credits provide a revenue stream for activities such as deploying clean energy technologies. On the demand side, carbon credit buyers can claim the GHG mitigation impact associated with the carbon credit for various purposes, for example to comply with a tax obligation, or to make a voluntary claim about a business's climate performance. Carbon credits often form part of the GHG mitigation commitments of countries, companies and other entities. For example, to achieve a net-zero target, entities need to balance their residual emissions with emission reduction or removals in the target year – potentially using carbon credits.

Carbon credits offer buyers mitigation options at a potentially low cost, and provide sellers with revenues – which in turn incentivise further mitigation action. In theory, this could create a virtuous cycle of buyers' mitigation ambition and sellers' mitigation action (Ahonen et al., 2023^[1]). However, practical experience with carbon credit markets paints a more complicated picture. A large share of carbon credits issued to date have had overstated mitigation impacts (although this varies by market segment) (Trove Research, 2023^[2]) and credits have sometimes supported misleading climate claims, leading to allegations of greenwashing (Trouwloon et al., 2023^[3]).

Several practical limitations can undermine the **environmental integrity** of carbon credit markets (i.e. where carbon credit transfers lead to GHG emissions that are not higher than if such transfers did not happen; Box 1.1). Efforts are underway to address past and present environmental integrity concerns.

The demand for carbon credits has grown rapidly in recent years, and could grow further in the future. Between 2017 and 2021, the value of **voluntary carbon market (VCM)** activity increased more than ten-fold, although market activity stabilised in the following two years (Ecosystem Marketplace, 2023^[4]). Demand from **compliance carbon markets (CCMs)** is set to grow in the coming years, due to the development of several carbon pricing instruments, as well as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (World Bank, 2023^[5]). Furthermore, several countries will engage in carbon trading under the **Paris Agreement's Article 6** to reach mitigation targets set out in their 2030 nationally determined contributions (NDCs) (IETA, 2024^[6]).

As multiple market segments grow, so can the **interplay** between them. Some carbon credit markets operate relatively independently (e.g. Japan's J-Credit System), whereas others have significant overlaps (e.g. CORSIA and VCMs). Interplay can occur between carbon credit markets that differ in their environmental integrity risks. Several governments are now developing policies to use carbon credit markets for climate objectives, or to enhance markets' environmental integrity. To take strategic action on the environmental integrity of carbon credit markets, governments could first consider the diversity of carbon credit markets and how markets interact.

¹ Terms in bold are defined in Box 1.1.

² This is different to permit markets, which disincentivise GHG emissions rather than rewarding GHG mitigation.

Box 1.1. Key concepts related to carbon credit markets in this paper

A longer list of definitions is provided in Annex D.

Carbon credit markets: Markets for carbon credits. A carbon credit is a tradeable intangible instrument that is issued by a carbon crediting mechanism, representing a verified GHG emission reduction to, or removal from, the atmosphere equivalent to one metric tonne of carbon dioxide equivalent.

Voluntary carbon markets (VCMs): Markets where tradeable emission units (such as carbon credits or permits) are traded and used voluntarily, in the absence of an obligation or binding commitment.

Compliance carbon markets (CCMs): Markets where tradeable emission units are used to comply with an obligation or binding commitment. These can be established by governments to enforce obligations for regulated entities. CCMs can also be established by international treaties to enforce sectoral obligations, or obligations for Parties to the international treaty.

Environmental integrity: ‘Environmental integrity’ in the context of carbon markets typically relates to climate mitigation, whereas ‘integrity’ also includes other social and environmental aspects. This paper uses the following core condition for environmental integrity (supplementary conditions apply, and are explained in Annex A):

Environmental integrity would be ensured if the engagement in the transfer of carbon credits leads to aggregate global GHG emissions that are not higher than if such transfers had not taken place. – based on (Schneider and La Hoz Theuer, 2019^[77])

Interplay: The overlaps and mutual influence that different carbon credit markets can have.

Carbon crediting mechanisms: An entity that registers mitigation activities and issues carbon credits for the mitigation outcomes achieved by these activities. Carbon crediting mechanisms can be categorised into governmental, international, and independent mechanisms (see details in Annex D).

Article 6 of the Paris Agreement: Establishes international rules for countries to voluntarily co-operate to achieve their NDCs. This includes three main elements:

- **Article 6.2** – A framework for bilateral co-operation, through which countries can co-operatively implement mitigation activities and transact Internationally Transferred Mitigation Outcomes (ITMOs). Article 6.2 gives participating countries considerable flexibility to design and execute co-operative approaches.
- **Article 6.4** – Establishes an international carbon crediting mechanism which is overseen by the Article 6.4 Supervisory Body (A6.4SB). The Paris Agreement Crediting Mechanism (PACM) will have its own methodologies, registry and third-party auditors (“designated operational entities”).
- **Article 6.8** – A framework for non-market-based co-operation.

Both Article 6.2 and 6.4 offer countries the possibility of market-based co-operation, where mitigation outcomes (sometimes in the form of carbon credits) can be issued, transacted and used.

Internationally Transferred Mitigation Outcomes (ITMOs): A type of unit of GHG reduction or removal which can be traded under the Paris Agreement’s Article 6. ITMOs represent real, additional and verified mitigation outcomes that have been authorised for use towards an NDC or other international mitigation purposes.

Note: VCMs and CCMs could involve trade in either carbon credits or permits. This analysis is primarily concerned with carbon credit markets, so unless stated otherwise, all references to VCMs and CCMs in this paper relate to carbon credit markets.

Sources: Paragraph 1 of the Annex I of Decision 2/CMA.3 (UNFCCC, 2021^[9]); (UNDP & UNFCCC, 2023^[9]).

This paper aims to improve the understanding by governments and other stakeholders of how carbon credit markets interact, and the potential role of policy making for high-integrity carbon markets. The analysis focuses on the interplay between VCMs and Article 6 of the Paris Agreement, with more limited references to other carbon credit markets, such as CORSIA and domestic compliance markets. The paper builds on an extensive literature review of academic research, policy documents, multilaterally negotiated texts, integrity initiatives and grey literature. Furthermore, data on carbon credit supply were collected from major carbon crediting mechanism registries and databases (see Annex C for the database construction methodology). These data were aggregated, harmonised and analysed. The aim was to understand how carbon credit supply has evolved over time, and the relevance of carbon credit markets for GHG mitigation in different contexts.

This paper is structured as follows. Section 2. gives a brief background to carbon credit markets, how they work, and their environmental integrity risks (Annex A provides additional details). Section 3. takes stock of recent developments in carbon credit markets, and explores how these may interact and influence environmental integrity. Section 4. presents potential ways that governments could engage with carbon credit markets to enhance their environmental integrity, while Section 5. outlines future considerations for carbon credit markets, and the potential roles they could play in the net-zero transition.

2. Background on carbon credit markets and environmental integrity

Key messages

Carbon credit markets reward greenhouse gas (GHG) emission reductions or removals, unlike permit markets, which discourage emissions. Carbon credit markets are currently very small compared to permit markets.

Carbon credit markets are diverse, and some market segments interact. These markets can be broadly categorised into two types: compliance carbon markets (CCMs), where credits are used to comply with a GHG obligation, and voluntary carbon markets (VCMs), where credits are used voluntarily. VCMs and CCMs can partially overlap and exercise mutual influence (“interplay”).

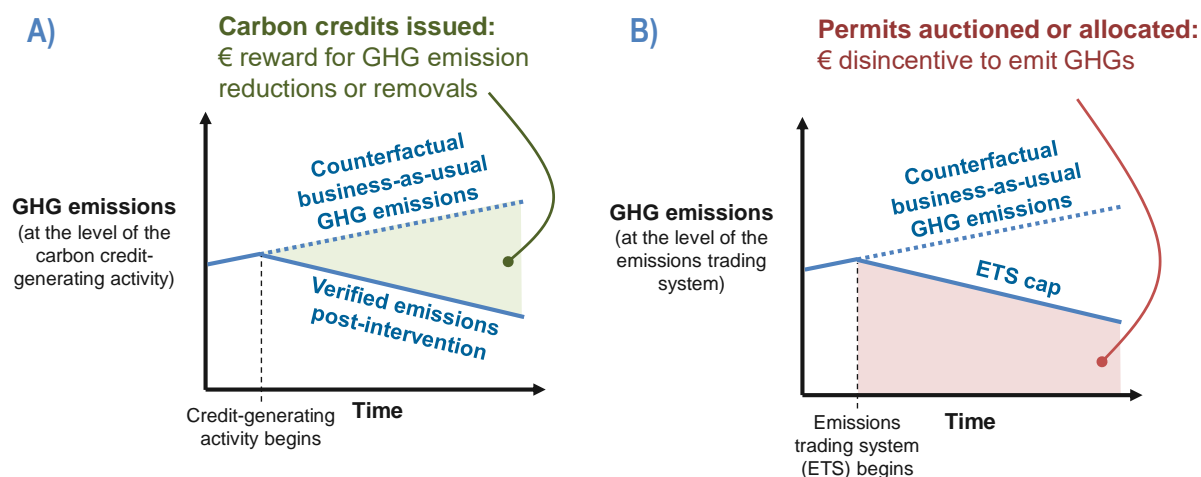
For carbon credit markets to support climate action effectively, they must operate with environmental integrity, i.e. ensuring that carbon credit transfers lead to more GHG mitigation than would have happened in their absence. This requires effective management of risks throughout the carbon credit lifecycle.

Environmental integrity risks in carbon credit markets are pervasive and vary by market segment. For example, for a large share of mitigation activities registered with independent and international crediting mechanisms, the mitigation impacts have been overstated.

Carbon markets can be categorised into permit markets and carbon credit markets. Permit markets put a constraint on GHG emissions in a defined part of the economy in which regulated entities³ can trade GHG emission permits with each other. Through permit trading, the market discovers the cost of emitting 1 tonne of carbon dioxide equivalents (t CO₂-eq) of GHG emissions, and this price incentivises regulated entities to reduce their emissions (Figure 2.1.B). In contrast, carbon credit markets provide a revenue stream for emission reductions or removals. Carbon credits are generated by comparing emissions within the activity boundary with a counterfactual baseline of how large emissions would have been in the absence of the activity (Figure 2.1.A). Carbon credits can come from a wide range of mitigation activities, with the most common categories being renewable energy and carbon sequestration in forests (Annex A). Some permit markets are linked to carbon credit markets through “offset provisions”. Such provisions allow regulated entities to purchase carbon credits and submit them to the regulator to offset a defined proportion of their liability under the permit market.

³ Such as facilities or companies covered by an emissions trading system or carbon tax.

Figure 2.1. Carbon credits and permits – how do they work?



Note: A) Describes the general functioning of a baseline-and-credit system, which underpins carbon credit markets. B) Describes the general functioning of an emissions trading system, also known as a permit market. Entities covered by a permit market typically have the possibility to sell excess permits if they reduce their GHG emissions. Therefore, there is an opportunity cost associated with GHG emissions covered by the scheme, which acts as a disincentive to emit GHGs. In permit markets where free allocation of permits is limited, regulated entities need to acquire permits through auctions or from other market participants, which can further strengthen the disincentive to emit GHGs (OECD, 2023^[10]). Source: Authors' own illustration.

Carbon credit markets are smaller than permit markets. In 2022, permit markets covered around 9 gigatonnes of carbon dioxide equivalents (Gt CO₂-eq), or 17% of global emissions (ICAP, 2023^[11]). Almost all permit markets are compliance carbon markets (often preceded by a voluntary pilot phase), where covered entities are subject to emission obligations and enforcement if they do not comply. Carbon credit markets are much smaller, with primary demand⁴ representing around 0.2 Gt CO₂-eq of emission reductions and removals in 2022 (Trove Research, 2023^[12]).⁵ Between 2018 and 2022, most demand for carbon credits came from developed countries, and most supply came from developing countries (Annex C). Table 2.1 summarises the main differences between permit markets and carbon credit markets.

⁴ Primary demand represents carbon credit retirements and is the definition of carbon credit demand used in this paper. This does not include secondary markets, or demand from carbon credit intermediaries of investors who “buy to hold” without retiring the carbon credit (Favasuli and Sebastian, 2021^[292]).

⁵ Estimates of carbon credit demand vary due to differences in methodology and scope. Key assessments for 2022 estimated primary demand to be roughly 0.2 Gt CO₂-eq (Trove Research, 2023^[12]) (World Bank, 2023^[5]).

Table 2.1. Comparison of permit markets and carbon credit markets

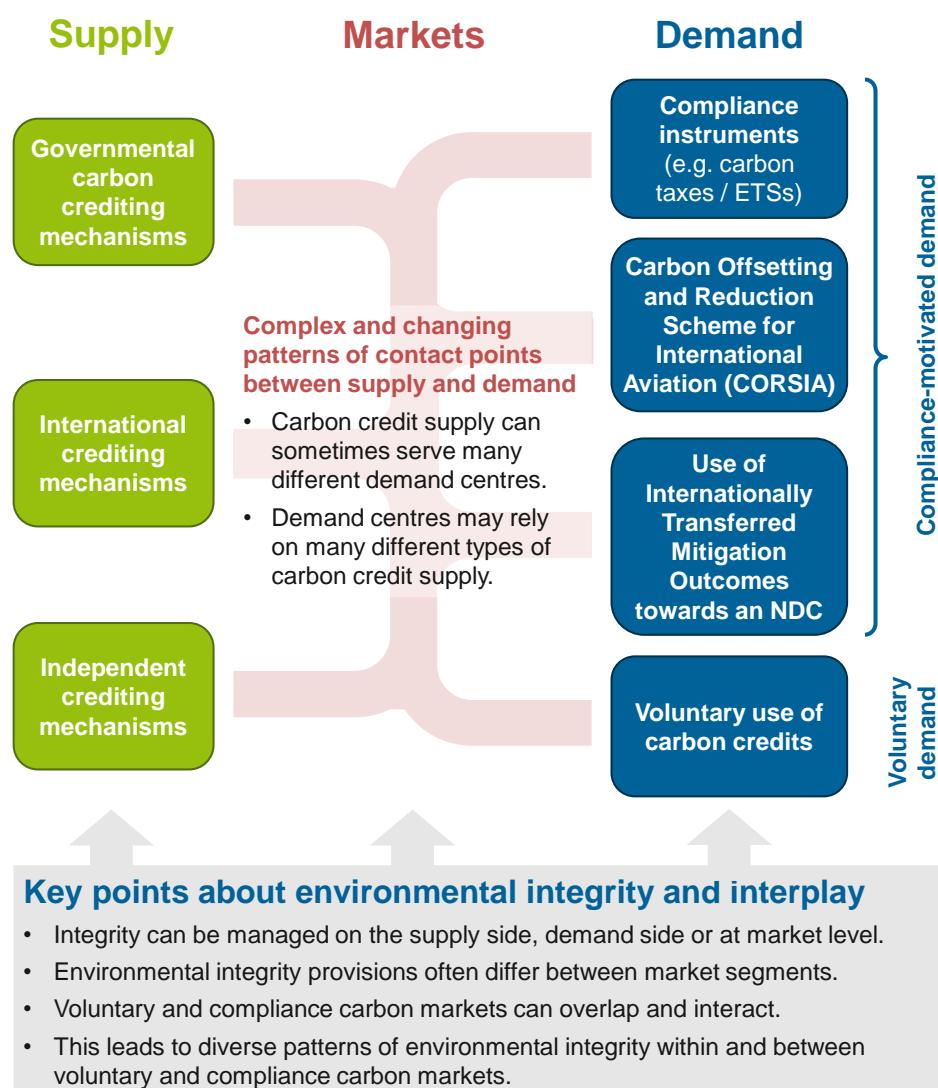
Characteristics	Permit markets	Carbon credit markets
Each unit represents	The right to emit 1 t CO ₂ -eq of GHG emissions	1 t CO ₂ -eq of GHG emissions reduced or removed
Incentive mechanism	Discourages GHG emissions	Rewards GHG emission reductions and removals
Other names	Allowance markets, cap-and-trade schemes, emissions trading systems (ETS)	Baseline-and-credit scheme, offset market
Notable examples	EU ETS, China's national ETS, California & Québec Cap-and-Trade Systems	Paris Agreement Crediting Mechanism, voluntary carbon markets (VCMs), California Compliance Offset Program
Market size in 2022	Emissions coverage: 9 Gt CO ₂ -eq Value: >USD 900 billion Revenues collected: USD 65 billion	Primary demand: 0.2 Gt CO ₂ -eq Value: >USD 2 billion
Voluntary or compliance?	Mostly compliance (sometimes preceded by a voluntary phase)	Either compliance or voluntary

Note: Carbon credit markets and permit markets incentivise GHG mitigation in different ways, so metrics for their relative size are not directly comparable. For example, the emissions coverage in permit markets represents all emissions covered by those instruments, whereas the primary demand in carbon credit markets only represents emissions reduced or removed, and not all emissions covered by credit-generating activities.

Sources: (ICAP, 2023^[11]; World Bank, 2023^[5]; Trove Research, 2023^[12]; Verma and Chestney, 2023^[13]).

Patterns of supply and demand in carbon credit markets are complex (Figure 2.2). The complexity is increased by the fact that there are different types of carbon credit markets, broadly categorised as either compliance carbon markets (CCMs) or voluntary carbon markets (VCMs). However, these labels are most appropriate for categorising motivations to buy carbon credits, rather than entire markets. The VCM and CCM categories each encompass a diverse and fragmented set of market segments, and the boundaries between them are not always distinct. In CCMs, governments can set market boundaries, rules and safeguards that strengthen the environmental integrity of these markets. However, the ambition of environmental integrity provisions varies between CCMs. Together with the complex linkages between VCMs and CCMs, this leads to diverse patterns of environmental integrity across CCMs and VCMs.

Figure 2.2. Categories of carbon credit supply and demand and their relevance for environmental integrity and interplay



Source: Authors' own illustration, based on (World Bank, 2022^[14]).

Carbon credit supply is created by mitigation activities that are registered with a carbon crediting mechanism. When activities have their mitigation outcomes verified, carbon credits are issued via the mechanism's registry. There are over 170 different categories of credit-generating activities (Ecosystem Marketplace, 2022^[15]) and a wide range of carbon crediting mechanisms. These can be categorised into international, governmental or independent mechanisms. Demand for carbon credits can come from voluntary or compliance-motivated buyers. In 2022, at least two-thirds of demand for carbon credits came from voluntary buyers.⁶ These buyers are mostly corporates using carbon credits to support a climate

⁶ According to information reported by governments to the World Bank (2023^[5]), around 43 million carbon credits were used for compliance purposes in 2022. In a review of VCM activity in 2022, Trove Research (2023^[12]) reported that 173 million carbon credits were used across 9 registries. There is likely some overlap between these estimates. The remainder of this paper refers to 'voluntary buyers' as the group of buyers, mostly corporates, that drive demand in

commitment or claim (Ecosystem Marketplace, 2021^[16]). Compliance-motivated demand comes from entities that can comply with a regulatory obligation or meet a binding commitment through the use of carbon credits. Compliance buyers are usually entities regulated under a compliance instrument but can also be countries using Internationally Transferred Mitigation Outcomes (ITMOs) to meet their NDC (Box 1.1).

Patterns of carbon credit supply and demand affect how markets interact, and these have changed significantly in the last decade. To complement Figure 2.2, some of the current main points of contact between supply and demand are as follows:

- Domestic compliance instruments tend to rely on carbon credit supply from governmental crediting mechanisms, or independent crediting mechanisms with additional origin and quality criteria (PMR, 2021^[17]).
- International compliance markets⁷ are in a transition phase from exclusively relying on international crediting mechanisms under the Kyoto Protocol, to more flexible arrangements. Under the Paris Agreement, countries have considerable flexibility over how to trade mitigation outcomes under Article 6.2 (e.g. via independent, international or governmental mechanisms). Countries will also be able to issue and use mitigation outcomes via the international Paris Agreement Crediting Mechanism (PACM), once it is fully operational (Box 1.1).
- Compliance carbon markets also include the use of carbon credits to meet the aviation sector's obligations under CORSIA. In the pilot phase (2021-2023), CORSIA granted eligibility to nine different international, independent and governmental crediting mechanisms. By March 2024, only two independent crediting mechanisms had gained eligibility to supply carbon credits for the first compliance phase (2024-2026), but the list is expected to grow (ICAO, 2024^[18]).
- Voluntary buyers can buy carbon credits according to their preferences, so their carbon trading patterns vary. This is unlike compliance markets, which typically have eligibility criteria for credit supply. Most voluntary demand is for credits from the independent Verified Carbon Standard and Gold Standard. Voluntary buyers also purchase credit supply from other crediting mechanisms, including mechanisms that also service compliance instruments (Ecosystem Marketplace, 2023^[4]).

A detailed description of voluntary carbon markets (VCMs), compliance carbon markets (CCMs) and how they interact is provided in Annex A.

Both voluntary and compliance carbon markets are subject to a range of environmental integrity risks which could undermine their effectiveness in supporting climate mitigation objectives. Recent reports have highlighted environmental integrity risks for both carbon credit supply and demand, notably in VCMs. For example, a large share of carbon credit-generating activities registered with independent and international crediting mechanisms overstated mitigation impacts.⁸ Furthermore, the voluntary use of carbon credits

VCMs. This does not include e.g. the voluntary use of Internationally Transferred Mitigation Outcomes (ITMOs) by some countries under Article 6.

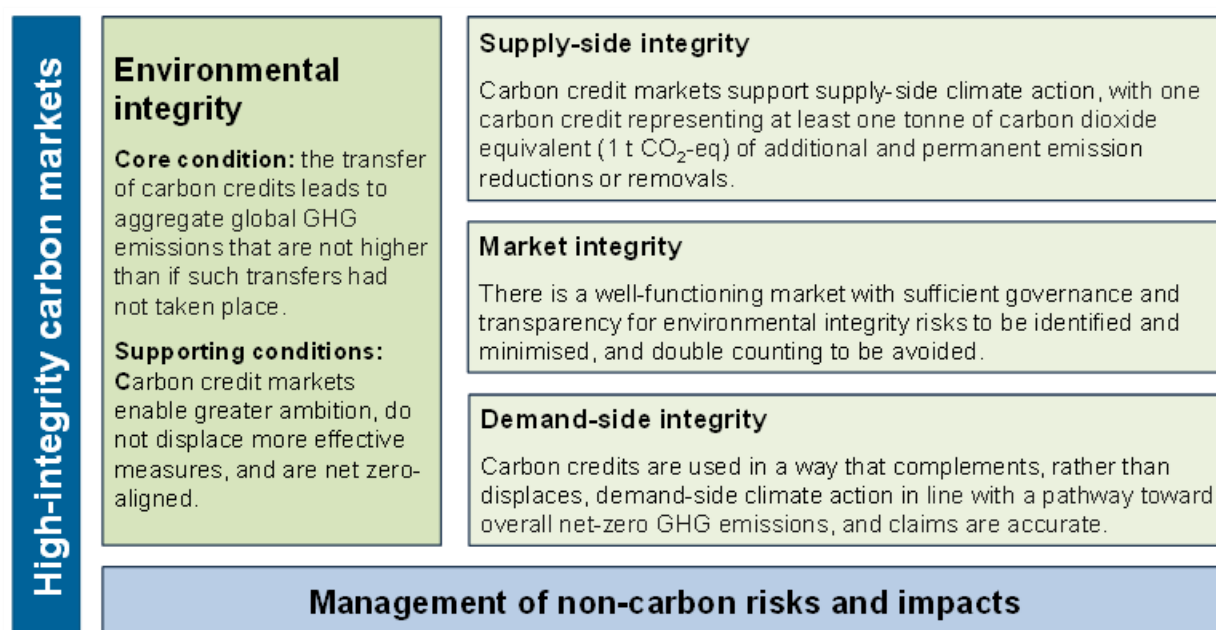
⁷ For the purposes of readability, this term refers to countries' use of ITMOs towards NDCs under the Paris Agreement, and countries' use of carbon credits to meet commitments under the Kyoto Protocol. However, most of Article 6 cooperation is currently bilateral, rather than occurring in an open market. Also, while the use of ITMOs towards NDCs in this paper is categorised as "compliance", countries have different views on the nature of such use.

⁸ For example, carbon credit ratings agencies (which assess carbon credit integrity) estimate that around half of assessed carbon credit-generating activities are of low quality. However, these patterns vary significantly between projects. "Low quality" refers to credit-generating activities rated B or lower by BeZero (57%) (BeZero Carbon, 2023^[296]), C or lower by Calyx Global (64%) (Calyx Global, 2023^[297]) and C or lower by Sylvera (44%) (Sylvera, 2023^[171]). These data were gathered from ratings agencies in July-September 2023. Ratings agencies assess quality using different assessment methodologies and scopes for carbon credit supply (Wawrzynowicz, Krey and Samaniego, 2023^[51]), typically do not include governmental mechanisms and only cover a segment of the market.

sometimes supports misleading claims about the buyer's climate performance (Trouwloon et al., 2023^[3]). These risks, and provisions to manage them, vary greatly both within and between VCMs and CCMs. An in-depth discussion of environmental integrity definitions and risks is provided in Annex A.

For carbon credit markets to operate with integrity in a broader sense, they should also support other social and environmental objectives. Definitions of environmental integrity vary, but this paper uses the definitions outlined in Figure 2.3. These recognise that environmental integrity builds on several factors relating to the generation (supply-side integrity), use (demand-side integrity) and trading environment (market integrity) of carbon credits. Figure 2.3 Components of high-integrity carbon markets.

Figure 2.3. Components of high-integrity carbon markets



Note: High-integrity carbon markets require both environmental integrity and effective management of non-carbon risks and impacts. This paper focuses on environmental integrity. Therefore, detailed definitions are provided for environmental integrity overall, as well as its constituent parts (supply side, demand side and market integrity).

Source: Authors' own illustration.

Several governments have recognised that carbon credit markets must operate with environmental integrity to deliver on climate goals (see e.g. Box 2.1), but putting this into practice is challenging. There are risks to environmental integrity throughout the carbon credit lifecycle;⁹ managing them end-to-end requires significant technical and administrative capacity.

⁹ This includes the (i) development and registration of a credit-generating activity; (ii) verification of GHG mitigation impacts; (iii) issuance, tracking and retirement on a carbon credit registry; (iv) trading of carbon credits over the counter or via exchanges; and (v) final use of carbon credits, including any associated communication and information disclosure.

Box 2.1. G7 Principles of High Integrity Carbon Markets

In April 2023, G7 Climate, Energy and Environment Ministers agreed on a Communiqué (G7, 2023^[19]), including an Annex that outlined principles to inform global efforts to enhance integrity of carbon credits (G7, 2023^[20]). This Annex (Principles of High Integrity Carbon Markets) was later endorsed by G7 Leaders in Hiroshima. The Principles apply to supply-side integrity, demand-side integrity and market integrity. On supply-side integrity, the Principles describe robust certification standards for GHG mitigation, as well as management of environmental and social impacts. On demand-side integrity, the document highlights the need for carbon credit users to pursue direct mitigation and provide transparency on the use of carbon credits. On market integrity, it recognises the need for transparent registries, emissions reporting and global co-operation for continual improvement and a uniform shift to integrity.

While these Principles highlight common ground among major economies, it's not clear yet how they will impact market practices. Regarding the future of the G7 Principles, the Ministers' Communiqué states that they "will facilitate their implementation [...] including by sharing experiences through [...] the Carbon Market Platform" and that they will "strive to promote these principles" (G7, 2023^[20]). In 2024, under the Italian Presidency, G7 countries committed to working with OECD under the Carbon Market Platform to share experiences of promoting the implementation of the Principles of High Integrity Carbon Markets (G7, 2024^[21]).

3. Key developments in carbon credit market interplay and environmental integrity

Key messages

Carbon credit markets are expected to grow as countries and companies plan to use carbon credits to meet short- and long-term mitigation commitments. Efforts are now underway to enhance environmental integrity in both VCMs and CCMs. These parallel developments could influence both environmental integrity and how carbon credit markets interact.

Frameworks for environmental integrity are being developed or enhanced on multiple fronts, including the Paris Agreement's Article 6 and market-led initiatives for VCMs. Governments could support environmental integrity enhancements across VCMs and CCMs by: (i) assessing the strengths and weaknesses of different frameworks; (ii) encouraging the uptake of ambitious provisions, aligned with international best practice; (iii) identifying and addressing potential gaps in integrity management; and (iv) providing clarity to market participants through domestic policy frameworks.

Governments are making diverse efforts to source and supply carbon credits, while the Article 6 framework is not yet fully operational. On the supply side, seller countries are preparing policy frameworks to attract carbon credit revenue for mitigation activities, and these frameworks could consider both CCMs and VCMs. On the demand side, some buyer countries are preparing to source mitigation outcomes, often using bespoke environmental integrity frameworks. When managing environmental integrity risks, countries can draw on examples from CCMs and/or VCMs.

Carbon credit market fragmentation could increase in the near term, due to: (i) diverse bilateral arrangements for carbon trading under Article 6.2; (ii) several new carbon pricing instruments whose carbon credit provisions differ; (iii) diverse government policies targeting VCMs; (iv) increasing seller country influence over carbon credit supply; and (v) a multiplication of market infrastructure. To minimise further fragmentation, governments could co-ordinate their efforts to enhance environmental integrity.

3.1. Carbon credit markets – a rapidly changing space

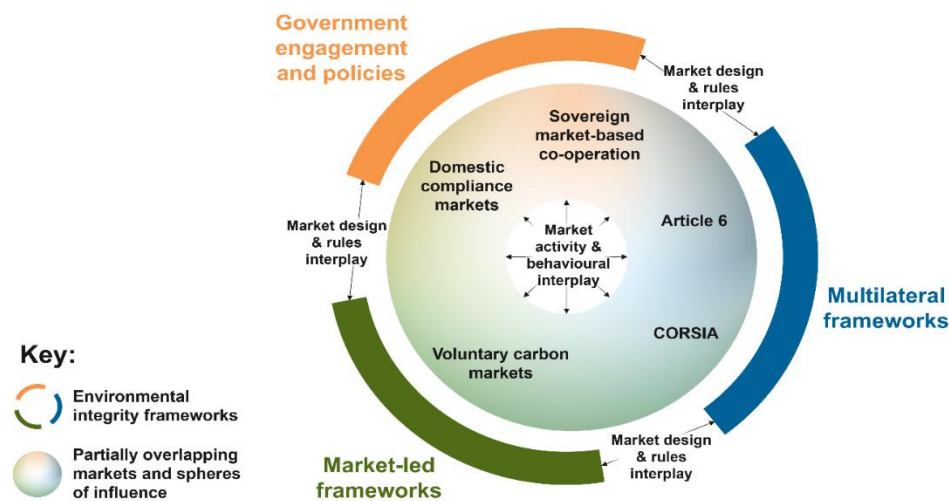
International carbon credit markets are currently undergoing rapid changes, with projected long-term growth, short-term credibility challenges, and reforms to environmental integrity frameworks. The long-term growth is connected to a wider momentum for the net-zero agenda. Several countries, companies, and other entities have adopted mitigation commitments which partly rely on future use of carbon credits. As a result, carbon credit demand is projected to grow substantially until 2030, and possibly beyond. However, 2023 saw growing public attention to the environmental integrity risks of carbon credit markets.¹⁰

¹⁰ For example, a high-profile article in the Guardian (2023_[325]), building on an article by West et al. (2023_[326]), claimed that avoided deforestation projects from the Verified Carbon Standard had been overcredited more than ten-fold. Other reports also called into question the environmental integrity of e.g. clean cookstove projects (Wiehl, Kammen and

These credibility challenges have hampered voluntary demand for carbon credits, but have also given momentum to efforts that aim to enhance environmental integrity across carbon credit markets.

Several efforts – by governments, multilateral frameworks¹¹ and market-led frameworks¹² – are underway to enhance the environmental integrity of carbon credit markets (Figure 3.1). Governments are developing policies and engaging in initiatives that influence environmental integrity across carbon credit markets. Governments' policy approaches to carbon credit markets differ, as carbon credit markets complement other climate policies which are adapted to national circumstances. Governments are also negotiating multilateral frameworks for carbon credit markets through the Paris Agreement's Article 6 and CORSIA. Moreover, market-led frameworks are influencing environmental integrity, primarily in VCMs. These framework developments are happening in parallel and can interact with each other, leading to *market design and rules interplay* (Section 3.2).

Figure 3.1. Interplay between carbon credit markets and their environmental integrity frameworks



Notes: The environmental integrity of carbon credit markets (shaded donut) is influenced by different types of environmental integrity frameworks (coloured arcs). Environmental integrity frameworks can exercise mutual influence ('market design and rules interplay'). Integrity frameworks could interact for example through the alignment of specific provisions, cross-references and delegation of responsibilities between frameworks. Carbon credit market segments (black labels inside the donut) can also overlap and exercise mutual influence ('market activity and behavioural interplay'). This activity interplay could happen due to correlations in supply, demand and prices between different market segments, as well as a diffusion of capital, knowledge and best practices.

Source: Authors' own illustration.

Carbon credit markets can also interact with regards to their *market activity and behaviour* (Section 3.3). Carbon credit markets consist of more or less connected market segments¹³ for goods (carbon credits),

Haya, 2024^[327]) and renewable energy projects (White and Ratcliffe, 2022^[232]). Several articles have later refuted the allegations of overcrediting (Mitchard et al., 2023^[328]) (Furey, 2023^[329]) (Gold Standard, 2024^[330]).

¹¹ In this paper, 'multilateral frameworks' refers to those developed under international treaties or organisations.

¹² Market-led frameworks is in this paper used as a catch-all term for various initiatives that seek to enhance environmental integrity primarily in VCMs. Note, however, that these 'market-led' initiatives are often multi-stakeholder, with support from the private sector, NGOs, IGOs and/or governments.

¹³ The connectedness between carbon credit markets varies. Many government-administered carbon credit markets (e.g. Australia, Canada, Japan) operate relatively independently from other carbon credit market segments and environmental integrity frameworks. Other markets, (e.g. VCMs and carbon credits traded for compliance with CORSIA) have significant overlaps.

which are partially differentiated (with regards to their respective origin, crediting mechanisms, mitigation activities, etc.). As such, supply, demand and prices in one market segment can affect the supply, demand and prices in another. For example, when demand for carbon credits from the EU Emissions Trading System declined in late 2011, this led to reduced demand and prices across many carbon credit markets (Michaelowa, Shishlov and Brescia, 2019^[22]).

3.2. Key developments in market design and rules

Carbon credit market design has been evolving in recent years, with developments in environmental integrity frameworks that have consequences for interplay as well as policy making for high-integrity carbon markets. Three main categories of environmental integrity frameworks are relevant: multilateral frameworks, market-led frameworks, and government policies and engagement. These frameworks influence different market segments and have different relative strengths and weaknesses (Figure 3.2).

Figure 3.2. Categories of environmental integrity frameworks

Environmental integrity framework types	Examples	Provisions apply to	Ambition	Speed of development
Multilateral frameworks	Article 6 CORSIA	International	Subject to political considerations	Slow
Market-led frameworks	ICVCM VCMI	Voluntary adopters	Subject to market buy-in	Fast
Government policies and engagement	National regulations Sovereign market engagement	Jurisdiction(s) covered by government(s) involved	Defined by government(s) involved	Medium

Note: CORSIA = Carbon Offsetting and Reduction Scheme for International Aviation, ICVCM = Integrity Council for the Voluntary Carbon Market, VCMI = Voluntary Carbon Markets Integrity Initiative.

Source: Authors' own categorisation.

3.2.1. Multilateral framework developments

United Nations Framework Convention on Climate Change (UNFCCC)

Article 6 under the Paris Agreement outlines how countries can co-operate to achieve their NDCs, and ongoing negotiations about its operationalisation could greatly influence carbon credit markets at large. A general rulebook for Article 6 co-operation was adopted at COP26 in Glasgow and further details were agreed at COP27 in Sharm El-Sheikh.¹⁴ Despite a lack of agreement on matters relating to Article 6.2 and Article 6.4 at COP28 in Dubai, several buyer and seller countries are proceeding with the use of Article 6.2 to implement their NDCs, and the first trades have taken place (Laude-Salcedo, 2024^[23]; IETA, 2024^[6]).

A defining feature of carbon trading under the Paris Agreement's Article 6.2 is that seller countries must apply corresponding adjustments¹⁵ to all mitigation outcomes authorised for use towards another country's

¹⁴ For Article 6.2 Guidance, see (Decision 2/CMA.3) and (Decision 6/CMA.4). For Article 6.4 Rules, Modalities and Procedures (RMPs), see (Decision 3/CMA.3) and (Decision 7/CMA.4) (UNFCCC, 2021^[8]) (UNFCCC, 2022^[289]).

¹⁵ Corresponding adjustments is a double-entry bookkeeping system which ensures that ITMOs cannot be double counted (i.e. by both buyer and seller) (Lo Re, Ellis and Greiner, 2022^[26]).

NDC or other international mitigation purposes.¹⁶ If a mitigation outcome is not authorised for such uses, seller countries may claim the associated GHG reduction or removal domestically. The extent to which such adjustments should apply in VCMs is fiercely debated (Box 3.1).

Article 6 rules directly influence the environmental integrity of countries' carbon trading and indirectly influence environmental integrity in other markets (Gold Standard, 2021^[24]). In particular, the Paris Agreement Crediting Mechanism (PACM) will have its own methodologies, registry, sustainable development tool and third-party auditor system, which could influence environmental integrity norms more broadly.¹⁷ However, PACM will take time to operationalise fully, and in its absence, countries' co-operative approaches under Article 6.2 could play a norm-shaping role in the short-term. Compared to PACM, Article 6.2 co-operation leaves flexibility for countries to define their own environmental integrity provisions. So, while countries can signal their expectations for high-integrity carbon markets through Article 6.2 co-operation, diverging environmental integrity frameworks between countries could drive market fragmentation¹⁸ (Section 3.3.2).

The Paris Agreement Crediting Mechanism (which is still being negotiated) could set a higher bar for environmental integrity than Clean Development Mechanism (CDM), the largest crediting mechanism under the Kyoto Protocol. For instance, the crediting periods for emission reduction activities under PACM will be limited to a total of 15 years (compared to up to 21 under the CDM). Moreover, crediting baselines shall, among other things, "*be [...] below business as usual*", "*contribute to the equitable sharing of mitigation benefits between [...] Parties*" as well as "*align with the long-term temperature goal of the Paris Agreement*" (UNFCCC, 2021^[8]). Each of these provisions, depending on how they are operationalised, could lead to fewer carbon credits being issued by mitigation activities, and more of the mitigation benefits accruing to the host Party (seller country).

If PACM adopts integrity provisions that are more ambitious than current market practices, countries may want to ensure there is sufficient demand for PACM to win market shares and strengthen its influence on environmental integrity norms. This is because enhancements to environmental integrity frameworks often reduce crediting levels and/or increase transaction costs, making it challenging for ambitious crediting mechanisms to scale (Section 4.3). If integrity enhancements are not accompanied with a premium price or certain source of credit demand, ambitious provisions could make the mechanism less attractive to project developers and voluntary credit buyers. On the other hand, ambitious integrity provisions could also improve a crediting mechanism's reputation and attractiveness.

¹⁶ Other international mitigation purposes (OIMP) include "international mitigation purposes other than achievement of an NDC" and "other purposes as determined by the first transferring participating Party" (Decision 2/CMA.3, paragraph 1(f)) (UNFCCC, 2021^[8]). In practice, this can include the use of ITMOs towards CORSIA obligations, or covered by other compliance or voluntary emission mitigation targets, sometimes including the use by Parties under specific circumstances.

¹⁷ As an indication of the potential influence that PACM could have once fully operationalised, several elements of the CDM are used also by other standards. The CDM's methodologies and auditor accreditation system are still relied upon by many independent and governmental carbon crediting mechanisms (CCQI, 2023^[50]).

¹⁸ Market fragmentation refers to a situation where there are multiple market centres for similar assets (carbon credits). Fragmentation of carbon credit markets can occur, for example, across trading venues, standards, jurisdictions.

Box 3.1. Corresponding adjustments in voluntary carbon markets

There is an ongoing debate about the extent to which corresponding adjustments (and authorisation of mitigation outcomes) should apply to VCMs (Streck, 2023^[25]). Under Article 6, corresponding adjustments effectively transfer mitigation impacts from the seller country's emissions balance to the ITMO user's (Lo Re, Ellis and Greiner, 2022^[26]). Corresponding adjustments are essential to ensure that mitigation outcomes are not claimed by several Parties to the Paris Agreement, but such adjustments are currently rare in VCMs. As such, there is a risk that climate benefits are claimed twice¹⁹ – by the seller country's NDC, and the voluntary carbon credit buyer (Fearneough et al., 2020^[27]).

Arguments for why such double claims should be avoided include:

- The use of carbon credits without corresponding adjustments to compensate for direct GHG emissions risks overstating the amount of mitigation achieved (Fearneough et al., 2020^[27]).
- Claims like 'carbon neutrality' can be difficult to defend if the underlying mitigation impacts are claimed twice, potentially undermining public trust carbon credit markets (Ahonon et al., 2023^[11]).
- Measures to avoid double claiming were already used by several crediting mechanisms in the context of Annex B countries under the Kyoto Protocol (Kreibich and Hermwille, 2021^[28]).

Arguments for why such double claims are acceptable include:

- Countries and companies operate overlapping and parallel GHG accounting systems. Double claiming of mitigation impacts between corporates and countries is commonplace and often allowed according to companies' GHG accounting rules (Howard and Greiner, 2021^[29]).
- Authorisations could increase administrative barriers for VCM-financed mitigation, while reducing activity proponents' access to carbon credit revenues, particularly in seller countries where government capacities to participate in Article 6 are limited (Choudhury, 2021^[30]).

Many stakeholders can influence whether credits used in the VCM are authorised under Article 6 and thus subject to corresponding adjustments. Emerging practices suggest that diverging rules for claims may co-exist going forward:

- On the supply side, some seller countries require that all exported carbon credits are authorised (e.g. Bahamas), whereas others leave this decision to the buyer (e.g. Ghana) (Granziera, Hamrick and Verdick, 2023^[31]).
- On the demand side, six European countries have jointly declared that offset claims must be accompanied by a corresponding adjustment (Government of the Netherlands, 2023^[32]). By contrast, the US-backed Energy Transition Accelerator allows non-adjusted carbon credits to compensate for a company's Scope 2 or 3 emissions, if the emissions and the carbon credits are generated in the same country (Energy Transition Accelerator, 2023^[33]).
- Market-led frameworks could also influence the role of corresponding adjustments for VCMs. For example, future provisions for corresponding adjustments are being considered on the supply side (ICVCM, 2023^[34]) and claims guidance exists on the demand side (VCMI, 2023^[35]).

If diverging rules continue to co-exist, this could create uncertainty for voluntary users of carbon credits and limit carbon credit demand. Emerging regulations can provide clarity in specific jurisdictions (Section 3.2.3). However, norms for corresponding adjustments in VCMs may evolve over time, as the supply of ITMOs will take time to scale (PMR, 2021^[36]). In the meantime, stakeholders have proposed that the use of carbon credits without corresponding adjustments support 'contribution claims'.²⁰ Such claims allow carbon credit users to claim a climate impact, while recognising that the mitigation outcome is reflected in the host country's emission balance (Fearneough et al., 2023^[37]).

PACM will also accommodate old mitigation activities from the CDM, many of which are subject to environmental integrity concerns. Over 1300 CDM projects and programmes have requested to transition to PACM. If all of these would successfully complete the transition procedure,²¹ they could generate up to 870 million credits using old CDM methodologies, with over 300 million potentially being eligible for use towards countries' first NDCs (UNEP-CCC, 2024_[38]). This could have environmental integrity implications, as many transitioning CDM activities are likely to have limited additionality (Fearneough, Schneider and Warnecke, 2021_[39]). After 2025, CDM activities must use an PACM methodology (which have yet to be developed), and demonstrate their continued reliance on carbon credit revenue (UNFCCC, 2023_[40]).

Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

CORSIA, established under the International Civil Aviation Organization (ICAO), is a compliance carbon market for the aviation industry, with a bespoke environmental integrity framework. For flights between ICAO member states who participate in CORSIA, airline operators need to offset GHG emissions that exceed a defined emissions baseline. CORSIA has established a framework for determining which crediting mechanisms and categories can supply CORSIA-eligible emissions units, based on criteria related to governance, transparency, additionality and more (ICAO, 2024_[18]).

Carbon credit trading for compliance with CORSIA is currently limited, but is expected to become a significant driver of carbon credit demand within a few years. A reduction in international air traffic during the COVID-19 pandemic led to low CORSIA demand in the pilot phase (2021-2023) (Lithgow, 2022_[41]). However, CORSIA demand could exceed 100 Mt CO₂-eq per annum before 2030 (CFP Energy, 2024_[42]).²²

CORSIA's could increase overlaps between CCMs and VCMs, as CORSIA-eligible carbon credit supply overlaps with other compliance and voluntary carbon markets. In CORSIA's pilot phase (2021-2023), carbon credit supply could be supplied by a range of independent, governmental and international crediting mechanisms (ICAO, 2023_[43]). By November 2023, only two independent crediting mechanisms had gained eligibility for the first compliance phase (2024-2026), but the list is expected to grow (ICAO, 2023_[43]).

The environmental integrity framework set out by CORSIA has influenced norms in other markets and contributed to voluntary-compliance interplay. The CORSIA framework has led to process improvements among several carbon crediting mechanisms (ICAO, 2023_[44]), informed voluntary buyers' decisions (Ecosystem Marketplace, 2023_[4]), provided the basis for standardised contracts (Xpansiv, 2024_[45]), and is directly referenced by the ICVCM's assessment framework (ICVCM, 2023_[46]).

¹⁹ This risk depends on the degree to which carbon crediting activities are covered by the seller country's NDC and GHG inventory (Fearneough et al., 2020_[27]).

²⁰ Claims made by entities who wish to take credit for contributing financially to mitigation efforts (for example by retiring carbon credits), rather than compensating for their direct emissions tonne-for-tonne.

²¹ This requires, among other things, that (i) the transition request is approved by the host Party; (ii) the host Party fulfils the participation requirements for PACM; (iii) the activity proponent submits supplementary documentation and pays a transition fee; (iv) this documentation passes a completeness check and substantive check; and potentially that (v) the activity passes a review by the Article 6.4 Supervisory Body, if so requested (UNFCCC, 2023_[40]). Not all projects will complete this process, and the estimated supply potential of projects often exceeds actual issuances, so the number of credits generated with CDM methodologies is likely going to be much lower than 870 million.

²² Projections of CORSIA demand vary considerably and is subject to uncertainties about the recovery of air traffic after the COVID-19 pandemic, the speed of emission reductions in the aviation sector, and the number of participating states (ICF Consulting et al., 2020_[319]).

CORSIA's environmental integrity framework has, in turn, been influenced by other frameworks. In the first compliance phase, CORSIA's rules were brought closer to Article 6 rules,²³ for example by requiring that obligated entities submit carbon credits with corresponding adjustments (ICAO, 2023^[43]). This is likely to result in a large volume of ITMO demand leading up to the compliance deadline for the first phase (31 January 2028), before the end of the first NDC period for countries (2030).

Implications for governments

Multilateral frameworks, in particular the Paris Agreement's Article 6, provide governments with an important avenue for enhancing environmental integrity in both CCMs (directly) and VCMs (indirectly). Countries could consider the following to leverage the impact of multilateral negotiations on environmental integrity across carbon credit markets (Figure 3.3):

- **Agree on a high-integrity rulebook under Article 6**

To effectively enhance environmental integrity of carbon credit markets, UNFCCC frameworks for international carbon trading will need to be more ambitious than existing market practices. A high-integrity PACM rulebook could provide a useful tool for countries to enhance environmental integrity norms in the medium- to long-term. If efforts to develop high-integrity provisions under the PACM are unsuccessful, or significantly delayed, countries could consider other options to enhance integrity using international frameworks. For example, countries could establish plurilateral "clubs" of buyer and seller countries with a common view of high-integrity carbon trading under Article 6.2. Such plurilateral constellations could refer to existing integrity frameworks (e.g. ICVCM, CORSIA, G7 Principles) and / or establish new ones to enable growth of high-integrity market segments.

- **Ensure that the Paris Agreement Crediting Mechanism maintains a high-integrity reputation**

Up to 870 million carbon credits, using old CDM methodologies, could be issued under the Paris Agreement Crediting Mechanism. While there are transitioning CDM activities that operate with environmental integrity, there are also those that could harm the reputation of PACM. To avoid such risks, countries can prioritise developing carbon credit supply with up-to-date methodologies, reflecting international best practice. If such efforts cannot satisfy the demand for ITMOs, countries can apply additional quality controls to the supply of mitigation outcomes from old CDM activities that are eligible for use towards first NDCs. Countries could also signal to voluntary buyers that they should conduct due diligence on supply from the PACM with the same rigour as they would for any other carbon credits.

- **Stimulate high-integrity market activity**

Governments could support or encourage high-integrity market segments, to support their uptake and influence on integrity norms. Demand-side countries could boost high-integrity market activity by e.g. (i) signalling their commitment to buy ITMOs or carbon credits that meet ambitious integrity criteria; (ii) developing incentives for voluntary buyers to source high-integrity carbon credits; (iii) providing investment, capacity building or other support for potential activity proponents and seller countries.

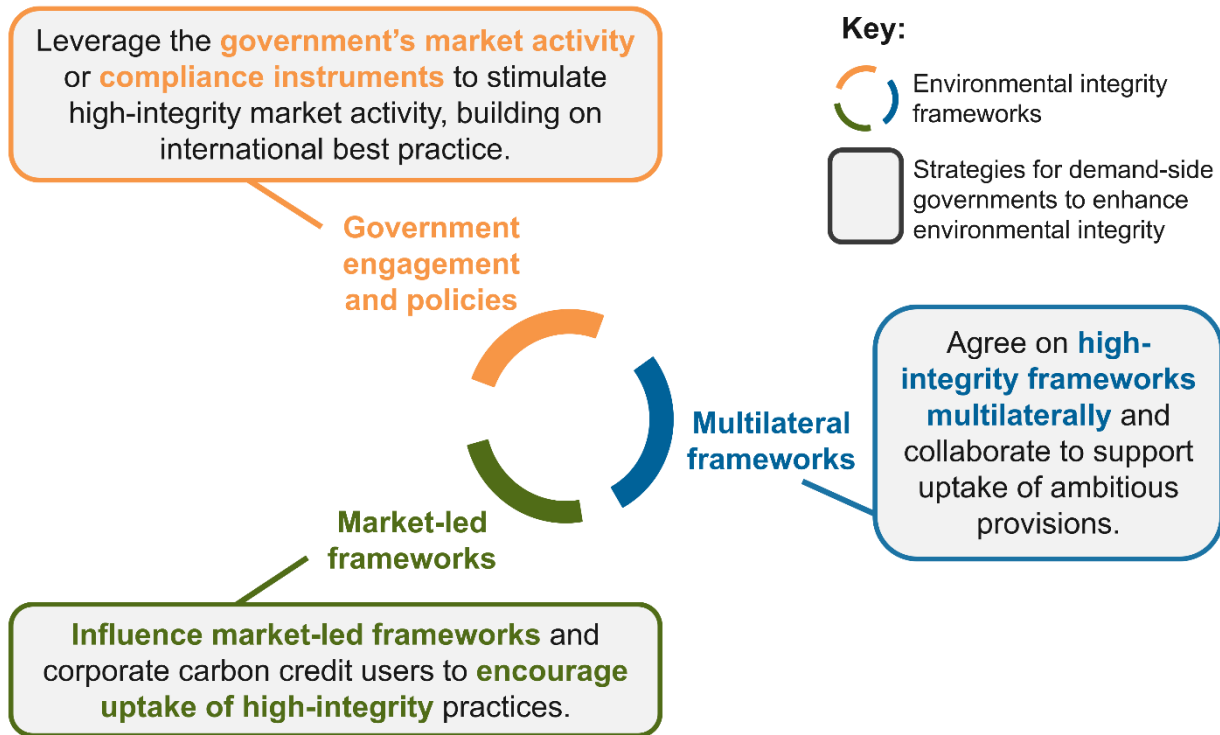
- **Work to level the playing field with less ambitious crediting mechanisms**

Countries with an interest in enhancing integrity may want to ensure that potential differences in environmental integrity provisions between crediting mechanisms do not undermine the competitiveness of high-integrity market segments. To promote alignment, governments could for example, seek to influence the Integrity Council of the Voluntary Carbon Market's (ICVCM) work

²³ ICAO's Technical Advisory Body (TAB) is also monitoring Article 6 developments to inform assessments of crediting mechanisms that apply for CORSIA eligibility, for example with regards to the requirement that business-as-usual baseline scenarios should be 'conservative' (ICAO, 2024^[332]).

programme on baselines and NDCs (ICVCM, 2023^[34]) and independent crediting mechanisms' efforts to define common principles for quantification and accounting (IETA, 2023^[47]).

Figure 3.3. Potential government strategies to enhance environmental integrity across carbon credit markets



Note: The environmental integrity of carbon credit markets is influenced by different types of environmental integrity frameworks (coloured arcs). Demand-side governments can engage with these frameworks (grey text boxes) in different ways to drive environmental integrity enhancements. Source: Authors' own illustration.

3.2.2. Market-led framework developments

Supply-side integrity initiatives

On the supply side, the Integrity Council for the Voluntary Carbon Market (ICVCM) (Annex B) aims to improve carbon credit quality with a set of Core Carbon Principles (CCP) and detailed framework for assessing alignment with these principles. ICVCM will assign a CCP-label to crediting mechanisms and credit categories that meet certain threshold requirements for emissions impact, governance, and sustainable development. To obtain the CCP-label, carbon crediting mechanisms and categories must meet environmental integrity requirements set out by CORSIA, as well as additional integrity provisions set out by ICVCM (ICVCM, 2023^[48]). The six largest independent crediting mechanisms have applied for the CCP-label. In 2024, ICVCM announced the first set of CCP-eligible crediting programmes and is expected to announce the first CCP-labelled credits (ICVCM, 2024^[49]). This will assist buyers to identify carbon credits that have passed a quality check in addition to that performed by carbon crediting mechanisms (ICVCM, 2023^[46]). ICVCM's framework may become more ambitious over time, based on the recommendations of "Continuous Improvement Work Programs" targeting specific supply-side integrity elements (ICVCM, 2023^[34]).

Other initiatives complement the ICVCM's binary assessment by providing risk assessments and integrity scores for individual projects or credit types. Such initiatives include the Carbon Credit Quality Initiative (CCQI, 2023^[50]) and carbon credit ratings agencies²⁴. Carbon credit ratings agencies provide buyers with project-level information on the likelihood that carbon credits represent 1 t CO₂-eq of additional and permanent emission reductions or removals that are not double counted. They also address social and environmental impacts (Wawrzynowicz, Krey and Samaniego, 2023^[51]).

Market-led frameworks could facilitate supply-side integrity enhancements, but their impact depend on market acceptance. For ICVCM to enhance integrity, the framework needs a critical mass of carbon crediting mechanisms to apply for the CCP-label, and buyers to assign a premium to CCP-labelled credits. Several independent crediting mechanisms have updated their standards to ensure CCP-eligibility, so ICVCM has already influenced market practices (VCS, 2023^[52]; Puro.earth, 2023^[53]).²⁵ Though, it remains to be seen which mitigation activities will receive CCP-labels, and what premiums CCP-labelled credits will command (Trove Research, 2023^[54]). For carbon credit ratings to enhance integrity, they need to effectively steer buyers towards high-integrity credits. This could in turn incentivise activity proponents to design high-integrity projects. An emerging correlation between good ratings and high carbon credit prices suggests that ratings agencies are indeed supporting integrity enhancements (Gould, 2024^[55]).

Supply-side integrity initiatives have developed provisions that governments could potentially build on, or learn from, alongside multilateral frameworks and frameworks by other governments. Depending on how they use carbon credit markets, governments could for example:

- Use the ICVCM's CCP-label as one of several screening tools to determine which credits are eligible for a compliance instrument, or for the government's own use (Merrill, 2023^[56]).
- Align government-supported carbon credit supply²⁶ with the CCPs to potentially attract additional demand from voluntary buyers.
- Use ratings agencies' intelligence to assess the integrity of carbon credit supply ex-ante (i.e. before an activity is developed), or ex-post (i.e. after carbon credits are issued). (Furey and Gill, 2023^[57])
- Refer to, or build on, market-led frameworks' integrity provisions when developing national policies or frameworks for carbon credit supply.

Demand-side integrity initiatives for voluntary buyers

Corporate net-zero commitments have grown rapidly, and this has led to a push for the environmental integrity of these commitments, and associated carbon credit use. Notably, the Voluntary Carbon Markets Integrity Initiative (VCMI) and the Science Based Targets initiative (SBTi), have sought to clarify how the use of carbon credits could support net-zero commitments (Annex B). A wide range of other initiatives also provide recommendations for demand-side integrity.²⁷ These initiatives share several principles, but differ in their detailed provisions, scopes and modes of implementation. Demand-side integrity initiatives

²⁴ For example, BeZero Carbon, Sylvera, Calyx Global and Renoster.

²⁵ Independent crediting mechanisms' efforts to align with ICVCM occur in parallel with regular updates to the mechanisms' procedures and methodologies. Such updates can sometimes have large implications for supply-side integrity. For example, the Verified Carbon Standard and Gold Standard halted registrations for grid-connected renewable energy projects in middle-income countries from 2020 onwards (Yadav, 2022^[302]). Furthermore, a recent consolidation and update of VCS's methodology for avoided deforestation (VCS, 2023^[303]) will likely lead to reduced crediting levels from this activity category (Calyx Global, 2023^[304]).

²⁶ For example, a governmental crediting mechanism, or a co-operative approach under Article 6.2 (in the case of a seller country).

²⁷ Such as the UN High-Level Expert Group on Net Zero, ISO Net Zero Guidelines, Race to Zero and more (Net Zero Tracker, 2023^[115]).

generally promote the following: (i) prioritising direct mitigation action over the use of carbon credits; (ii) using high-integrity carbon credits; (iii) providing transparency on the use of carbon credits. Some differences between demand-side integrity initiatives include the types of claims they recommend, and how they view the use of carbon credits to compensate for direct emissions. For example, VCMI and SBTi both steer voluntary carbon credit users away from offsetting claims, but VCMI offers companies some flexibility to use carbon credits towards their Scope 3 emissions (VCMI, 2023^[35]).

The impact of demand-side integrity initiatives on environmental integrity is dependent on market buy-in. Ultimately, the market behaviour of corporate carbon credit buyers is dependent on their perceived risks and rewards of VCM engagement. Demand-side integrity initiatives can provide potential VCM buyers with guidance and reduce perceived risks. However, where demand-side integrity enhancements increase costs (e.g. due to more expensive carbon credits), corporates may also need a perceived reward (e.g. a communication benefit) to change how they use carbon credits (SBTi, 2024^[58]). Such rewards can be limited, as carbon credit use has become increasingly subject to reputational concerns, litigation risk and regulation (GenZero and MSCI Carbon Markets, 2023^[59]). SBTi and VCMI may provide some clarity and confidence to VCM buyers, but neither framework is binding and there is still some disagreement about “what good looks like” for corporate carbon credit use (Kreibich, Brandemann and Jüde, 2022^[60]). Therefore, to improve clarity on demand-side integrity norms, further guidance or endorsements may be needed from other stakeholders with and influence over corporate behaviour, for example governments (Nordic Council of Ministers, 2022^[61]) or financial institutions (OECD, 2023^[62]).

Implications for governments

Most of carbon credit demand currently comes from voluntary buyers (Section 3.3.1), so as governments seek to enhance environmental integrity, they could consider how they engage with market-led frameworks. Governments’ engagement with market-led frameworks could work in both directions: (i) Market-led frameworks informing governments’ carbon credit market engagement and policies (ii) Governments influencing the content and use of market-led frameworks (Figure 3.3).

Market-led frameworks could lead to environmental integrity enhancements, but their impact will depend on market acceptance. Four market-led initiatives²⁸ came together at COP28 to promote an ‘end-to-end integrity framework’ for carbon markets to support corporate climate action (We Mean Business Coalition, 2023^[63]). Among voluntary adopters of these market-led frameworks, there will likely be voluntary carbon market segments operating with enhanced integrity risk management (e.g. CCP-labelled credits supporting VCMI-approved claims). However, market-led frameworks may also leave gaps where complementary policies or government action would be needed to manage integrity risks. Therefore, governments could:

- **Keep a watching brief on integrity initiatives**

Governments could learn from, and build on, market-led frameworks in carbon credit markets, as some of these frameworks set integrity provisions that go beyond existing regulations. For example, ICVCM will improve supply-side transparency, and VCMI provides a clear logic for how carbon credits can complement private entities’ direct mitigation efforts (ICVCM, 2023^[46]; VCMI, 2023^[64]). Governments who intend to enhance environmental integrity across carbon credit markets need to be aware of these initiatives’ main features. This will require ongoing government efforts, as market-led frameworks’ provisions and uptake will evolve over time. By keeping a watching brief, governments can identify lessons for their own carbon credit market engagement.

- **Encourage the use of ambitious environmental integrity provisions**

²⁸ These were the Greenhouse Gas Protocol (GHG Protocol), Science-Based Targets initiative (SBTi), Integrity Council for the Voluntary Carbon Market (ICVCM) and Voluntary Carbon Markets Integrity Initiative (VCMI).

Where market-led frameworks set ambitious provisions, these may be more costly for market participants to adopt. Therefore, government support or endorsements could accelerate the uptake of selected frameworks. For example, the UK government will in 2024 consult on how ICVCM and VCMI could potentially be endorsed and / or applied in their regulatory regime (UK Government, 2023^[65]). Moreover, the Singaporean government is planning to leverage ratings agencies' intelligence to identify high-integrity carbon credits under Article 6.2 (Furey and Gill, 2023^[57]).

- **Address areas where integrity management is lacking**

VCM initiatives support integrity enhancements in some areas, but also give other areas less attention. Governments could analyse emerging frameworks and identify areas where further integrity enhancements are needed. One such area is transparency, guidance and capacity building to promote environmental integrity at the seller country-level (Box 3.2).

- **Promote synergies and alignment between frameworks**

Market-led frameworks sometimes provide overlapping or competing recommendations for market participants. Governments could assist market participants in identifying how integrity initiatives could be used in a complementary and synergistic way, for example through the development of guidance (Section 4.3.3) or public-private platforms for carbon credits (Section 3.3.2). Governments can also support strategic collaboration and dialogue among these frameworks.²⁹ As Article 6 negotiations progress, governments could also clarify how VCM integrity initiatives can align with Article 6 to promote a uniform shift to integrity (G7, 2023^[20]).

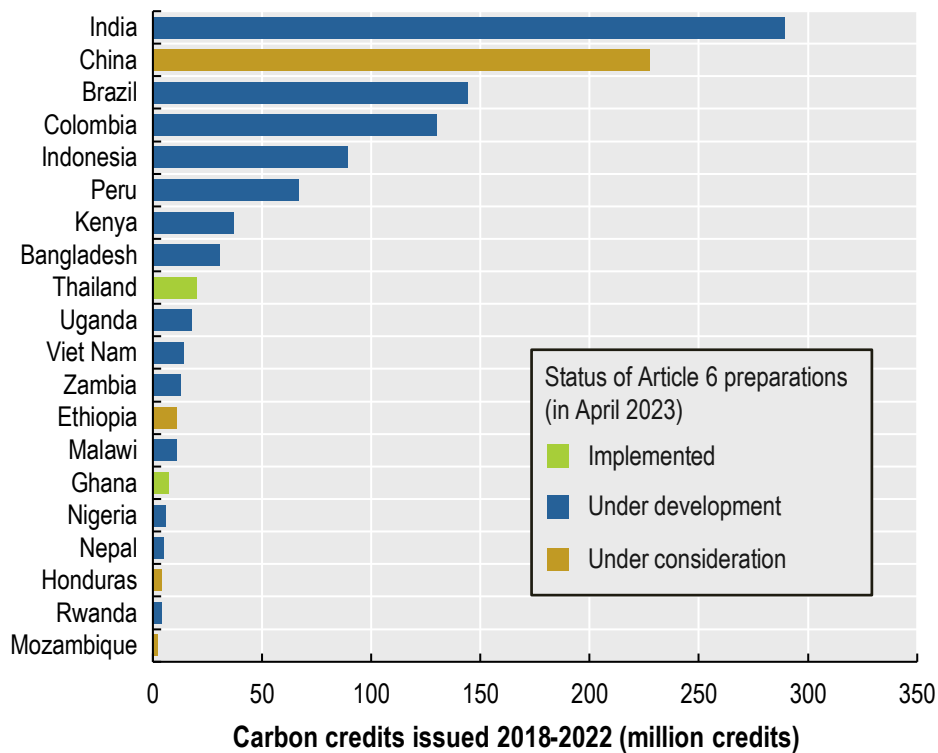
3.2.3. Government policies and engagement

Supply-side policy developments

Several potential seller countries under Article 6 are currently developing frameworks for how the seller country will engage in Article 6, as well as other carbon credit trading. As of 30 April 2023, only a few countries, such as Ghana and Thailand, with modest potential to supply carbon credits, had established comprehensive frameworks for participating in Article 6 (Figure 3.4).

²⁹ For example, through convening platforms like the World Bank Engagement Roadmap (World Bank, 2023^[320]), or Carbon Market Platform.

Figure 3.4. Status of Article 6 preparations in 20 potential seller countries



Note: Article 6 preparations are advancing rapidly, so the status of implementation of the countries above may not be reflective of their current situation. In the assessment done by Adelphi and Gold Standard in April 2023, countries' preparations were categorised as follows:

"Implemented": The relevant institutional, administrative, legal and infrastructure arrangements to participate in Article 6 are already in place.

"Under development": Actively preparing for Article 6 implementation, although measures are still being developed and are not yet fully in place to enable participation.

"Under consideration": Currently considering whether or how to use Article 6, but with no active preparations underway for implementation.

Source: Status of Article 6 preparations based on Hynes, Hall and Machnik (2023^[66]). Authors' own analysis of issuance data, see details in Annex C.

Developing a carbon credit market strategy involves strategic, tactical, operational and technical issues that have implications for environmental integrity and equity (MOEJ, 2022^[67]; World Bank, 2022^[68]). A key consideration for seller countries in Article 6 is the risk of "overselling" mitigation outcomes³⁰ – which, if not appropriately managed, may hinder seller country achievement of their NDC (World Bank, 2022^[68]). To avoid such risks, seller countries can for example steer Article 6 co-operative approaches towards mitigation activities that are inaccessible³¹ or ensure that a share of the mitigation outcomes are not transferred (Day et al., 2023^[69]). More generally, seller countries are experiencing various challenges related to identifying the role for carbon credit markets in supporting their NDC – including how to price ITMOs, which sectors and activities to include in Article 6 co-operation, and how to combine Article 6 engagement with other finance and mitigation instruments (GGGI, 2023^[70]). Therefore, various seller

³⁰ Since authorised mitigation outcomes have a corresponding adjustment applied, these do not count towards the seller country's NDC achievement. If a seller country authorises more mitigation outcomes than it can afford, alongside efforts to keep mitigation benefits domestically, this could lead to so called overselling. Since a country's GHG emissions can be unpredictable, there is always a degree of risk involved that could compromise NDC achievement, where Article 6 engagement is one of several risk factors, but also an opportunity to finance NDC implementation.

³¹ For example, technologies with low penetration rates or high abatement costs.

country-specific considerations are important for understanding whether carbon markets operate with environmental integrity (Box 3.2).

Box 3.2. Seller country-specific environmental integrity considerations

Several aspects of seller countries' climate policies and carbon market engagement can have implications for environmental integrity, including:

- **How Article 6 is used in relation to the seller country's NDC** (e.g., sectors, activities, and technologies): If co-operative approaches under Article 6 focus on mitigation actions that are inaccessible to the seller country or mitigation outcomes are shared between the seller and buyer, this can strengthen the environmental integrity of the approach. Furthermore, seller countries can reassure buyers by providing clarity on how co-operative approaches relate to the country's climate objectives as well as other mitigation efforts and investments.
- **The ambition level of the seller country's NDC** (e.g., sector coverage and target stringency): An NDC with an ambitious GHG mitigation target can act as an important safeguard for the environmental integrity of authorised mitigation outcomes, as this incentivises seller countries to use Article 6 co-operation for mitigation activities that would be difficult to achieve on their own.
- **The extent of progress made by the seller country against its NDC** (e.g. GHG mitigation achieved since the start of the NDC period, and estimated gap to NDC target): Demonstrated progress against the seller country's NDC can reassure buyers that co-operation on carbon markets goes beyond direct mitigation efforts by the seller government.
- **Seller country assurance of unit quality** (e.g., eligible activities, methodologies, MRV systems): As highlighted in Annex A, carbon credits have varying quality, and seller countries may implement different systems to ensure supply-side integrity.

Transparency and guidance on seller country-specific environmental integrity considerations is limited, in comparison to activity-level and credit mechanism-level aspects. Information or guidance on these and other seller country-relevant integrity considerations is already available in some areas, e.g. (World Bank, 2021^[71]). Improving transparency on seller country contexts and carbon market engagement is both technically and politically challenging (OECD & IMF, 2022^[72]; Michaelowa et al., 2019^[73]).³²

Supply-side governments' policy frameworks can shape carbon credit market interplay, notably by scoping out which sectors and activities can serve different markets (domestic vs international, or voluntary vs compliance). For example, Ghana's carbon market framework assigns different use cases (voluntary or compliance) to carbon credits depending on whether they are generated from activities within the unconditional NDC, conditional NDC, or outside the NDC altogether (Ghana Environmental Protection Agency, 2022^[74]). Ghana and several other countries (e.g. Zambia, Zimbabwe and India) have also defined lists of technologies and activities which are eligible (positive lists) or ineligible (negative lists) for generating mitigation outcomes (GGGI, 2023^[70]). Beyond strategic frameworks, countries are also implementing a wide range of policies with implications for carbon credit supply, including revenue sharing arrangements, the development of registries, exchanges and crediting mechanisms (Trove Research,

³² For example, there is a "technical expert review" (TER) established under Article 6 of the Paris Agreement (PA). The TER is the PA's dedicated framework for promoting transparency, accuracy, completeness, consistency and comparability under Article 6 and complements the broader reporting and review provisions under the Article 13 modalities, procedures, and guidelines (Falduto, Ellis and Simeonova, 2021^[291]). The TER is instructed not to review, among other things, the adequacy or appropriateness of a Party's NDC, a co-operative approach, or the authorisation of mitigation outcomes (Paragraph 10 of the Annex II of Decision 6/CMA.4) (UNFCCC, 2022^[289]).

2023^[54]). As well as influencing the environmental integrity of credits, these policies can affect the attractiveness of the seller country to investors and project developers (Abatable, 2023^[75]).

Demand-side policy developments

Multiple policy developments are affecting both the scale and nature of compliance and voluntary demand with potential implications for interplay and integrity. Governments exercise a lot of influence over compliance demand, while their influence over voluntary demand is more indirect.

Compliance demand for carbon credits is currently small compared to voluntary demand, but is more directly influenced by governments' efforts to enhance integrity. The three main categories of compliance demand are:

- Sectoral obligations under CORSIA (discussed in Section 3.2.1)
- Domestic and regional compliance instruments (such as carbon taxes and ETSs)
- International compliance use (ITMO use towards NDC under Article 6).⁷

Demand from domestic and regional compliance instruments is expected to grow and could contribute to a fragmentation of carbon credit markets – with uncertain outcomes for environmental integrity. Such demand is currently below 50 Mt CO₂-eq per annum globally (World Bank, 2023^[5]), but is expected to grow.³³ These market segments are typically subject to considerable government control over carbon credit market activity and environmental integrity provisions. Most compliance instruments only recognise carbon credits that have been generated domestically, with some only recognising supply from governmental crediting mechanisms (La Hoz Theuer et al., 2023^[76]).³⁴ Growing demand from compliance instruments means governments' may also expand their sphere of influence in carbon credit markets (Figure 3.3). While this could give governments considerable control over environmental integrity, it could also increase market fragmentation by driving growth in crediting mechanisms and methodologies with limited international recognition. There is little research on the environmental integrity of governmental mechanisms compared to independent and international crediting mechanisms (Cevallos, Grimault and Bellassen, 2019^[77]; I Care, 2022^[78]; Michaelowa et al., 2019^[79]). Therefore, the environmental integrity implications of potential growth in governmental crediting mechanisms are unclear.

An increasing number of domestic compliance instruments are recognising carbon credit supply from independent crediting mechanisms, and this could lead to greater interplay between VCMs and CCMs. Noteworthy examples are Chile, Colombia, South Africa and Singapore, whose carbon taxes recognise carbon credits from independent standards, with some additional government-defined quality controls (La Hoz Theuer et al., 2023^[76]; NEA, 2023^[80]; Ministry of the Environment, 2024^[81]). Prior to their integration in compliance instruments, this credit supply was primarily used by voluntary buyers.

When it comes to countries' use of ITMOs towards 2030 NDCs, demand is also expected to grow, and buyer countries can exercise significant influence over environmental integrity. Several potential buyer countries and seller countries have signed bilateral agreements to facilitate the development of co-

³³ Compliance demand is expected to, on balance, increase as several large jurisdictions are developing or expanding carbon pricing instruments with carbon credit provisions (e.g. China, India, Japan, Mexico), faster than other jurisdictions are reducing the scope for carbon credit use (e.g. Colombia, subnational schemes in North America) (Sizer, Ginsberg-Keig and O'Muircheartaigh, 2023^[307]).

³⁴ Often, carbon credits have to be generated via a governmental crediting mechanism (e.g. in Canada, Taiwan and China) (La Hoz Theuer et al., 2023^[76]). Governmental crediting mechanisms will likely also feature in several carbon pricing instruments currently under expansion or development (e.g. Mexico, Japan and India) (World Bank, 2023^[98]; Ministry of Power, 2023^[306]).

operative approaches and ITMOs transactions under Article 6.2.³⁵ However, the total volume of ITMO demand remains uncertain (IETA, 2024^[6]; Swedish Government Official Reports, 2020^[82]).³⁶ Buyer countries have different ways of managing the environmental integrity of Article 6.2 co-operation, including by:

- Developing methodologies in partnership with the seller country (e.g. Japan under the Joint Crediting Mechanism) (Government of Japan, 2023^[83])
- Updating and enhancing methodologies from the existing crediting mechanisms like CDM, Verified Carbon Standard (VCS) or Gold Standard (e.g. Switzerland and the KliK Foundation) (KliK Foundation, 2023^[84])
- Leveraging existing integrity frameworks, such as CORSIA and ICVCM (e.g. Singapore's International Carbon Credit Framework) (NEA, 2023^[80])

Some of these approaches leverage solutions originally developed in VCMs. Several Article 6.2 buyers also manage the environmental integrity of Article 6.2 co-operation through procurement and due diligence procedures as well as lists of eligible and/or excluded activities, (see e.g. case study on Switzerland – Section 4.3.3).

In the short term, ITMO demand is likely to exceed ITMO supply from new co-operative approaches, with potential implications for environmental integrity. The pipeline of ITMOs under Article 6.2 is small (Manuell, 2023^[85]), and there have been delays in operationalising PACM (Granziera, Hamrick and Verdieck, 2023^[31]). Significant demand for ITMOs is expected from CORSIA (2028) and countries' first NDCs (2030). If the supply of high-integrity ITMOs does not scale soon, buyers may need to resort to ITMOs from transitioned CDM activities, many of which have had their additionality questioned (Fearnehough, Schneider and Warnecke, 2021^[39]).

Finally, some governments are also developing policies that influence demand in VCMs (O'Muirheartaigh and Sizer, 2023^[86]), often to improve transparency, or regulate claims. Governments possess multiple levers to influence voluntary demand (see Section 4. for details), and some of the more common policy approaches to date include:

- Defining corporate sustainability reporting requirements, including on carbon credit use³⁷
- Regulation of how carbon credits can be used to support climate claims – often with a view to protect consumers³⁸
- Creating labels and frameworks to recognise companies who use carbon credits³⁹

³⁵ The potential buyer countries who had signed such agreements by February 2024 were Japan, Kuwait, Monaco, Norway, Singapore, South Korea, Sweden, Switzerland (UNEP-CCC, 2024^[321]; IETA, 2024^[6]). Such agreements had been signed with over 40 different potential seller countries.

³⁶ Some countries have clearly signalled the volumes of ITMOs they intend to purchase before 2030, such as South Korea (37.5 million) (Kuo, 2023^[308]) and Switzerland (at least 20 million) (KliK Foundation, 2024^[187]), while other countries have made more vague statements (UNFCCC, 2023^[137]). The actual demand for ITMOs is likely to depend on the scale of buyer countries' emissions reductions, the availability of ITMOs and potential political decisions about the role for Article 6 in supporting NDC achievement.

³⁷ e.g. EU's Corporate Sustainability Reporting Directive, US Securities Exchange Commission's Climate-related Disclosures, UK's Transition Plan Disclosure Framework, International Sustainability Standards Board's Climate-related Disclosures (Sylvera, 2023^[178])

³⁸ e.g. France's decree on carbon neutrality (Ministry of Ecological Transition, 2022^[179]), EU's Directive to empower consumers for the green transition (European Parliament, 2023^[311])

³⁹ e.g. Canada's Net-Zero Challenge, Australia's Climate Active (Idalina et al., 2023^[309]), Ecuador's Carbono Cero Program (Carbono Neutral, 2024^[310])

A recent development that could significantly influence VCM activity is the EU Directive on empowering consumers for the green transition. This law will limit the scope for carbon credit-supported claims such as “climate neutral” in the EU from 2026 onwards (European Parliament, 2024^[87]). Such claims have been an important use case for carbon credits in recent years (GenZero and MSCI Carbon Markets, 2023^[59]). In parallel, the EU is also developing other policies that influence carbon credit markets, including detailed guidance for the substantiation of green claims (and how these relate to carbon credits) (EPRS, 2024^[88]), and a certification framework for carbon credits from carbon dioxide removal activities (EPRS, 2024^[89]). Moreover, the recently established corporate disclosure framework outlines how companies should report on their use of carbon credits (OJEU, 2023^[90]). Since multiple policy files influence the carbon credit lifecycle, policy coherence within jurisdictions is key to provide carbon credit market participants with a safe space for high-integrity activities.

Further considerations for governments

Governments are key to enhancing environmental integrity across carbon credit markets, but steering markets towards higher integrity is challenging. Carbon credit markets are changing rapidly, and so are their policy frameworks. Policies could, inadvertently, increase market friction, drive market fragmentation, and create uncertainty for market participants (WEF, 2023^[91]; GenZero and MSCI Carbon Markets, 2023^[59]). To effectively enhance environmental integrity, governments should strive to address timely challenges, and give predictable signals for how carbon credit markets can operate with environmental integrity over time. As governments continue to develop policies for carbon credit markets, they may wish to consider the following (see also Section 4.):

- **Prioritise capacity building on the supply side**

Article 6 frameworks that align carbon credit markets with seller countries’ NDCs and long-term strategies are key for enhancing supply-side environmental integrity and mobilising investment into co-operative approaches (IETA, 2023^[92]). Since voluntary demand is projected to exceed Article 6 demand at least in the near-term, seller countries could also consider how they approach VCMs (Section 5.3).

- **Ensure coherent policies and engagement on the demand side**

Many governments are currently creating compliance demand and developing policies which influence voluntary buyers (Section 4.3.3). While these efforts could enhance environmental integrity, divergent demand-side policies for carbon credit market could also drive further market fragmentation. Governments could therefore explore options to co-ordinate their demand-side integrity policies with those of other actors or standards, as harmonised rules could pool liquidity around high-integrity market activity (see Section 4.2.3).

- **Provide clear market signals for long-term investment in high-integrity activities**

Carbon credit-generating activities can have long lead times. Therefore, to scale high-integrity carbon credit market segments, governments may need to provide the market with early and credible demand signals. In the Article 6.2 context, countries who intend to buy ITMOs to meet their NDCs may want to estimate their ITMO needs⁴⁰, and assess whether they can source enough high-integrity units by 2030. To facilitate ITMO sourcing, buyers can provide market signals on the quantity, quality and timing of ITMOs they intend to purchase, as this can inform supply-side strategies and investments (Michaelowa et al., 2021^[93]).

⁴⁰ Countries may need to present estimations with confidence intervals considering the uncertainty of GHG trajectories.

3.2.4. Market infrastructure developments

The environmental integrity of carbon credit markets is also influenced by its market infrastructure – the systems through which mitigation activities and carbon credits are recorded, traded and financed. This market infrastructure is rapidly maturing (World Bank, 2023^[5]) with greater standardisation and transparency, but also some signs of market fragmentation, and some remaining gaps.

Key developments to market infrastructure include:

- Digital systems to improve transparency⁴¹ (CAD Trust, 2023^[94])
- Insurance services to characterise and alleviate risk for buyers (Blanc and Filmanovic, 2023^[95])
- Standardisation of trading terms (IETA, 2023^[96])
- Development of benchmark contracts (Spilker and Nugent, 2022^[97])
- Establishment of carbon credit ratings agencies (Wawrzynowicz, Krey and Samaniego, 2023^[51])
- Growth in exchange-based trading (World Bank, 2023^[5])

Taken together, these developments could lead to improved transparency and risk management in VCMs (World Bank, 2023^[5]). However, the total size of voluntary carbon markets first exceeded USD 1 billion in annual traded value in 2021 (Ecosystem Marketplace, 2023^[4]), so a lot of market infrastructure, governance, and accountability mechanisms have yet to be established.

Carbon credit markets are currently experiencing trends which could lead to greater standardisation in some areas, and fragmentation in other areas. Regulators and international bodies⁴² have begun to explore frameworks for greater standardisation, legal certainty, transparency and oversight in carbon credit markets (World Bank, 2023^[5]). At the same time, several countries are developing governmental carbon crediting mechanisms and registries, adding to an already complex landscape with over 27 governmental crediting mechanisms (World Bank, 2023^[98]). Furthermore, there is an upsurge in national carbon credit exchanges (in many cases with government support). These exchanges can improve transparency and oversight of market activity, but may also divide liquidity pools and aggravate issues related to market fragmentation (Betz et al., 2022^[99]).

Implications for governments

To ensure that market infrastructures facilitate environmental integrity enhancements, governments could:

- **Request analytical work on market integrity**
To date, limited research has been done on the relationship between market functioning and environmental integrity (Annex A). Further attention from researchers, integrity initiatives and regulators would be useful. Such analytical work could aim to identify priority actions for governments, so that market structures and conditions are favourable for environmental integrity enhancements.
- **Support the acceleration of digital ecosystems**
The development of digital ecosystems for carbon credit markets (e.g. for activity development and management, registry systems, trade and post-trade infrastructure) could bring substantial

⁴¹ For example, the Climate Action Data Trust (CAD Trust), who develop digital infrastructure that links, aggregates and harmonises carbon credit registries' data in a meta-data layer infrastructure. By supporting disclosure on credits and activities against a common data model, this could lead to transparency improvements over time (CAD Trust, 2023^[94]).

⁴² Notable examples include: US Commodity Futures Trading Commission (CFTC), International Organization of Securities Commissions (IOSCO), International Institute for the Unification of Private Law (UNIDROIT), International Sustainability Standards Board (ISSB), International Swaps and Derivatives Association (ISDA).

environmental integrity improvements. For example, greater interoperability of registries could reduce the risk of double counting and digital MRV could reduce information asymmetries between activity proponents and auditors (World Bank, 2022^[100]). Since carbon credit market infrastructure is a public good, government support may be needed for market participants to overcome co-ordination and investment barriers to greater digitisation.

- **Minimise further market fragmentation**

When governments develop carbon credit market policies, they could assess the risk of increasing market fragmentation. To minimise fragmentation, governments could seek to align with international standards, or implement market infrastructure in partnership with other countries.

3.3. Key developments in market activity and behaviour

Carbon credit market activity is rapidly changing, with shifts in both supply-side and demand-side behaviour. This paper cannot provide an exhaustive overview of market developments, but it highlights two macro-trends. Firstly, voluntary demand has recently become a major driver of carbon credit market activity (Section 3.3.1). Secondly, governments are ramping up efforts to mobilise carbon credit supply (Section 3.3.2). Both trends are likely to shape carbon credit market activity in the near-term, and are therefore important for governments to consider as they seek to promote high-integrity carbon markets.

3.3.1. Environmental integrity implications of a market dominated by voluntary demand

VCM activity currently has a considerable influence on prices and environmental integrity norms in carbon credit markets, due to recent growth in carbon credit demand from voluntary buyers. Since the Paris Agreement was signed, there has been a surge in voluntary climate action by non-state actors, including the use of carbon credits for climate claims and net-zero targets (Ecosystem Marketplace, 2023^[4]). VCM activity now represents a majority of carbon credit demand (World Bank, 2023^[5]), and analysts estimate that this could grow further (GenZero and MSCI Carbon Markets, 2023^[59]). Unlike demand from compliance instruments, which have defined eligibility criteria, voluntary buyers could in theory buy any carbon credit. Depending on buyers' carbon credit preferences, quality expectations and investment patterns, certain market segments may grow, and others decline (Trove Research, 2023^[101]; Ecosystem Marketplace, 2023^[4]).

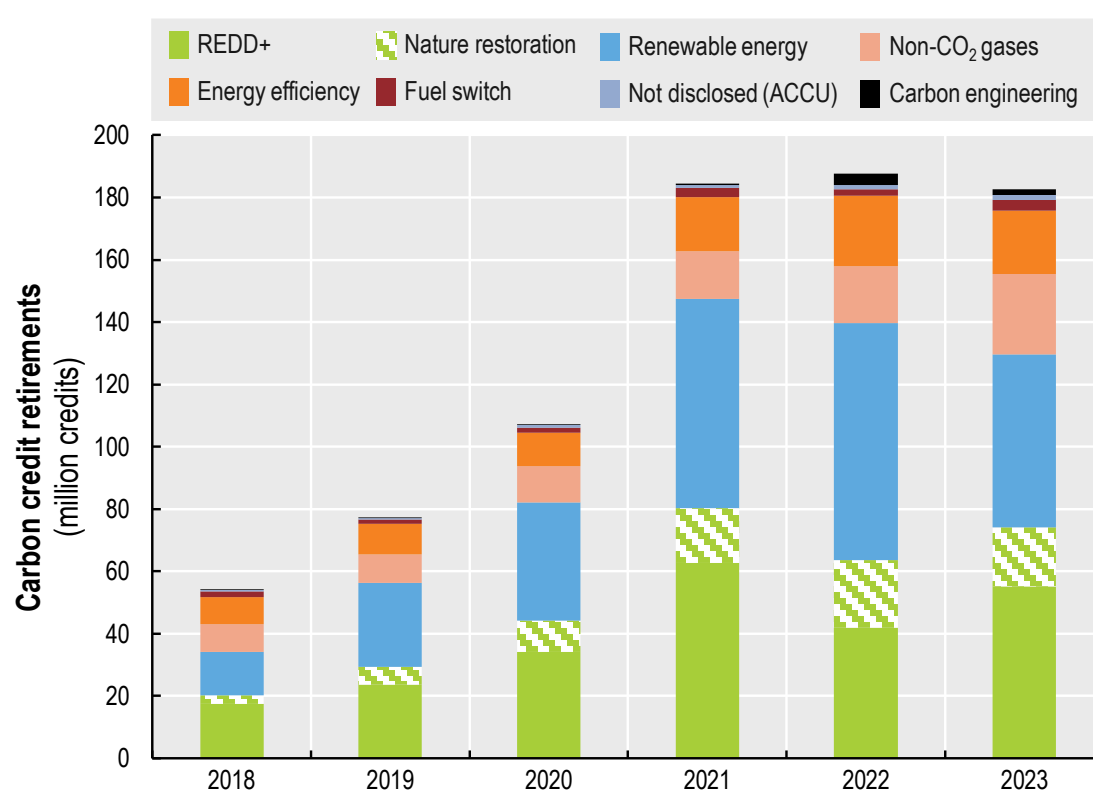
Voluntary buyers can, through their purchase preferences, influence carbon credit market composition, and as a result also environmental integrity. Some carbon credit types are used more in VCMs than in CCMs, for example, carbon credits from avoided deforestation and clean cooking.⁴³ Furthermore, voluntary buyers assign significant premiums to carbon credits with certified social and environmental co-benefits (Ecosystem Marketplace, 2023^[4]). If voluntary buyers continue to be a dominant source of demand, their preferences are likely to influence investments in carbon credit-generating activities (Trove Research, 2023^[101]), and consequently the market composition. Different activities are associated with different environmental integrity risks (Annex A). Therefore, if VCMs change the overall carbon credit market composition, this also changes the distribution of environmental integrity risks.

Voluntary buyers' behaviour can also influence interplay. Notably, the overlaps between VCMs and CCMs depend on the degree to which voluntary buyers purchase carbon credits that are also eligible for compliance markets.

⁴³ Carbon credits from avoided deforestation and clean cooking activities accounted for 30% and 8% of all carbon credit retirements in 2023, respectively (MSCI Carbon Markets, 2024^[102]; Climate Focus, 2023^[112]). Most of these credits were likely used in VCMs, considering the limited eligibility of these activity types under compliance instruments.

Stakeholder pressure and governments' actions can influence voluntary buyers' behaviour, as seen by recent market trends. For example, carbon credit retirements increased sharply in 2021, partly connected to the breakthrough in Article 6 negotiations at COP26 in Glasgow. However, in 2023, the credibility of carbon credit markets was seriously challenged, causing the value of primary market activity to decline by 20% compared to 2022 (MSCI Carbon Markets, 2024^[102]). This decline was likely due to increasing media attention to carbon credit quality concerns, reputational risks for buyers, and economic headwinds (Gabbatiss, 2023^[103]; Twidale and Mcfarlane, 2023^[104]). As a result, some buyers are searching for carbon credits with attributes that are perceived as a sign of high-integrity, such as more recent vintages, or carbon credits from removal activities (Ecosystem Marketplace, 2023^[4]). Carbon credit demand is still at a high level compared to 2018-2020 (Figure 3.5), and several indicators suggest that the market could grow further in the near-term.⁴⁴

Figure 3.5. Primary demand for carbon credits (2018-2023)



Note: The diagram represents primary demand for carbon credits (retirements), by activity category. The data was aggregated by MSCI Carbon Markets from 13 registries, representing carbon credit retirements for both voluntary and compliance purposes. Several governmental crediting mechanisms are not reported in this diagram, such as China GHG Voluntary Emission Reduction Program, Republic of Korea Offset Program, and Thailand Voluntary Emission Reduction Program.

Source: Carbon credit retirements (MSCI Carbon Markets, 2024^[105]); Activity categories (Trove Research, 2022^[106]).

While voluntary demand for carbon credits could grow considerably, the VCM's potential to accelerate global mitigation action should not be overstated. The costs associated with achieving mitigation targets are substantial. For example, the estimated cost of mitigation outlined in Morocco's NDC alone is USD

⁴⁴ This includes increases in the number of companies setting net-zero targets (MSCI Carbon Markets, 2024^[102]), the number of unique buyers of carbon credits (Gourlay, 2023^[322]) and investments in carbon-credit generating activities (Trove Research, 2023^[101]).

38.8 billion for the period 2020-2030 (World Bank, 2022^[107]). By comparison, global corporate spending on ESG business services was estimated to be USD 37.7 billion in 2023. Within most corporates' ESG and CSR strategies, carbon credit purchases are a marginal activity. To address mitigation financing needs across developing countries, decisive government action and scaled up public and private finance for climate action will be needed (Bhattacharya et al., 2023^[108]).

There is currently an abundant supply of carbon credits, so increased demand and higher carbon credit prices could create a more enabling environment for high-integrity credit-generating activities. Several estimations suggest that current carbon credit prices are too low to compensate the true cost of many credit-generating activities (World Bank, 2023^[109]; UK CCC, 2022^[110]; Quentin Grafton et al., 2021^[111]). Total carbon credit demand is now high compared to the last decade, although substantially lower than the peak in 2011,⁴⁵ when compliance demand drove most market activity. At the end of 2023, around 878 million carbon credits remained unretired from the largest independent crediting mechanisms (Climate Focus, 2023^[112]).⁴⁶ As carbon credit buyers move towards newer vintages and higher quality standards, the likelihood of older carbon credits being used could diminish (Ecosystem Marketplace, 2023^[4]). Nonetheless, some argue that this supply still exercises a downward pressure on prices in the market (Maslin, 2021^[113]).

Implications for governments

Because voluntary demand is an important driver of market activity and environmental integrity norms, governments could explore how they influence VCM activity. To leverage potential of VCMs to enable mitigation, governments could therefore:

- **Clarify if and how climate claims can be supported by carbon credits**

Governments can provide greater detail on the types of claims that companies can make, and the actions they need to take to make such claims. By doing this governments could both address risks of greenwashing and provide a safe space for high-integrity use of carbon credits. Governments have many potential levers to carbon credit use (regulating markets, setting sustainability standards and labels, enhancing corporate transparency), so policy coherence for carbon credit markets is important (Section 3.2.3).

- **Provide co-ordinated signals on whether and how carbon credits can be used towards net-zero targets, including interim milestones**

The use of carbon credits towards net-zero targets both constitutes a greenwashing risk and an untapped mitigation opportunity (GenZero and MSCI Carbon Markets, 2023^[59]; Noels and Jachnik, 2022^[114]). There is currently conflicting guidance on how carbon credits can contribute to net-zero targets, and whether they can contribute to interim milestones on the path to net-zero (Net Zero Tracker, 2023^[115]). Governments could signal desirable behaviours in relation to credit use through regulation, guidance, or governments' own market participation (see Section 4. for details). Co-ordination of such government signals is key, as many carbon credit buyers are multinational companies.⁴⁷

⁴⁵ Traded value in VCMs averaged USD 2 billion in 2021-2022 (Ecosystem Marketplace, 2023^[4]). In 2011, the value of the primary carbon credit market (including CCMs) was estimated at around USD 4 billion and secondary markets over USD 20 billion (Kossov and Guigon, 2012^[164]).

⁴⁶ This excludes the CDM, from which there is close to 1 billion unretired Certified Emission Reductions (CERs) (Michaelowa, 2021^[312]). However, most of this supply is likely to never be used.

⁴⁷ The recently announced Taskforce on Net Zero Regulation (PRI, 2023^[313]) could prove useful for co-ordinating government signals on the role of carbon credits for net-zero targets. Governments could also refer to other avenues for co-ordinated solutions, including: (i) international standard-setters (e.g. (ISSB, 2023^[174]) and (ISO, 2022^[314])); (ii)

3.3.2. Governments' efforts to mobilise carbon credit supply

Governments can influence the environmental integrity of carbon credit markets through their efforts to source and supply carbon credits. In light of the agreement on an Article 6 rulebook in 2021, several governments have accelerated efforts to develop and enable carbon credit supply. Such efforts are happening against the background of changing patterns of carbon credit supply. In the last decade, supply has shifted from being dominated by carbon credits from the multilaterally negotiated Clean Development Mechanism (CDM) and Joint Implementation (JI), to independent entities where governments exercise less direct influence. Between 2018-2022 (Figure 3.6) independent carbon crediting mechanisms accounted for most (57%) of carbon credits issued, with the largest crediting mechanism being the Verified Carbon Standard (VCS), representing 42% of total supply (see details in Annex C).

The current dominance of independent carbon crediting mechanisms gives governments a reason consider how they influence this carbon credit supply and its environmental integrity. In some domestic compliance carbon credit markets, independent crediting mechanisms already absorb various functions and reduce the administrative burden for governments (PMR, 2021_[17]).⁴⁸ When governments rely on independent crediting mechanisms for compliance instruments, this is usually accompanied by additional criteria on e.g. carbon credit origin and quality (La Hoz Theuer et al., 2023_[76]). Questions remain as to what role independent crediting mechanisms will play in the Article 6.2 context. Because the Paris Agreement Crediting Mechanism is not yet fully operational, independent crediting mechanisms may also play an important role for internationally traded carbon credit supply in the near-term. Both supply-side and demand-side governments under Article 6.2 can influence this role for independent crediting mechanisms, and whether it is conditioned on additional environmental integrity criteria.

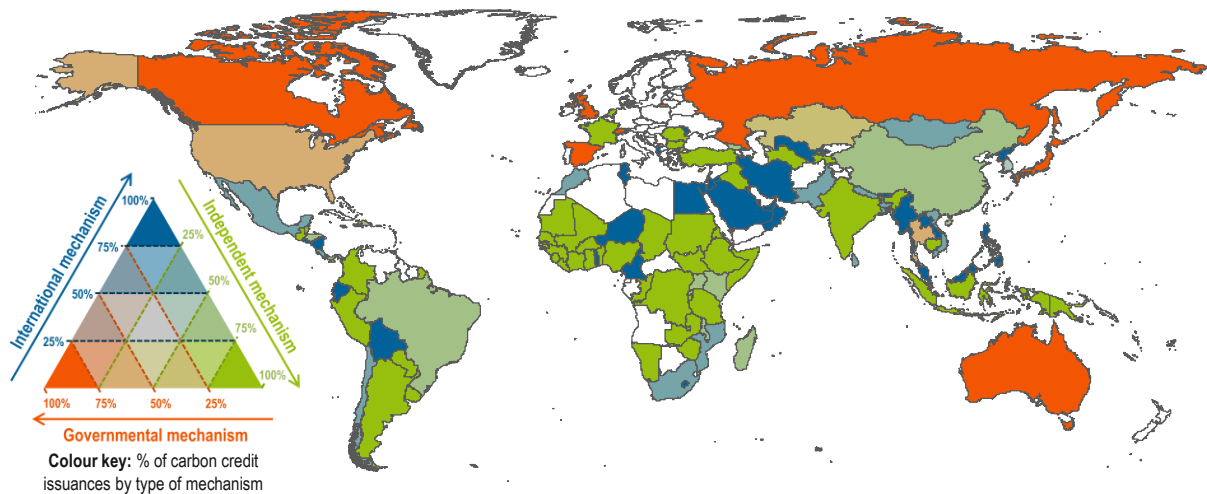
Supply-side governments' strategies for carbon markets will play a large role for how patterns of carbon credit supply evolve. Current patterns of credit supply vary substantially by country with regards to the volume of supply, types of credit-generating activities, and types of crediting mechanisms (Figure 3.6). Seller countries' existing portfolio of carbon credit-generating activities could influence their decisions about: (i) which mechanisms are used to accredit projects and issue credits, (ii) which type of credit-generating activities should be encouraged, and (iii) how benefits are shared from these activities. In turn, seller countries' carbon credit market frameworks can influence project proponents' willingness to invest in the market and the composition of carbon credit supply.

There are substantial differences between countries with regards to the types of carbon crediting mechanisms used to generate supply, and this can influence supply-side integrity (Annex A). For example, over half (51%) of the carbon credits generated in Thailand (light orange in Figure 3.6) between 2018-2022 were issued via the governmental Thailand Voluntary Emission Reduction Program. In the same period, issuances in Ethiopia (green in Figure 3.6) were dominated by independent crediting mechanisms (93%). Finally, some countries, such as Egypt (blue in Figure 3.6), had almost all carbon credits supplied through the international Clean Development Mechanism (97%). In cases where most supply comes from independent carbon crediting mechanisms, the government might have limited visibility on carbon credit-generating activities within their jurisdiction (VCMI, 2023_[16]). This is in contrast to countries where most supply comes from governmental mechanisms, in which case public administrators often manage the registration of, and transparency on, credit-generating activities (PMR, 2021_[17]).

regional coalitions (e.g. (Government of the Netherlands, 2023_[32]) and (Nordic Council of Ministers, 2022_[61]); and (iii) self-regulatory initiatives (e.g. (VCMI, 2023_[64]) and (SBTi, 2024_[315]).

⁴⁸ Governments may refer to independent standards to: replicate or build on design elements (e.g. methodology development, project cycle requirements); outsource specific functions (e.g. registry management, auditor accreditation); or give recognition to independently issued credits – often with additional gatekeeping requirements (e.g. on credit origin and quality) (PMR, 2021_[17]).

Figure 3.6. Carbon credit issuances by type of mechanism and country (2018-2022)



Note: Total issuances over 5 years were used as credit volumes for individual countries vary greatly year-on-year. Where subnational, national, bilateral or regional crediting mechanisms issue carbon credits (e.g. in USA, Canada, Japan, China and Russia), these have been classified as “governmental” mechanisms and are reported on a national level. Japan’s Joint Crediting Mechanism operates in 29 countries and aims to supply ITMOs under Article 6.2, but is classified as “governmental” as the category “international” refers only to crediting mechanisms under international treaties and international organisations.

Source: Authors’ own analysis, see details in Annex C.

Several countries are now preparing to supply ITMOs under Article 6, and emerging approaches could lead to greater carbon credit market interplay. To mobilise supply, seller countries can turn to a wide range of actors, including the UNFCCC, other international organisations and multilateral development banks (A6IP, 2023^[117]), as well as independent standards (Winrock International, 2023^[118]; Gold Standard, 2023^[119]; Verra, 2023^[120]). At least in the near-term, independent crediting mechanisms may be well positioned to supply ITMOs under Article 6.2, which would increase overlaps between international VCMs and CCMs. For such ITMOs to be issued, the seller country must authorise the mitigation outcomes, and this may be subject to additional criteria, such as the alignment of the crediting activity with the seller country’s NDC. Indications from both countries (Gadde, 2023^[121]; NEA, 2023^[80]) and independent crediting mechanisms themselves (Verra, 2023^[120]) suggest that a market segment of Article 6.2 supply from independent crediting mechanisms is indeed emerging. The first ITMOs from independent crediting mechanisms were issued in late 2023 (Gold Standard, 2023^[122]; Verra, 2023^[123]).

Given the supply-side integrity risks associated with a large share of existing carbon credit supply (Annex A), entities participating in Article 6.2 could consider additional quality controls. This is to ensure that cooperative approaches are consistent with environmental integrity provisions in the Article 6.2 Guidance:

“Describe how each cooperative approach ensures environmental integrity, including: [...] Through robust, transparent governance and the quality of mitigation outcomes, including through conservative reference levels, baselines set in conservative way and below ‘business as usual’ emission projections (including by taking into account all existing policies and addressing uncertainties in quantification and potential leakage);”
[Paragraph 18 (h), Annex to Decision 2/CMA.3] (UNFCCC, 2021^[8])

Potentially more concerning for environmental integrity under Article 6.2 is that some seller countries intend to authorise mitigation outcomes associated with REDD+⁴⁹ results. These mitigation outcomes do not meet several of the standard environmental integrity requirements applied by carbon crediting mechanisms.⁵⁰

When it comes to VCMs, supply-side governments can exercise varying degrees of control over exported carbon credits. Supply-side government policies for VCMs can be light-touch (e.g. by improving visibility on carbon credit supply through reporting obligations for activity proponents) or more involved (e.g. by requiring that supply is generated from a governmental crediting mechanism, or traded through a national exchange and/or registry) (Trove Research, 2023_[54]).

Supply-side governments' efforts to generate carbon credit supply are often supported by international organisations and multilateral development banks, who can assist in the development of supply-side environmental integrity provisions. The World Bank Group has been particularly active in supporting the mobilisation of carbon credit supply through various carbon funds⁵¹, which aim to build capacities and innovate new carbon crediting solutions. Several of these funds enable both results-based climate finance and carbon credit trading – sometimes with bespoke environmental integrity provisions, e.g. FCPF (2023_[124]) and TCAF (2020_[125]). In the next decade, these funds could deliver carbon credit issuances at scale, with some of them potentially sold as ITMOs (World Bank, 2023_[126]). Moreover, organisations such as GGGI,⁵² UNDP, GIZ, ADB and EBRD are working to build seller country capacities and originate ITMO supply, alongside direct partnerships and procurement actions by Article 6.2 buyer countries (UNEP CCC, 2023_[127]).

Recently, several initiatives aiming to scale carbon credit supply have emerged, often with demand-side government support and environmental integrity innovations (see Table 3.1). These initiatives combine support from companies, governments and philanthropic organisations, further blurring the lines between carbon credit markets for governments and companies. Some of these initiatives advance scaled-up crediting approaches.⁵³ Scaled-up crediting can eliminate several project-level environmental integrity risks, but also introduce new risks.⁵⁴ Another innovative feature of several of these initiatives (e.g. ACMI, LEAF Coalition and ETA) is that they combine supply-side and demand-side integrity management. The commitments made to these initiatives to date indicate that they could gain a significant market share in the future. Moreover, since these initiatives are backed by governments, corporates may perceive these platforms as a source of carbon credits with low risk. Therefore, the environmental integrity provisions set by government-backed platforms could have ripple effects on VCM behaviour going forward.

⁴⁹ Reducing emissions from deforestation and forest degradation in developing countries.

⁵⁰ These units are therefore subject to considerable supply-side integrity risks compared to carbon credits, such as inflated baselines, limited audit requirements and lacking measures to address non-permanence (IETA, 2023_[316]).

⁵¹ Such as: Forest Carbon Partnership Facility, Initiative for Sustainable Forest Landscapes, Transformative Carbon Asset Facility, Carbon Initiative for Development, Carbon Partnership Facility (World Bank, 2020_[318]). Among other things, these funds build technical capacities and systems for robust monitoring, reporting, and verification (MRV), and enable informed decision-making related to participation in carbon markets.

⁵² For example, GGGI aims to facilitate over 50 Mt CO₂-eq of ITMO sales by 2030 via a “Carbon Transaction Platform” (Manuell, 2023_[317]).

⁵³ For example, the LEAF Coalition will generate supply via the jurisdictional ART TREES standard,⁵³ and ETA is supporting the development of a sectoral carbon crediting standard for emission reductions achieved in the electricity sector (Winrock International, 2023_[118]).

⁵⁴ For example, scaled-up carbon crediting can reduce risks related to leakage, project-level additionality and adverse selection (Schwartzman et al., 2021_[212]). However, scaled-up crediting can introduce other challenges, such as baseline determination and MRV requirements on a jurisdictional level, or assessing the additionality of climate policy adoption (Schneider et al., 2014_[333]). Strong seller country capacities are key to effectively manage these challenges.

Table 3.1. Selected initiatives for scaling up carbon credit supply

Initiative	Description	Environmental integrity features	Commitments to date (end of 2023)	Key countries involved
Lowering Emissions by Accelerating Forest finance Coalition (LEAF Coalition)	The LEAF Coalition aims to build a market for REDD+ (avoided deforestation) emissions reduction credits from large-scale schemes operated by national or sub-national governments.	LEAF Coalition manages supply-side integrity through the ART TREES standard and a minimum guaranteed price of USD 10 per t CO ₂ -eq for seller countries. On the demand side, LEAF defines several buyer criteria to confirm that carbon credit use is additional to direct mitigation efforts.	USD 1.5 billion in intentions to buy carbon credits. The first transactions, worth USD 60 million, were announced in November 2023.	Supporters: US, UK, Norway Potential hosts: Over 26 jurisdictions, including DRC, Ghana, and Nigeria.
Energy Transition Accelerator (ETA)	ETA aims to use carbon credit revenues as a revenue stream to help mobilise private capital to power sector decarbonisation in developing and emerging economies.	To manage supply-side integrity, ETA supports the development of a carbon crediting standard at the electricity sector-scale. The initiative also requires, among other things, that ETA credits are ICVCM-aligned. On the demand side, ETA defines several buyer criteria to confirm that carbon credit use is additional to direct mitigation efforts.	No financial commitments have been made public.	Supporter: US Potential pilot countries: Chile, the Dominican Republic, Nigeria, Philippines
African Carbon Markets Initiative (ACMI)	ACMI strives to boost the supply and demand of African carbon credits to reach 300 Mt CO ₂ -eq annually by 2030. This involves collaborating with African governments to develop VCM activation plans, among other initiatives.	ACMI has welcomed the efforts of integrity initiatives, international standard-setters and governments to address credibility challenges in carbon credit markets. Furthermore, ACMI intends to work with ICVCM and VCMI to establish transparency and benefit-sharing standards for both sellers and buyers.	USD 1 billion in intentions to buy carbon credits, as well as USD 250 million in signed intentions to invest in projects.	Supporter: UAE Potential participating countries: Nigeria, Kenya, Malawi, Gabon, Nigeria and Togo
Transition Credits Coalition (TRACTION)	TRACTION convenes stakeholders interested in developing transition credits, generated by the early retirement of coal-fired power plants and their replacement with cleaner energy. In a pilot phase, coalition members will test the feasibility of transition credits for two coal plants in the Philippines.	The pilot phase will use a methodology which is going through the approval process under the Verified Carbon Standard. The initiative will consult with ICVCM to explore how the traction credits can gain CCP-eligibility.	No financial commitments have been made public, but Singapore has expressed interest in buying transition credits if they meet relevant standards for environmental integrity.	Supporter: Singapore Pilot country: Philippines

Sources: LEAF: (Emergent, 2024^[128]; Manuell, 2023^[129]) | ETA: (Energy Transition Accelerator, 2023^[33]) | ACMI: (ACMI, 2023^[130]) | Traction: (See, 2023^[131]; MAS, 2023^[132]).

Implications for governments

Selective government support to carbon crediting approaches can influence the composition of credit supply, and consequently environmental integrity. Considering carbon credit supply can have long lead times and payback periods, government efforts to enhance supply-side integrity can take time. Nonetheless, if governments provide long-term signals and supporting frameworks, they can improve the investment conditions for activities with ambitious environmental integrity provisions. The following points could therefore be considered by both supply-side and demand-side governments:

- **Consider differentiated frameworks for environmental integrity on the supply side**

Supply-side governments often have limited resources to engage with carbon credit markets, and may therefore need to prioritise their efforts to support supply-side integrity (Box 3.3). To support integrity enhancements, while allowing carbon credit markets to support a wide range of mitigation

activities, supply-side governments can consider differentiated frameworks for supply-side integrity. This could include different protocols for carbon credit quality control and different scopes of creditable activities, depending on the intended use case for carbon credits. Such differentiation could be based on whether activities and mitigation outcomes:

- Are authorised vs. non-authorised;
- Support compensation vs. contribution claims;
- Are sold internationally vs. domestically;
- Are used for compliance vs. voluntary purposes.
- **Demand-side governments' can use their market leverage to source high-integrity credits**

As a 'premium buyer' of carbon credits, demand-side governments can set a high bar for environmental integrity and remain an attractive source of demand. Compared to most voluntary buyers, governments can source larger volumes of credits, with longer-term certainty, often at a higher price.⁵⁵ Demand-side governments can also lend the government's credibility to initiatives which crowd in additional investments and carbon credit demand (Table 3.1). Furthermore, demand-side governments could, through bilateral support and capacity building initiatives, strengthen integrity management on the supply-side.

Box 3.3. Administrative considerations for supply-side governments

As supply-side governments seek to develop environmental integrity provisions for carbon credit supply (whether for VCMs or Article 6), they need to balance government oversight with streamlined processes. On the one hand, greater government oversight of activities and environmental integrity frameworks could strengthen supply-side integrity and provide improve international buyer confidence. However, tighter quality controls also increase governments' and project developers' administrative burden, transaction costs, leading to weaker incentives for mitigation activities. Determining the scope of carbon credit-generating activities is also a balancing act. Governments could aim for carbon credits to come from "high-hanging fruits"⁵⁶, but if the scope for carbon credit markets is too restrictive, it could deter potential investments.

Carbon credits should always uphold supply-side integrity, but governments have limited resources to oversee, and quality assure carbon credit supply. Supply-side governments may therefore want to focus their resources to quality assure carbon credit supply that serves high stakes use cases. For example, a carbon credit that is sold domestically to a voluntary buyer who makes a contribution claim, is associated with relatively low stakes. However, an ITMO that is used towards another country's NDC has higher stakes – if the carbon credit is low-quality, it undermines the seller country's NDC achievement and global mitigation efforts.

⁵⁵ Article 6 buyers generally do not disclose the prices of purchased ITMOs. However, there are indications (Gourlay, 2023^[323]) that their willingness to pay is well above the average price (USD 5.8) of carbon credits traded in VCMs in 2023 (MSCI Carbon Markets, 2024^[102]).

⁵⁶ Mitigation activities which have comparatively high marginal abatement costs and / or implementation barriers, and are therefore more likely to be additional to a country's existing mitigation ambition (Day et al., 2023^[69]).

4. Potential government strategies for carbon market interplay and environmental integrity

Key messages

Carbon credit markets are growing, making their environmental integrity an increasingly relevant concern for policy makers. As environmental integrity enhancements can be commercially challenging for market participants, government action may be needed to accelerate the growth of high-integrity carbon credit market segments. As voluntary buyers account for a large share of total demand, governments need to consider how they engage with both VCMs and CCMs.

The extent of governments' engagement with VCMs and CCMs could be adjusted based on the significance of these markets for each government's climate objectives. The role of carbon credit markets for domestic GHG mitigation varies substantially. For example, among the top 20 supplier countries of carbon credits over 2018-2022, carbon credit issuances ranged between 0.3% and 19% of annual GHG emissions.

To focus their efforts, governments could:

- evaluate the current and expected role of VCMs and CCMs nationally, and how these fit with mitigation objectives
- identify the levers available to enhance the mitigation performance of carbon credit markets in priority market segments
- consider how these levers interact with multilateral frameworks, market-led frameworks and other countries' carbon credit market policies
- develop carbon credit market engagement priorities in collaboration with other countries and market stakeholders to promote integrity enhancements in a joined-up way.

Governments can draw on a wide range of policy approaches to influence the integrity of the supply side, demand side and markets across VCMs and CCMs. To enhance carbon credit quality, governments could develop supply (e.g. through governmental crediting mechanisms) or facilitate supply (e.g. through enabling conditions for carbon crediting with ambitious integrity provisions). This could be coupled with policies that generate demand for high-integrity credits (e.g. through compliance instruments) and influence voluntary demand (e.g. through guidance for corporate carbon credit buyers). Governments could also support initiatives that facilitate market integrity enhancements (e.g. initiatives that improve standardisation and transparency) or regulate markets, where relevant (e.g. to enhance governance and oversight).

4.1. Changing carbon credit markets – changing role for governments?

Carbon credit markets have a number of desirable and undesirable characteristics from a public policy perspective.⁵⁷ Carbon credit markets have a number of desirable characteristics for policy makers: they are not associated with competitiveness concerns, they face limited political economy challenges, and in theory they could stimulate mitigation at a low cost (D’Arcangelo et al., 2022_[133]). Furthermore, carbon credit markets could, if accompanied by robust social and environmental safeguards, support both climate mitigation and development objectives (Annex A). However, they also have a number of undesirable characteristics: they require a source of demand or public expenditure, they are associated with high administrative costs, and targeting carbon credit revenues is difficult (D’Arcangelo et al., 2022_[133]). Moreover, because of difficulties in determining the additionality of credit-generating activities, carbon credit markets risk support inframarginal activities (Calel et al., 2021_[134]). Enhancing the environmental integrity of carbon credit markets is therefore a central concern to make these instruments more effective mitigation instruments, and more useful for policy makers. As some carbon credit market segments interact, governments may have an interest in enhancing the environmental integrity across both VCMs and CCMs.⁵⁸

Carbon credit markets are estimated to grow and change, giving governments reasons to reassess their carbon market policy and engagement strategies. Globally, the volume of annual demand for carbon credits (in t CO₂-eq) is roughly equivalent to the GHG emissions of the Netherlands (Ecosystem Marketplace, 2023_[4]; Crippa et al., 2023_[135]). Estimations suggest that the market could multiply several times within the next decade (GenZero and MSCI Carbon Markets, 2023_[59]). This potential growth presents both new opportunities for GHG mitigation, as well as greater negative consequences if environmental integrity risks are not managed. The stakes in carbon credit markets are therefore increasing. At the same time, the market composition is changing. Demand has become more dominated by voluntary buyers, and supply has become more dominated by independent crediting mechanisms. These recent and expected developments for carbon credit markets give governments reasons to evaluate their role in both VCMs and CCMs. Demand-side governments,⁵⁹ who are evaluating their future engagement with carbon credit markets, could consider several guiding principles (Section 4.2) and draw on a wide range of policy approaches (Section 4.3).

4.2. Guiding principles and questions for government action on environmental integrity

Based on the analytical work and market interviews, this paper suggests that, to enhance integrity across carbon credit markets, governments could take **strategic**, **focused** and **collaborative** policy approaches

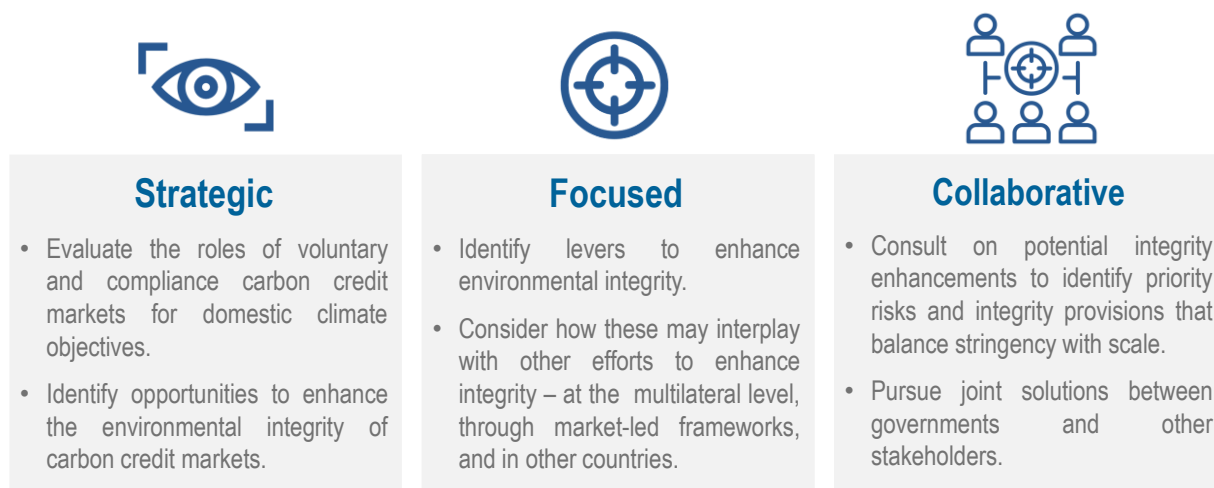
⁵⁷ See Table 5 in D’Arcangelo et al. (2022_[133]) for further analysis, where carbon credit markets can be considered a form of subsidy to abatement.

⁵⁸ When it comes to domestic CCMs, governments can exercise significant control over the market’s boundaries, rules and safeguards. Several domestic compliance schemes operate relatively independently from other carbon credit market segments, for example in Canada and Australia. If carefully designed, CCMs with ambitious environmental integrity provisions can provide a robust tool for governments to support mitigation efforts (Annex A).

⁵⁹ In this paper “demand-side governments” refers to those governments that either seek to buy international carbon credits themselves or have jurisdiction over the companies that represent most of carbon credit demand. Many countries may be both on the supply side and demand side, but OECD Member countries, together with the companies registered in these jurisdictions, are generally net buyers of carbon credits – i.e. “demand-side”. Some countries may be net buyers in one market segment, and net sellers in another.

(Figure 4.1). This section unpacks these guiding principles, together with questions that could assist governments in prioritising their efforts to enhance environmental integrity across VCMs and CCMs.

Figure 4.1. Guiding principles for governments' efforts to enhance environmental integrity across carbon credit markets



Source: Authors' own illustration.

4.2.1. Strategic

Carbon credit markets present both strategic mitigation opportunities and potential environmental integrity challenges for governments. These challenges and opportunities are different for each country, and depend on, e.g., the role of carbon credit markets for GHG mitigation objectives, the composition of domestic carbon credit markets, and their associated environmental integrity risks. To take a strategic policy approach to carbon credit markets, governments could therefore explore the following questions:

- How important are voluntary and compliance carbon credit markets for the government's GHG mitigation objectives?
 - How large⁶⁰ are the different carbon credit market segments over which the government can exercise an influence?⁶¹

⁶⁰ By volume (t CO₂-eq reduced or removed) and value (USD per annum in primary demand / carbon credit retirements).

⁶¹ On the supply side, governments could usefully map: (i) Carbon credits generated within the government's jurisdiction; (ii) Carbon credits from overseas that is supported by and/or sourced by the government; (iii) Carbon credits from overseas that is sourced by entities within the government's jurisdiction.

On the demand side, governments could usefully map: (i) Compliance demand generated by the government (e.g., ITMO demand and/or compliance instruments); (ii) Voluntary demand that can be influenced by domestic guidance regulations (e.g. domestically registered companies, or overseas companies who use carbon credit-supported claims to market their products and services to domestic consumers)

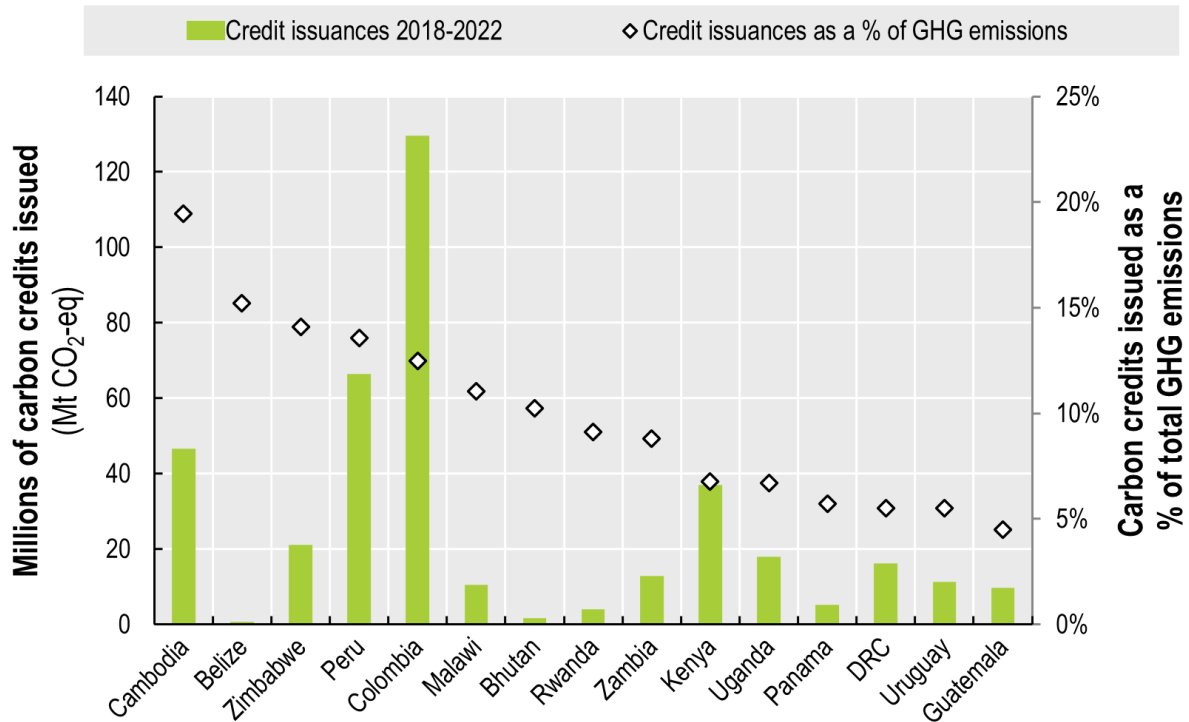
On the market-level, governments could usefully map how domestic carbon credit trading works and familiarise themselves with the stakeholder ecosystems associated with this carbon trading.

- What is the relative potential of carbon credit markets to deliver on domestic GHG mitigation objectives, compared to other potential policy instruments and financing sources?
- How could the role of carbon credit markets for domestic mitigation objectives evolve over time?
 - How are carbon credit markets expected to change over time in terms of market size and composition?
 - Are some sectors, activities or technologies more relevant for generating carbon credit supply in the short- or long-term (e.g., emission reductions vs. removals)?
- How can the government target its engagement with carbon credit markets to support climate objectives?
 - In which carbon credit markets (e.g., domestic vs. international, voluntary vs. compliance) should the government prioritise its efforts?
 - What are the most significant environmental integrity risks and mitigation opportunities in these priority markets?
 - What is the relative importance of supply-side, demand-side and market integrity in these markets?
- What role could carbon credit markets play for policy objectives other than domestic climate mitigation (e.g., supporting overseas development, or protecting and empowering consumers)?

Overall, by evaluating the scale of the opportunities and the risks, governments can get a better idea of how to prioritise government resources.

Among supply-side countries, carbon credit markets are typically small in relation to countries' total GHG emissions and a relatively marginal tool for real economy-mitigation, but this varies by country. Among the top 20 supplier countries of carbon credits in 2018-2022, carbon credit issuances ranged between 0.3% (China) and 19% (Cambodia) of annual GHG emissions (Annex C). As shown in Figure 4.2, 15 supply-side countries issued carbon credits equivalent to at least 5% of their total GHG emissions between 2018-2022. However, most (59%) of carbon credit supply came from countries where carbon credit issuances were below 2% of total GHG emissions.

Figure 4.2. Top 15 countries by carbon credit supply in relation to domestic GHG emissions



Note: The diagram represents the period of 2018-2022. Patterns of carbon credit issuances and countries’ GHG emissions could change substantially over the course of the period of current nationally determined contributions. The diagram expresses carbon credits in tonnes of CO₂-equivalents reduced or removed, notwithstanding potential environmental integrity issues. Due to environmental integrity risks, 1 carbon credit may in many cases not actually represent 1 t CO₂-eq (Annex A), so the percentages presented in this diagram cannot be directly interpreted as the impact of carbon credit supply on the country’s mitigation performance. Nonetheless, it give an indication of the prominence of carbon credit markets as a mitigation instrument.

Source: Authors’ own analysis of issuance data, see details in Annex C. GHG emissions data obtained from Crippa et al. (2023_[135]).

On the demand side, countries and sub-national jurisdictions use carbon credit markets for their GHG mitigation objectives to varying degrees. Within the OECD, several countries intend to use Article 6 towards their 2030 NDCs, but it is often unclear to what extent Article 6 will be used (Kreibich, 2024_[136]). Only 5% of countries’ have, in their NDCs, quantified how much their NDC achievement can rely on Article 6 co-operation (UNFCCC, 2023_[137]). Beyond Article 6, several countries also use carbon credit markets to stimulate mitigation in sectors that are not covered by carbon taxes and emissions trading systems (e.g. Colombia) (OECD, 2023_[10]) and to facilitate government support for mitigation (e.g. Australian Carbon Credit Unit Scheme) (Henderson et al., 2021_[138]).

VCMs play a marginal role in demand-side countries’ climate strategies. There are few publicly available assessments of the size of VCM activity by country. Nonetheless, an analysis of voluntary demand in the United Kingdom estimated that UK-based and UK-listed firms retired around 20 million carbon credits in 2021 (AlliedOffsets, 2022_[139]). This is to be compared with the UK’s domestic GHG emissions of 426 Mt CO₂-eq in the same year (Crippa et al., 2023_[135]). While the UK Climate Change Committee concluded that there is strong evidence that the mitigation impacts of carbon credits have been overstated (UK CCC, 2022_[110]), the scale of UK-based carbon credit demand points to a considerable mitigation opportunity, if environmental integrity is enhanced.⁶² However, UK-based VCM demand generally supports mitigation

⁶² However, a large proportion of these mitigation benefits would accrue outside the UK, unless voluntary demand is redirected towards a domestic source of carbon credit supply.

activities overseas, and so does not contribute towards domestic GHG mitigation objectives. While carbon credit demand in the UK is comparatively high,⁶³ other OECD countries could also evaluate mitigation opportunities associated with VCM demand.

Box 4.1. Considerations for managing environmental integrity in carbon credit markets

- **Environmental integrity requires end-to-end frameworks**

This includes frameworks for supply-side, demand-side and market integrity. Moreover, integrity is only ensured if all essential quality requirements are satisfied. For example, a lack of additionality cannot be compensated for with good rules on non-permanence. This makes carbon crediting prone to quality risks and calls for robust oversight.

- **Supply-side integrity is not a binary outcome, but rather a risk distribution**

Multiple factors influence the likelihood that carbon credits are of high quality (Schneider et al., 2022^[140]; Broekhoff et al., 2019^[141]). Independent assessments of carbon credit quality which assign a range of scores (e.g. ratings agencies and CCQI) can therefore complement the binary assessment of carbon crediting mechanisms and meta-standards (e.g. CORSIA and ICVCM).

- **Carbon crediting is methodologically challenging and complex**

It relies on counter-factual scenarios, which are often uncertain. The complexity of credit-generating activities and methodologies increases the risk that activity information can be manipulated. For example, activity proponents could select reference areas for deforestation that are not representative. This makes it difficult for crediting mechanisms and auditors to fully prevent issuance of low-quality credits. To minimise environmental integrity risks associated with their own carbon credit use, demand-side governments may therefore require significant technical capacity (i.e. dedicated resources), or access to intelligence on carbon credit quality.

- **Incentives are needed for environmental integrity enhancements**

In voluntary carbon markets, neither activity proponents, third-party auditors nor crediting mechanisms have inherent economic incentives to enhance integrity, other than to mitigate reputational risks (IOSCO, 2023^[142]). Therefore, carbon credit markets could benefit from governance frameworks and incentive structures that strengthen market players' motivation to move towards high-integrity practices.

- **Environmental integrity enhancements require consultation and research**

Due to evolving circumstances and knowledge, substantial analytical work and public input may be required to identify weaknesses in environmental integrity frameworks. However, if environmental integrity frameworks are updated too abruptly, or in an unpredictable way, it could deter market participants and investors from using carbon credits as a tool for mitigation action. Public consultations can therefore be useful to identify integrity enhancement priorities, as well as market participants' pain points associated with more ambitious provisions.

4.2.2. Focused

Governments could focus their integrity enhancement efforts by mapping existing and potential measures related to strategic carbon credit market segments. The following questions could help identify a focus:

⁶³ UK-based demand for carbon credits in 2021 represented over 10% of the global market for carbon credits (AlliedOffsets, 2022^[139]), while the UK economy accounted for 3% of world GDP in the same year (World Bank, 2024^[324]).

- What levers (Section 4.3) could the government use to address strategic environmental integrity risks and mitigation opportunities (as outlined above)?
- What other initiatives and frameworks are addressing the priority issues, and what implications could they have for potential government engagement? This mapping exercise could include:
 - Efforts by multilateral frameworks and international organisations
 - Efforts by market participants and market-led frameworks
 - Efforts by other countries and jurisdictions
- Are there opportunities to build on, or create synergies with, other efforts to address the priority issues – and if so, what are these?

Since developing and implementing carbon credit market-related policies can be very complex, governments may need to prioritise how they use scarce resources to enhance environmental integrity, end-to-end (Box 4.1). Governments need to identify issues that they are well-positioned to resolve, and methods that leverage their strengths.

4.2.3. Collaborative

Carbon credit market fragmentation could increase in the near-term, due to: (i) diverse bilateral arrangements for carbon trading under Article 6.2 (ii) several new carbon pricing instruments with different carbon credit provisions (iii) diverse policies targeting voluntary carbon credit buyers (iv) increasing seller country influence over carbon credit supply (v) a multiplication of market infrastructure. This is complicated by the fact that the multilateral framework under Article 6 of the Paris Agreement is not yet complete.

While individual governments' efforts to enhance environmental integrity are useful, there is also a risk that divergent efforts and frameworks could contribute to market fragmentation. To minimise further fragmentation, different governments' efforts to enhance environmental integrity could be co-ordinated and aligned. Governments could also seek collaboration with market participants (e.g. to benefit from practitioners' perspectives) and other stakeholders (e.g. researchers who are advancing best practice solutions, or communities who are affected by carbon credit-generating activities). To improve policy co-ordination, governments could explore:

- Is there a risk of market fragmentation associated with the government's planned efforts to enhance environmental integrity?
- Which internationally applicable frameworks could be referred to, when seeking to enhance environmental integrity?
- What scope is there to develop environmental integrity frameworks and carbon credit market engagement strategies in co-operation with other governments and stakeholders?

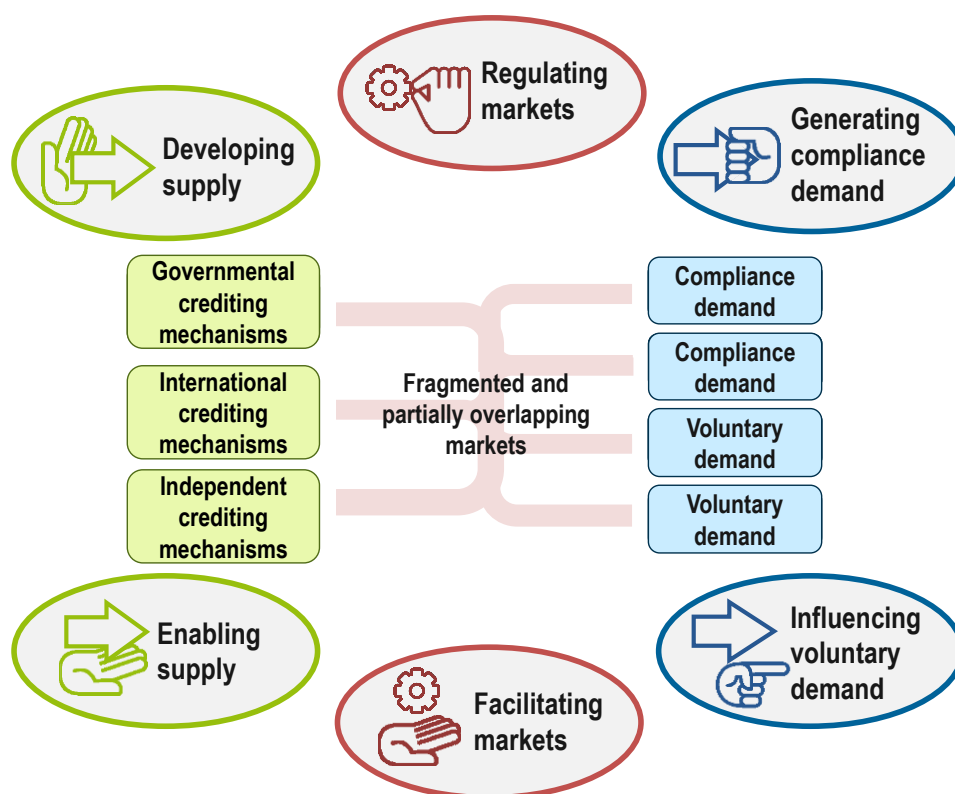
Governments could explore options to align around high-integrity solutions. Stakeholders are updating and enhancing environmental integrity frameworks on multiple fronts – including in multilateral negotiations, market-led initiatives, international organisations and standards bodies. Several of these frameworks offer practical solutions that could be applicable across multiple jurisdictions. If governments referred to international best practice frameworks, this could support multiple aims – enhancing integrity, minimising market fragmentation, enabling markets to scale, and avoiding duplication of efforts. The more governments refer to common integrity frameworks, the greater their chances will be to stimulate growth of high-integrity market segments. However, given the challenges in operationalising the Paris Agreement

Crediting Mechanism, governments may want to use plurilateral constellations⁶⁴ to co-ordinate and pool market influence, at least in the near-term.

4.3. Potential policy approaches for enhancing environmental integrity across voluntary and compliance carbon credit markets

Governments can use various policy tools and approaches to influence environmental integrity across carbon credit markets (Figure 4.3). Depending on a country's strategic challenges and opportunities related to carbon credit markets, they may want to focus their efforts on either voluntary or compliance carbon credit markets. Since carbon credit markets require end-to-end systems to operate with environmental integrity (Box 4.1), governments may need to consider several policy approaches in combination.

Figure 4.3. Policy approaches for enhancing environmental integrity across carbon credit markets



Note: Carbon credit markets consist of diverse mechanisms for generating carbon credit supply (green), different sources of compliance-motivated and voluntary demand (blue), as well as fragmented and partially overlapping markets (red). Depending on their carbon credit market policy priorities, governments can focus their attention on different carbon credit market segments and policy approaches (oval shapes). Governments' policy approaches to carbon credit markets co-exist with a wide range of multilateral and market-led frameworks that also aim to enhance environmental integrity.

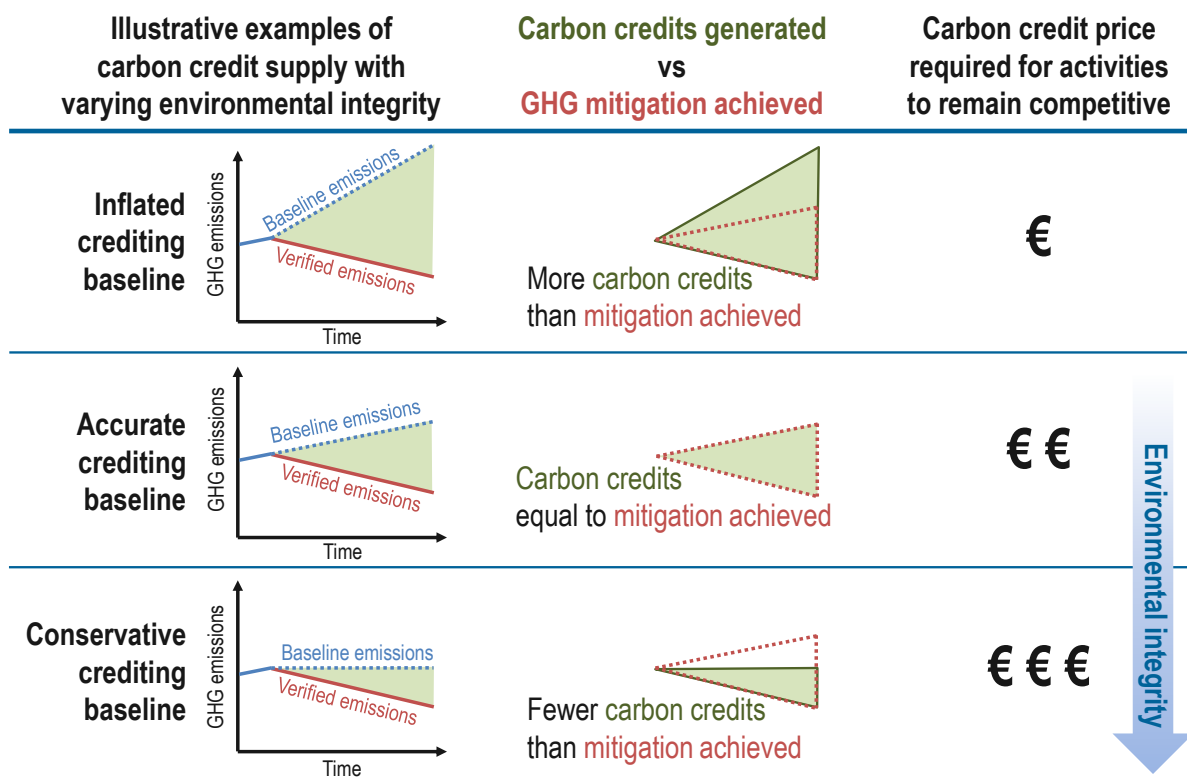
Source: Authors' own illustration.

⁶⁴ Such constellations could include: (i) groups of major economies, such as G7 and G20; (ii) regional partnerships like the Indo-Pacific Economic Framework, or regional alliances of seller countries, such as in West Africa and Eastern Africa; (iii) signatories of joint declarations, such as the San José Principles, or Call to Action for Paris Aligned Carbon Markets.

4.3.1. Supply-side policy approaches

Governments can take various measures to enhance supply-side integrity, but for high-integrity supply to scale, complementary demand-side measures may be needed. Figure 4.4 illustrates a central challenge for enhancing supply-side integrity: high-integrity activities typically generate fewer carbon credits than low-integrity activities.⁶⁵ If high-integrity supply is in direct competition with low-integrity supply, the high-integrity supply may be at a competitive disadvantage, because the activity proponent needs a greater compensation per carbon credit issued. Therefore, if governments want to enhance supply-side integrity, they may need to: (i) Shield high-integrity supply from direct competition with low-integrity supply; (ii) Support market participants in identifying and rewarding high-integrity supply with appropriate premiums; (iii) Target carbon credit demand or other forms of support to high-integrity supply.

Figure 4.4. Illustrative examples of carbon credit supply with varying levels of environmental integrity



Note: The diagram illustrates differences in the number of carbon credits generated (green area) by a mitigation activity, depending on the level of conservativeness of the crediting baseline (dotted blue line). The crediting baseline is the counterfactual scenario against which mitigation impacts are assessed, and carbon credits are issued. Mitigation activities with conservative crediting baselines (fourth row) issue fewer credits than comparable mitigation activities with more generous crediting baselines (second row). If carbon credits with varying levels of environmental integrity are traded in common market, high-integrity mitigation activities need to command considerable carbon credit premiums to remain competitive.

Source: Authors' own illustration.

⁶⁵ While Figure 4.4 only illustrates the issue of crediting baselines, similar challenges apply to other supply-side integrity elements such as additionality, permanence, leakage etc.

Developing supply

Governments can directly develop high-integrity supply through their own carbon crediting mechanisms or building on existing crediting mechanisms. The most direct way of controlling supply-side integrity is to develop a government-administered carbon crediting mechanism with ambitious environmental integrity safeguards. To date, at least 27 national and sub-national jurisdictions have developed carbon crediting mechanisms (World Bank, 2023^[98]). This policy approach has the advantage of giving the government control over the environmental integrity provisions associated with this carbon credit supply.⁶⁶ Disadvantages include that carbon crediting mechanisms are administratively challenging to establish and maintain (PMR, 2021^[17]). Governments may require significant technical expertise to develop solutions (e.g. methodologies, registries, auditing systems) that outperform those of existing crediting mechanisms (Cevallos, Grimault and Bellassen, 2019^[77]). Therefore, before a government sets up a new crediting mechanism, they could map whether there are existing standards and infrastructure that could be built on. Furthermore, they could estimate whether the expected carbon credit demand is sufficient to motivate the significant up-front and operational costs associated with a governmental crediting mechanism. In several cases, e.g. California, South Africa and Korea, governments have chosen to outsource multiple supply-side functions to other crediting mechanisms (Section 3.3.2), while retaining a degree of control through e.g. carbon credit eligibility criteria and mechanism oversight (PMR, 2021^[17]).

Beyond their development of, and collaboration with, carbon crediting mechanisms, governments can also directly support activities and platforms that issue carbon credits (Table 3.1). They can also indirectly support the development of a high-integrity pipeline, e.g. through initiatives that build capacities and increase market access of potential seller countries (ACMI, 2023^[130]; A6IP, 2023^[117]).

Case study: UK's efforts to create carbon credit supply

The UK Woodland Carbon Code (WCC) is an example of how governments can, through the development of a carbon crediting mechanism, control supply-side integrity and provide long-term certainty to market participants. The WCC is a carbon crediting mechanism for afforestation projects in the UK and contributes to national GHG mitigation targets, as well as an objective of achieving 12% forest cover by 2060 (UK WCC, 2024^[143]). The UK government has supported the mechanism in two main ways: (i) through its initial piloting in 2007, its set-up and continuous running since then; and (ii) through a dedicated fund to guarantee long-term revenue to project developers. This GBP 50 million fund offers selected project developers the option to sell their credits to the government, and has helped the WCC become the largest European governmental crediting mechanism by volume (I Care, 2022^[78]). Alongside the Woodland Carbon Code, the UK government has also supported the development of a Peatland Code and a future Saltmarsh Code (House of Lords, 2022^[144]).

The WCC seeks to demonstrate good practices for supply-side integrity through various practices. For example, there is a 20% buffer to cover non-permanence risks, which is high compared to other carbon crediting mechanisms (Ramesh et al., 2022^[145]). In addition, the WCC's methodology, supported by academia and forestry stakeholders through its Advisory Board, includes UK-specific assumptions, in particular relating to biomass carbon sequestration (Jenkins et al., 2018^[146]). Furthermore, the WCC further reduces reversal risks and supports other environmental objectives by aligning with UK Forestry Standards, to encourage a wide range of improved forestry practices from project developers, such as maintaining tree species diversity (I Care, 2022^[78]; Cevallos, Grimault and Bellassen, 2019^[77]). To signal its supply-side integrity to prospective buyers, WCC has sought, and gained, endorsement from the

⁶⁶ E.g. provisions for additionality, quantification and permanence, registry and infrastructure requirements, as well as guidelines or rules on which types of use cases that carbon credits can support.

International Carbon Reduction and Offset Alliance (ICROA, 2023^[147]). To support demand-side integrity, WCC also provides examples of claims that corporations can make after using credits (UK WCC, 2024^[148]).

Case study: Canada's efforts to create a regulated market for carbon credits

Canada's Greenhouse Gas Offset Credit System is an example of how carbon credit markets with government oversight and robust procedures for regulatory development can incorporate additional safeguards to support environmental integrity. The Offset Credit System establishes a regulated source of carbon credit supply, which can be used for compliance by entities covered by the federal carbon pricing system (Output-Based Pricing System, or OBPS), or for voluntary purposes (ECCC, 2024^[149]). The scheme was established in 2022, and by April 2023 it had two approved methodologies,⁶⁷ with five more under development (ECCC, 2024^[150]).

The development of the Offset Credit System involved extensive consultations and expert input. To stimulate feedback from stakeholders, the federal government published three discussion papers, collected written inputs and held over 230 hours of stakeholder consultations. Through this process, the government could consult on, inter alia:

- Options for the structure, functioning and purpose of the carbon credit market (ECCC, 2018^[151])
- Considerations for the design of offset protocols (including environmental integrity criteria) (ECCC, 2019^[152])
- Priorities for which mitigation activities to support through the Offset Credit System (ECCC, 2020^[153]).

Furthermore, thanks to the Canadian government's continual engagement with Indigenous peoples across multiple policy areas, the Offset Credit System could be developed with considerable engagement by Indigenous peoples (Canada Gazette, 2022^[154]).

Canada's GHG Offset Credit System is enshrined in federal regulations and linked to a carbon pricing system, which can have benefits for environmental integrity. Because the system is linked to the OBPS, it could benefit from a comparatively predictable source of demand, with an intended carbon price trajectory (Canada Gazette, 2022^[155]). Demand predictability is not only important to stimulate investments into mitigation activities, but also for carbon credit markets to support higher-cost abatement options, with a greater likelihood of additionality (Day et al., 2023^[69]). Furthermore, the Offset Credit System is supported via dedicated resources (CAD 9.6 million between 2022-2031) for the government to oversee and expand the carbon credit market. Notably, the introduction of the Offset Credit System included updates to the *Environmental Violations Administrative Monetary Penalties Act*. These updates enable the government to issue administrative monetary penalties to market stakeholders who breach regulations associated with the Offset Credit System (Canada Gazette, 2022^[154]). Such enforcement powers tend to be more limited under independent and international crediting mechanisms.

Enabling supply

Governments can influence supply-side integrity by providing enabling conditions for carbon credit-generating activities with high environmental integrity. Governments wishing to enable carbon credit supply (either to sell or to buy) can for example:

- Develop policy frameworks that steer activity proponents toward specific sectors, activities, crediting mechanisms or methodologies (e.g. Article 6 frameworks, regulatory frameworks for the

⁶⁷ The two approved methodologies are for Landfill Methane Recovery and Destruction, as well as Reducing GHG Emissions from Refrigeration Systems.

certification of emissions reductions or removals) (World Bank, 2022^[68]; European Commission, 2022^[156])

- Establish incentives, or simplified planning and approval procedures, for selected activities (e.g. support for emerging carbon removal technologies) (U.S. Congress, 2022^[157])
- Establish frameworks to reduce regulatory risk for supply-side investments, for selected activities (e.g. procedures for authorisations and reporting, arrangements for benefit-sharing, legal rights associated with carbon credits, and communication channels with relevant authorities) (VCMI, 2023^[116])
- Provide enabling conditions for the development of high-integrity carbon credit supply (e.g. improving transparency on market-relevant information, developing MRV systems) (ACMI, 2022^[158]; USDA, 2024^[159])

A key role for supply-side governments is to provide markets with strategic direction on how carbon credit-generating activities can support domestic climate objectives (Section 5.3). This requires governments to take a whole-jurisdiction view – assessing mitigation opportunities, associated costs and available financing instruments, to guide carbon credit markets towards areas where they can complement other mitigation efforts (World Bank, 2022^[68]). In the short term, this may be difficult as NDCs, LT-LEDs, or net-zero commitment of seller countries could benefit from further clarity on aspects relevant to carbon credit markets (Section 5.3). If seller countries do not have strong institutional arrangements, or limited information to make decisions about their Article 6 co-operation, there is a risk that such co-operation complicates the achievement of their NDCs (GGGI, 2023^[70]). While the process of taking a whole-jurisdiction view is resource-intensive, it can enhance the environmental integrity of carbon credit supply on a market-level, in addition to the activity-level.

Case study: Ghana’s efforts to provide framework conditions for voluntary and compliance carbon markets

In 2022, Ghana released a framework for their involvement in international carbon markets, which provides an example of how seller countries can facilitate carbon credit supply (Ghana Environmental Protection Agency, 2022^[74]). The framework outlines, among other things, (i) the institutional arrangements and procedures for carbon credit market activities in Ghana; (ii) how carbon credit market activities relate to Ghana’s NDC; (iii) environmental integrity provisions, including eligible methodologies and crediting mechanisms; (iv) detailed procedures and reporting requirements for co-operative approaches under Article 6.2; and (v) comparatively simple rules for VCM projects, which must receive recognition from the Ghanaian government through a letter of endorsement.

The clarity provided by the Ghanaian carbon credit market framework has led to significant interest from international activity proponents. Ghana has signed bilateral partnerships with Sweden, Switzerland and Singapore, and is negotiating with further countries. In 2023, Ghana’s pipeline of mitigation activities grew from 12 to 35. This is generating considerable investment in future mitigation outcomes. For example, the pipeline of co-operative approaches developed under the agreement with Switzerland are estimated to generate over USD 1 billion in investment and carbon credit revenue (CMO, 2024^[160]).

4.3.2. Market policy approaches

Regulating markets

Governments can enhance market integrity through market regulations and development of market structures, something that is particularly relevant for jurisdictions with high volumes of carbon credit trading. Currently, most jurisdictions do not have regulatory oversight of the primary market for voluntary use of carbon credits, while secondary markets are regulated to a greater extent (IOSCO, 2023^[142]). In

compliance markets, governments can exercise a greater degree of oversight (Annex A), depending on how much of the market administration has been delegated to non-governmental stakeholders (Section 3.3.2). The legal definition of carbon credits varies by jurisdiction and therefore, the competencies for regulating and supervising carbon credit markets vary (UNIDROIT, 2023^[161]). There are few examples of market regulation specifically targeting carbon credits, but a step in this direction has been taken by IOSCO, in their work to define considerations for regulatory authorities based on experiences from commodities and derivatives markets (IOSCO, 2023^[142]).

If governments further explore regulation of carbon credit markets, the scope of such regulations and implementation responsibilities need to be carefully considered. Several issues related to market integrity in carbon credit markets fall within the typical remit of financial market regulators, such as prevention of market abuse, orderly trading and transparency. However, several other issues (e.g. improving registry infrastructure, auditor accreditation systems, standardising carbon credit quality) may require financial market regulators to collaborate with carbon credit market stakeholders,⁶⁸ to develop effective and targeted solutions.

Case study: US CFTC's efforts to regulate secondary carbon credit markets

The US Commodity Futures Trading Commission (CFTC), an agency promoting market integrity and preventing disruptions in derivatives markets, has recently signalled the importance of regulatory oversight for VCMs (Benham, 2023^[162]). During COP28, the CFTC released proposed guidance on the listing of voluntary carbon credit derivative contracts, such as futures contracts for CORSIA-eligible credits (Xpansiv, 2024^[45]; US CFTC, 2023^[163]). The guidance seeks to clarify how the US Commodity Exchange Act's Core Principles on market integrity apply to exchanges that list carbon credit derivative contracts (US CFTC, 2023^[163]).

The CFTC's guidance could strengthen market integrity and supply-side integrity, but at least in the near-term this integrity enhancement will only apply to a small market segment. The guidance addresses environmental integrity on several levels – exchanges, derivative contracts and the carbon credits that underpin them. CFTC recommends that exchanges provide searchable, comparable and publicly available data on the carbon credits that underpin derivative contracts. This includes information relevant to assessing the quality of underlying carbon credits (e.g. additionality, baseline-setting), as well as the integrity of the carbon crediting mechanism (e.g. governance, third-party validation and verification systems). As it can be challenging for exchanges to control for all these factors, the proposed guidance from December 2023 acknowledges existing "standards for high-integrity" credits (such as CORSIA and ICVCM). However, the guidance does not detail how these standards should be applied (US CFTC, 2023^[163]). Exchange-traded derivative contracts are currently small compared to primary carbon credit market activity (IOSCO, 2023^[142]). Nonetheless, past experience has shown that secondary markets can become a major venue for carbon credit trading (Kossov and Guigon, 2012^[164]), and the CFTC's guidance could inspire other regulatory efforts that seek to enhance transparency and oversight of carbon credit markets.

Facilitating markets

Governments can also enhance market integrity by facilitating the development of markets and market infrastructure. There are several market integrity risks (Annex A) for which regulation may only provide a partial solution (e.g. fragmentation of registries, information asymmetries). Governments could therefore seek to enhance market integrity through other means, for example:

⁶⁸ Including other government authorities, carbon credit trading platforms, market-led integrity initiatives, carbon crediting mechanisms.

- **Enable high-integrity domestic exchanges**

Carbon credit exchanges can enable carbon credit trading with greater liquidity, transparency and with more resilient infrastructure (TSVCM, 2021^[165]). Exchanges can also screen for high-integrity credits, and support more effective supply-demand signalling (Blaufelder et al., 2021^[166]).

- **Support initiatives that seek to enhance digital market infrastructure**

Greater digitalisation of carbon markets could enhance market integrity. For example, work planned under Climate Action Data (CAD) Trust (Annex B) could address issues related to registry fragmentation. Moreover, quicker adoption of digital MRV could reduce the reliance on costly and potentially error-prone manual processes (World Bank, 2022^[100]).

- **Evaluate the role that governments could play in reducing information asymmetries**

Carbon credits are characterised by considerable information asymmetries between carbon credit supply and demand, and this can inhibit environmental integrity enhancements (Annex A). Several recent developments in carbon markets could potentially reduce such asymmetries, including ratings agencies, data providers, CCP-labelled credits, MRV technologies. These innovations could be supported through governments' policies and/or carbon credit market engagement. Alternatively, governments could seek to develop their own regulatory frameworks to support effective supply-demand signalling (e.g. EU Carbon Removal Certification Framework) (Messina, 2023^[167]).

Case study: Singapore's efforts to develop a carbon credit trading hub

Singapore has, through public-private partnerships and facilitation of initiatives, been an early mover in enhancing market integrity for carbon credits. For example, the Alliance for Action on Sustainability (an industry coalition working in collaboration with the Singaporean government), identified that Singapore was well-positioned to use existing capabilities to improve market integrity in VCMs (EST, 2021^[168]). Among other things, this partnership led to the establishment of Climate Impact X, a carbon exchange jointly owned by the state investment fund Temasek, Singapore Exchange (SGX Group) and private investors (S&P, 2023^[169]). CIX is screening carbon credits to pool liquidity in contracts with higher integrity performance than market average. For example, CIX offers a contract for recent REDD+ credits (2020 and after) that, on average, have high ratings compared to the REDD+ category overall (CIX, 2023^[170]; Sylvera, 2023^[171]). Moreover, the exchange is now planning for a standardised contract backed by CCP-labelled credits (CIX, 2023^[172]).

Singapore is also facilitating market integrity enhancements in other ways. For example, it supports the market integrity initiative CAD Trust together with the World Bank and IETA (CAD Trust, 2022^[173]). Furthermore, Singapore is helping develop a 'playbook' for how independent carbon crediting mechanisms could support seller countries' Article 6 engagement. If this project can develop standard procedures that can be applied across countries and crediting mechanisms, this could reduce transaction costs and market fragmentation (Verra, 2023^[120]).

4.3.3. Demand-side policy approaches

Influencing voluntary demand

Governments can enhance demand-side integrity in VCMs through e.g. frameworks for corporate disclosures on carbon credit use (ISSB, 2023^[174]), guidance on the use of credits for net-zero targets (Laine et al., 2023^[175]), frameworks to recognise companies who use carbon credits (Climate Active, 2024^[176]) and rules for climate claims (Box 4.2). Since regulations relevant to carbon credit use can come from different government authorities, and vary across jurisdictions, it can be difficult for companies to navigate a patchwork of requirements (WEF, 2023^[91]). Governments could explain, in plain language, how this

range of policy measures cover carbon credits and their use. By gathering information on domestic requirements in one place, governments can make it easier for companies to conform with domestic frameworks for demand-side integrity (see e.g. Finnish case study below). Governments could also consider joint working groups between advertisement, environmental and financial regulators to improve policy coherence (Macquarie, 2023^[177]).

Policies that influence voluntary demand for carbon credits are often created for more purposes than only to enhance demand-side integrity. For example, environmental claims regulations often encompass a wide range of consumer-facing products and services, and corporate disclosure frameworks are intended to give investor- and stakeholder-relevant information on many sustainability issues. As such, carbon credit-related provisions in these policy frameworks sometimes lack the detail and precision needed to effectively enhance demand-side integrity (Sylvera, 2023^[178]). For example, ISSB primarily requires disclosures on the planned use of carbon credits (that very few corporates have visibility on) (ISSB, 2023^[174]). To improve demand-side transparency, countries can evaluate how corporate and financial disclosure regimes relate to carbon credit markets (UK Government, 2023^[65]).

Box 4.2. Regulation and litigation of carbon credit claims

Environmental claims supported by carbon credits have recently been subject to updated regulations, enforcement by consumer protection authorities, and litigation (Kreibich, Brandemann and Jüde, 2022^[60]). These efforts to address potential greenwashing in VCMs often build on existing consumer protection regulations (Ahonen et al., 2023^[1]).

Governments have taken different policy approaches to updating consumer protection regulations – resulting in a mosaic of rules for the type of claims that can be made, and how. For example, the EU Directive on empowering consumers in the green transition will drastically reduce the scope for environmental claims based on carbon credits from 2026 onwards. By contrast, French regulations currently allow claims like ‘zero carbon’ or ‘carbon neutral’ supported by carbon credits, if companies also reduce their own emissions and meet detailed reporting requirements (Ministry of Ecological Transition, 2022^[179]). Similarly, California’s *Voluntary Carbon Market Disclosures Act* from 2023 does not prohibit carbon credit-based claims. Instead, it specifies reporting obligations related to carbon credits used, as well as the user’s climate targets and interim progress towards that target (California Legislative Information, 2023^[180]).

Action is also being taken by regulatory watchdogs in several countries, both to update guidance and pursue enforcement actions against misleading claims (Kreibich, Brandemann and Jüde, 2022^[60]). In the UK, the Committee of Advertising Practice updated its guidance on carbon neutral and net zero claims in advertising, recommending transparency on strategies to meet climate targets, and carbon crediting schemes used (CAP, 2023^[181]). The same year, the UK Advertisement Standards Authority ruled against environmental claims from several airlines and energy companies, due to a lack of direct evidence of their climate impacts and language that could mislead consumers (ASA, 2023^[182]). Bottom-up efforts by civil society have also sought to address carbon credit-supported claims, such as cases brought forward in the US (Haderlein and Kouyoumdjian LLP & Russell Law, 2023^[183]) and in Europe (BEUC, 2023^[184]).

Overall, these developments have created stricter boundaries for demand-side behaviours, outlining what carbon credit users *cannot* do (GenZero and MSCI Carbon Markets, 2023^[59]; Kreibich, Brandemann and Jüde, 2022^[60]). To complement these efforts, governments could also provide clarity on the conditions under which companies *can* make carbon credit-supported claims (see case study on Finnish guidance below).

Case study: Finland’s efforts to guide voluntary carbon credit users’ behaviour

The Finnish government has developed extensive guidance for voluntary buyers on how they can use carbon credits in a way that aligns with the Paris Agreement (Laine et al., 2023^[175]). The guidance document provides an overview of Finnish and European legislation relevant to voluntary mitigation action and carbon credits, as well as an overview of environmental integrity norms in international and market-led frameworks (Laine et al., 2023^[175]). While the guidance is non-binding, it helps voluntary buyers navigate relevant regulations and initiatives in a single document.

To support high-integrity engagement with VCMs, the document outlines what the Finnish government define as good practices for (i) carbon credit producers (ii) carbon credit users and claimants (iii) private consumers. For carbon credit users, the guidance highlights that marketing claims should be supported with clear reporting on the user’s actions to reduce direct emissions, what proportion of their emissions are covered by carbon credits, and whether they are making a contribution or compensation claim (Laine et al., 2023^[175]). Considering the rapid evolution of environmental integrity norms and policies relating to carbon markets, documents like the Finnish guidance need to be regularly updated (which is also acknowledged

in the guidance). Therefore, relatively small markets could usefully consider developing demand-side integrity guidance in partnership with other countries (Government of the Netherlands, 2023^[32]), to share the costs of keeping guidance up to date.

Generating compliance demand

Governments can generate compliance demand in multiple ways,⁶⁹ and use this to influence the environmental integrity of carbon credit supply. Unlike in voluntary carbon markets, where buyers can choose carbon credits freely, compliance demand is usually restricted to credits that meet specific criteria, including environmental integrity provisions. These restrictions can cover different aspects, e.g. the eligibility of credit supply to specific economic activities (Swiss Federal Council, 2023^[185]) or methodologies used to calculate crediting levels (Canada Gazette, 2022^[154]) (Section 4.3.1). Furthermore, in CCMs governments can dedicate implementation capacity to compliance and enforcement, and if needed apply penalties to violations of environmental integrity provisions (Canada Gazette, 2022^[154]).

Governments could leverage the relative strengths of compliance systems to enhance environmental integrity standards. In most cases, the volume of compliance demand for carbon credits is tied to multi-year phases for compliance instruments (OECD, 2023^[10]), or government targets (Section 3.2.3). As such, compliance demand is in many cases associated with less uncertainty than voluntary demand. If prices associated with compliance demand are higher than prices in VCMs, governments and regulated entities can act as ‘premium buyers’, setting ambitious environmental integrity criteria, while remaining an attractive source of demand for activity proponents (Galdi et al., 2022^[186]).

Case study: Switzerland’s work to set environmental integrity norms through Article 6.2 co-operation

Switzerland is currently a prominent source of demand for ITMOs under Article 6, and has developed a framework with multiple environmental integrity criteria that provide a practical interpretation of the Article 6.2 Guidance (Decision 2/CMA.3) (UNFCCC, 2021^[8]). Switzerland is expected to source at least 20 million ITMOs by 2030, largely driven by the country’s targets for fuel emission reductions (KliK Foundation, 2024^[187]). Switzerland’s CO₂-ordinance provides detailed provisions for how this will work. This includes a list of activities that cannot be used for Article 6.2 co-operative approaches, for example, avoided deforestation and waste sector activities that do not apply circular economy principles (Annex 2 of (Swiss Federal Council, 2023^[185])). Furthermore, the Swiss government has, in its bilateral agreements with potential Article 6.2 seller countries, specified further provisions of relevance to environmental integrity (FOEN, 2023^[188]).⁷⁰ A detail relevant to carbon market interplay is that some of Switzerland’s bilateral agreements explicitly mention the use of ITMOs for voluntary offsetting, intended for use towards the government administration’s own emissions (Fellermeyer, 2023^[189]).

⁶⁹ For example, by allowing obligated entities to meet a mandatory emissions liability (e.g. under a carbon tax or ETS) with carbon credits, by participating in CORSIA, or by using ITMOs towards their NDC.

⁷⁰ This includes language that goes above and beyond environmental integrity provisions in the Article 6.2 Guidance – for example references to “Promote enhanced climate action and safeguard against incentives for low ambition”, and “attribution of the Mitigation Outcomes to the sources of finance, where adequate”. Furthermore, the agreements specify procedures for authorisation, MRV, reporting, transfers, corresponding adjustments, which are important for the management of end-to-end integrity under Article 6 co-operation (FOEN, 2023^[188]).

5. Future considerations: the role of carbon credits on the path to net zero

Key messages

Governments could provide clear market signals to reduce uncertainties and support long-term planning for high-integrity market activity.

In particular, governments could clarify:

- how the potential use of carbon credit markets fits with governments' NDCs and long-term strategies, as well as other GHG mitigation policies and sources of finance for climate action
 - whether they intend to buy or sell mitigation outcomes under Article 6, and if so, whether there are any associated environmental integrity provisions
 - how seller countries' contexts (e.g. NDC ambition) could influence buyer decisions in international carbon markets
 - how carbon credit markets could align with pathways for achieving net-zero emissions, addressing both carbon credit supply and demand.
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5.1. Market signals – an enabler for high-integrity market activity

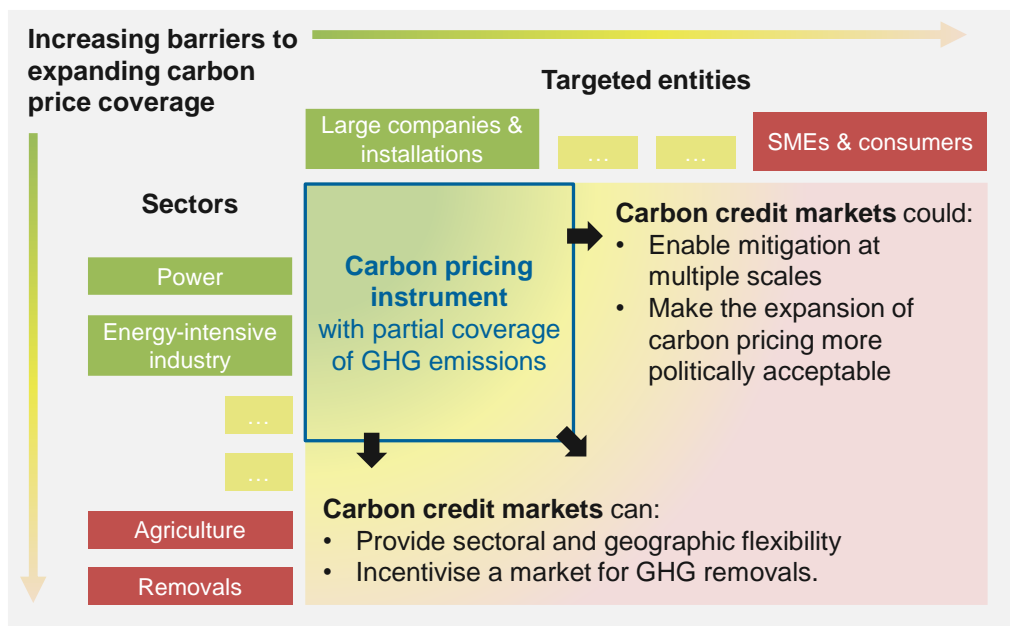
The potential role of carbon credit markets in supporting net-zero transitions could change over time. For carbon credit markets to effectively support GHG mitigation, market frameworks need to enable long-term planning and investments in mitigation activities (by both countries and companies). However, both VCMs and CCMs, and their respective environmental integrity frameworks are changing rapidly. This creates uncertainty about the current and future role of carbon credit markets, increasing risks for potential investments (IETA, 2023^[190]). To unlock GHG mitigation potential from carbon credit markets, governments could usefully provide clarity on the role of carbon credit markets, and how this may evolve over time. Considering countries differences in national circumstances and existing policies, the role of carbon credit markets will differ by jurisdiction. Nonetheless, governments could provide market signals about the role of carbon credit markets with regards to several aspects outlined in this section.

5.2. The role of carbon credit markets relative to other climate policies and carbon pricing instruments

The role of carbon credit markets relative to other carbon pricing instruments and climate policies could usefully be clarified, to enhance their mitigation impact. Carbon credit markets could theoretically support almost any mitigation activity, but governments can steer domestic carbon credit markets towards areas (sectors, activities, technologies) where markets will be most needed, and most likely to operate with environmental integrity.

Governments who plan on using carbon pricing instruments to reduce GHG emissions could clarify the role of VCMs and CCMs relative to other carbon pricing approaches. Generally, subsidies for carbon reduction or removal (such as carbon credit mechanisms) face several cost effectiveness challenges compared to carbon prices (such as taxes or ETSs).⁷¹ Nevertheless, carbon credit markets can provide a useful incentive for mitigation in countries or sectors where polluter-pays carbon pricing or other policies are less feasible (PMR, 2021^[191]). In many countries, carbon credit markets are combined with a carbon tax or ETS to allow for carbon pricing instruments to incentivise mitigation across a broader part of the economy (Figure 5.1) (La Hoz Theuer et al., 2023^[76]).

Figure 5.1. Example of how carbon credit markets could support carbon pricing instruments over time



Note: For countries that have, or plan to implement, a carbon pricing instrument (such as a carbon tax or ETS), carbon credit markets could complement the carbon pricing instrument (blue box) and enable increased mitigation action and ambition (black text) over time. The scope for each carbon pricing approach could usefully be informed by whether polluter-pays carbon pricing faces low (green) or high (red) barriers. The diagram is an illustrative example only, and its relevance to countries will depend on their national circumstances, priorities and existing carbon credit market engagement.

Source: Authors, adapted from BCG & GFMA (2021^[192]).

Carbon taxes and ETSs can be administratively challenging to implement and may face political economy challenges – particularly in LDCs. In contexts where such instruments are less feasible, carbon credit markets could play a bridging role and enhance governments' experience with carbon markets (BCG & GFMA, 2021^[192]). Over time, carbon credit markets could enhance government capacity and uptake of low-carbon solutions, potentially making the political economy more conducive for other carbon pricing instruments. However, there is a risk that carbon credits limit incentives to expand climate policies (Martins Barata, 2016^[193]), so potential perverse incentives of carbon credit markets for climate policy-making need

⁷¹ These challenges include: (i) For carbon credit prices to be maintained at a level that stimulates mitigation, some form of support or robust credit demand is required – with potential implications for other public spending (PMR, 2021^[191]); (ii) It is difficult to target carbon subsidies to additional (marginal) projects (Calel et al., 2021^[134]); and (iii) the per-tonne economic incentive from carbon credits typically stimulates less mitigation than an equivalent penalty on emissions (Henderson et al., 2021^[138]).

to be carefully managed. One way to avoid such perverse incentives is to deploy sectoral, jurisdictional or policy-level crediting approaches, which can reward mitigation action by governments and projects alike.

5.3. The role that Article 6 and VCMs could play for countries' climate objectives

Governments could clarify several aspects of their Article 6 (Table 5.1) and VCM engagement, to enable private sector participants' to effectively contribute to countries' NDCs and long-term strategies. This includes to what extent, and under what conditions, they intend to buy or sell mitigation outcomes under Article 6. Seller countries could provide detailed breakdowns of their mitigation objectives, current and intended policies, financing needs, and the role that Article 6 could play for different sectors (IETA, 2023^[92]; World Bank, 2024^[194]). Buyers countries could – to the extent possible – send clear signals to the market about e.g. the quantity, quality, timing of ITMOs they intend to purchase, as this could inform supply-side strategies and investments (Michaelowa et al., 2021^[93]). Moreover, clear regulatory frameworks for VCMs in supply-side countries could also facilitate investment in activities that can contribute towards countries' climate objectives (VCMI, 2023^[116]; ACMI, 2023^[130]).

Table 5.1. Selected aspects of countries' climate plans that can provide clarity for Article 6 trading

Element of climate plans	To be clarified by	Relevance to countries Article 6 engagement	
		Relevance for seller country	Relevance for buyer country
Intention on using Article 6 co-operation This can include information on whether, to what extent, and under what conditions (e.g. above certain environmental integrity standards) the country will engage in Article 6 co-operation.	Buyer & Seller	Detailed information from both seller and buyer countries on their intentions to use Article 6 co-operation can facilitate supply-demand signalling, investment certainty and the development of co-operative frameworks.	
Basis for quantification of NDC targets This includes the basis for the country's emissions balance (e.g. economy & GHG coverage) and NDC target (e.g. single-/multi-year target).	Buyer & Seller	How the seller country's NDC is quantified can, among other things, inform methodologies for, and reporting on, co-operative approaches.	How the buyer's NDC is quantified can inform better estimations of potential future ITMO demand and reduce investment uncertainty.
Details and potential conditionality of NDC targets This includes potential breakdowns of the mitigation target (e.g. sectoral targets) and potential conditionality of NDCs (e.g. how much, which sectors, what sources of finance).	Seller	Detailed NDCs are the starting point for seller countries' Article 6 strategies. This can inform the potential scale and nature of co-operative approaches, as well as which types of mitigation outcomes could receive authorisations.	Clear signals from seller countries can reduce search costs for buyer countries.
Procurement strategy for meeting ITMO demand This can include information on where ITMOs could come from (e.g. sectors, activities, crediting mechanisms), as well as who is responsible for acquiring them (e.g. managed by public authority / delegated to companies who can use ITMOs towards a tax obligation). As Article 6 implementation is nascent, such procurement strategies would need to be continually reviewed and updated.	Buyer	Clear signals from buyer countries can reduce the search costs for seller countries.	A detailed and long-term ITMO procurement strategy, with a clear division of responsibilities can enable relevant entities to develop co-operative approaches and acquire ITMOs in a timely manner.

Note: While around 70% of NDCs include some form of conditionality and this is used to inform several countries Article 6 engagement, "conditionality" has not been defined under the Paris Agreement, nor is it mentioned in Article 6 Guidance (Kreibich, 2024^[136]).

Source: Authors' own elaboration from Michaelowa et al., (2021^[93]) and World Bank (2021^[71]).

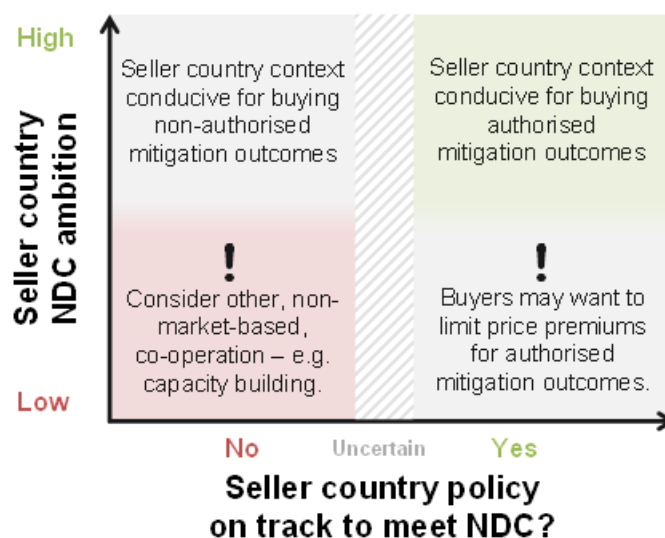
5.4. The role that authorisation and seller country context could play for buyer decisions

Authorised and non-authorised mitigation outcomes (Section 3.2.1) could play different and complementary roles in carbon credit markets. Non-authorised mitigation outcomes can contribute towards the seller country's NDC achievement, whereas the authorisation of mitigation outcomes effectively transfers the associated mitigation benefit to another user (Ahonen et al., 2023^[1]). Since non-authorised and authorised mitigation outcomes are associated with different accounting practices and impact ownership, they can also be used for different purposes. For example, six European countries have declared that only authorised mitigation outcomes can support 'offsetting claims', whereas non-authorised mitigation outcomes can support 'contribution claims' (Box 3.1). While this difference is important, the Article 6 framework also outlines various provisions (including those mentioned in Section 3.2.1) to ensure that both authorised and non-authorised mitigation outcomes are shared, and result in mitigation benefits in the seller country. If such sharing of mitigation benefits is the norm, the challenges outlined below are of less relevance.

There is a potential risk that Article 6 discourages NDC ambition, but this risk can be managed if ITMO buyers' take host country contexts into account to their purchase decisions. In particular, ITMO buyers could usefully be informed by the seller country's NDC ambition and progress towards it (Figure 5.2). For example, if a country's NDC requires minimal mitigation beyond business-as-usual, it can sell authorised mitigation outcomes with marginal risk to its NDC achievement. If ITMOs are sold at a premium compared to non-authorised mitigation outcomes, the country could be disincentivised to increase their NDC ambition, as this reduces their potential ITMO revenues. While the potential for carbon market revenue is only one of several factors influencing countries' target setting, there is a theoretical risk that a large international carbon market, with considerable premiums for authorised credits, could discourage future NDC ambition (Füssler et al., 2019^[195]). Alternatively, countries with ambitious NDCs could be encouraged to "oversell" ITMOs, making the achievement of their NDC more difficult. To manage these potential risks, buyers could usefully take seller countries' NDCs into account when sourcing ITMOs.

Figure 5.2 presents a grid which may inform buyers' decisions, to avoid creating perverse incentives for NDC ambition. However other seller country-specific environmental integrity considerations should be managed alongside perverse incentives – particularly seller country safeguards for carbon credit quality (World Bank, 2021^[196]). As it is unlikely that buyers can source large amounts of authorised mitigation outcomes from seller countries in the top right quadrant of Figure 5.2, buyer countries measures to manage potential perverse incentives will be needed for most ITMO trades.

Figure 5.2. Potential roles for authorised and non-authorised mitigation outcomes under different seller country NDC contexts



Note: Different seller country NDC contexts could usefully inform buyers' decisions to avoid creating perverse incentives for future NDC ambition. While authorised and non-authorised mitigation outcomes have different implications for seller country GHG accounting, all Article 6 mitigation co-operation is intended to generate greater mitigation benefits than what is authorised for international transfer.

Source: Authors' own illustration.

5.5. The role and nature of carbon credit supply over time

Governments could also clarify how carbon credit supply can evolve over time to support the net-zero transition. Several supply-side measures may need to be introduced for carbon credit markets to be “consistent with a pathway toward overall net zero emissions” (as is outlined in the recently adopted G7 Principles – Box 2.1). For example, carbon credit markets will need to shift from a market dominated by emissions reductions to removals with long-term storage as the world approaches net zero (Jeudy-Hugo, Lo Re and Falduto, 2021^[197]; Allen et al., 2020^[198]).⁷² Moreover, net zero-alignment could imply the alignment of crediting baselines with net-zero pathways, or excluding activities that lock in technologies with net-zero incompatible emission levels (UNFCCC Secretariat, 2023^[199]).

Measures to align carbon credit supply with net zero could affect activity eligibility and crediting levels. This can have commercial implications for carbon market participants, so government signals may be needed to steer market players towards net zero-consistent practices. For instance, the market for removal credits has grown rapidly in recent years, but without government support it will not scale quickly enough to align with 1.5°C-consistent pathways (DESNZ, 2023^[200]; Honegger, 2023^[201]).

⁷² Currently, deep and rapid reductions in emissions is an urgent priority (IPCC, 2022^[249]), making GHG emission reduction credits relevant and timely for advancing global GHG mitigation efforts. However, as the world moves closer to net-zero, opportunities to reduce emissions through credit-generating activities will become more scarce, and there will be a greater need to deliver carbon removals to balance residual emissions from hard-to-abate sectors (Jeudy-Hugo, Lo Re and Falduto, 2021^[197]). The transition to net-zero GHG emissions will not be a uniform movement as countries and sectors move at different speeds (SBTi, 2024^[229]), so signals on the net-zero alignment of carbon credit supply may need to take this into account.

5.6. The role that carbon credits could play in companies' net-zero pathways

Governments could guide market players on how carbon credits could support voluntary private sector GHG mitigation in line with net-zero pathways. Several initiatives have sought to define good practice for the voluntary carbon credit use,⁷³ and while they share some common principles, their differences have contributed to confusion (WEF, 2023^[91]). There are several key areas where there is still disagreement on the role that carbon credits could play, including:

- The nature of claims that companies can make (e.g. compensation vs. contribution claims)
- The degree to which companies can use carbon credits towards current GHG emissions (e.g. not at all vs. a set percentage of current emissions)
- The degree to which companies can use carbon credits to balance their GHG emissions in different target years (e.g. only in the net-zero target year vs. also towards interim targets)
- The relevance of carbon credits for Scope 1, 2 and 3 emissions (e.g. more flexibility to use carbon credits towards Scope 3 emissions vs. same relevance for all Scopes)
- The role of carbon credits from reduction vs. removal activities over time (e.g. no distinction vs. increasing share of removals over time)
- The role of carbon credits with corresponding adjustments (e.g. corresponding adjustments not needed vs. corresponding adjustments needed for compensation claims) (GenZero and MSCI Carbon Markets, 2023^[59])

Due to this lack of clarity, corporates are open to criticism from stakeholders who disagree on what is considered high-integrity carbon credit use. This likely inhibits carbon credit demand from companies that have set net-zero targets (GenZero and MSCI Carbon Markets, 2023^[59]; Trove Research, 2023^[202]). To leverage corporate climate commitments, while enhance transparency and accountability on their net-zero pathways, governments could usefully outline what net zero-consistent credit use entails over time.

⁷³ These include VCMI, SBTi and NewClimate Institute; standards and guidance from international organisations, such as ISO and the UN High Level Expert Group on Net Zero; frameworks agreed by several governments, such as the G7 and the Nordic Council of Ministers; as well as national frameworks such as Canada's Net-Zero Challenge and Australia's Climate Active programme (Kreibich, Brandemann and Jüde, 2022^[60])

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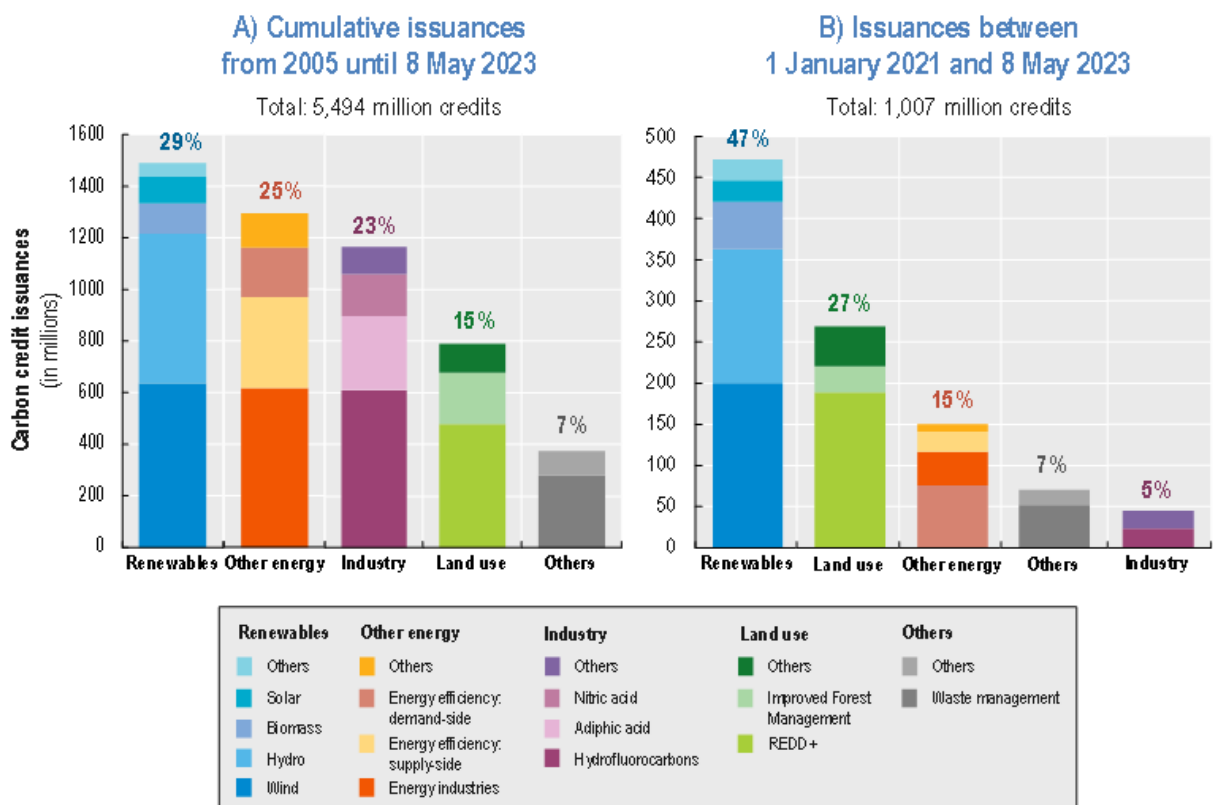
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Annex A. Detailed background: Understanding carbon credit markets, environmental integrity, and interplay

Further background on carbon credit supply, demand and markets

Carbon credit markets can stimulate mitigation across a wide range of countries, sectors and GHGs – and this flexibility has led to a large diversity of supply, demand, and markets (Figure A A.1). Different carbon credit markets have different methodologies, governance systems, registries, and eligibility of crediting activities. This, in turn, leads to differences in the perceived quality of different credits.

Figure A A.1. Carbon credit issuances by type of mitigation activity



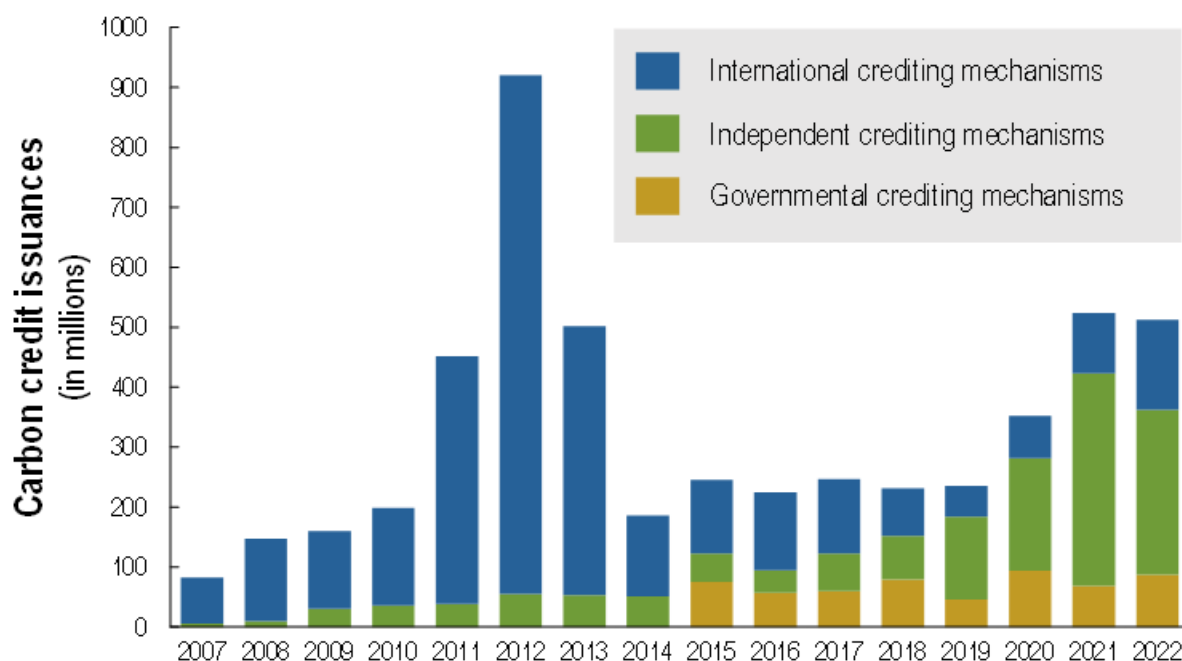
Notes: Carbon credit issuances across the seven largest carbon crediting mechanisms (Clean Development Mechanism, Joint Implementation, Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve and ART TREES), as per registry data and category classification by Öko-Institut.

Sources: Analysis commissioned by OECD and performed by Öko-Institut, see details in Annex C.

Carbon credit supply currently comes from a wide range of economic activities, including energy generation, industry, land use and waste management. Renewables, in particular wind and hydro power plants, make up the largest share of issued credits, and an even increasing share in recent years (Figure A A.1, Panel B). Cumulatively, around 5.5 billion carbon credits have been issued from seven of the largest carbon crediting mechanisms (Figure A A.1, Panel A). The largest share (44%) has come from the Clean Development Mechanism (CDM), which was established under the Kyoto Protocol, but no longer accepts new projects. New supply will be created under the Paris Agreement's Article 6 framework; however, this is not yet fully operational.

Carbon credit demand can come from a wide range of sources, which evolve over time and influence the shape of carbon credit markets. The level of demand affects carbon credit prices, investments into new carbon credit-generating activities, as well as when and how carbon credits are issued. The European Union's Emissions Trading Scheme (EU ETS) was for a long time the most prominent source of demand for carbon credits, and prompted the retirement of 1.57 billion credits between 2008 and 2020 (European Commission, 2021^[203]). In 2009-2011, the EU made a series of decisions to restrict the demand for carbon credits, in parallel with a decrease in allowance prices in the EU ETS. These EU developments led to a crash in demand for carbon credits in 2011-2012, and carbon credit market activity has not fully recovered since (Michaelowa, Shishlov and Brescia, 2019^[22]). Carbon credit demand is now more fragmented between smaller compliance markets, and voluntary buyers. The fragmentation of carbon credit demand has led to a shift in carbon credit supply from the multilaterally negotiated CDM to independent crediting mechanisms, where governments exercise less direct influence (Figure A A.2).

Figure A A.2. Carbon credit issuances by year and type of crediting mechanism



Note: Definitions of international, independent and governmental crediting mechanisms are provided in Annex D. Data from the Carbon Pricing Dashboard (World Bank, 2023^[98]) only includes governmental crediting mechanism data from 2015 onwards. Any credits issued by governmental mechanisms (e.g., in California, China, and the UK) before 2015 are not included in the diagram above.

Sources: Authors' elaboration of data from World Bank (2023^[98]), UNEP-CCC (2023^[204]), UNFCCC (2016^[205]) and MSCI Carbon Markets (2024^[105]). All information used as available by 8 January 2024.

Potential mitigation benefits of carbon credit markets

Carbon credit markets could accelerate the net-zero transition on multiple fronts by addressing ambition, action, and finance gaps (Ahonen et al., 2023^[1]; UNEP, 2021^[206]). On the supply-side, carbon credit revenues could incentivise mitigation action through the deployment of clean energy technologies, the enhancement of natural carbon sinks, management of non-CO₂ GHG emissions and more (Ecosystem Marketplace, 2023^[4]). On the demand side, carbon credits could enable countries and companies to increase their mitigation ambition, as credits can support GHG mitigation at a potentially lower cost (Yu et al., 2021^[207]). Furthermore, carbon credit markets could support international co-operation, unlock climate investments, and complement other instruments in the climate policy toolbox (World Bank, 2023^[208]). For these mitigation benefits to be realised, carbon credit markets would need to operate with greater environmental integrity than many have in the past. Several integrity risks like non-additionality and double counting could undermine the ability of carbon credit markets to support GHG mitigation (see further in next section).

Carbon credit revenues could accelerate mitigation efforts on the supply side, notably in developing countries (Ecosystem Marketplace, 2023^[4]). Between now and 2030, developing countries alone are estimated to require USD 2.4 trillion a year in finance for climate action (Bhattacharya et al., 2023^[108]).⁷⁴ Carbon credit markets could partially address this gap, by providing a revenue stream that can unlock investments in a range of mitigation activities, such as renewable energy or forest carbon sequestration. Carbon credit revenues can increase the expected returns of mitigation activities, making these activities more viable to investors (World Bank, 2023^[208]). Estimates suggest that carbon credit markets could potentially leverage investments 7 times the value of carbon credit revenues in the energy sector (Energy Transition Accelerator, 2023^[33]). Around 77% of carbon credits issued between 2018-2022 came from emerging markets and developing economies (EMDEs) (Annex C). As such, carbon credit markets are well-positioned to support increases in private climate finance to EMDEs, which is widely considered to be a key challenge for climate finance globally (OECD, 2023^[209]; IEA & IFC, 2023^[210]; Buchner et al., 2023^[211]).

As an outcome-based payment, carbon credit revenues could support enduring GHG mitigation from activities with modest upfront financing needs and considerable ongoing costs. This includes many credit-generating activities related to waste, land use and carbon removals (World Bank, 2023^[109]). However, outcome-based payments and carbon credit revenues remain a very small share⁷⁵ of financial flows for mitigation.

Carbon credit markets could support supply-side mitigation action at multiple scales – from entire sectors to individual activities. Most carbon credits come from GHG mitigation projects, or programmes of activities. However, other approaches are now emerging to support GHG mitigation impacts at a jurisdictional and sectoral level (Schwartzman et al., 2021^[212]). Such scaled-up carbon crediting (Section 3.3.2) could incentivise governments to accelerate climate action, e.g. by prematurely shutting down coal-fired power plants and accelerating renewable energy deployment (Energy Transition Accelerator, 2023^[33]). Carbon credits could also enable mitigation action at smaller scales, such as in communities and households. Carbon credit markets leverage decentralised action and private sector capabilities, so they can support household and community-level interventions like low-carbon solutions for energy access, water purification and waste management. These interventions, and other mitigation actions supported by carbon

⁷⁴ This estimated need includes investments in mitigation, adaptation and loss and damage (Bhattacharya et al., 2023^[108]). Both estimates of financing needs and current flows are uncertain and should be seen as indications rather than precise assessments (OECD, 2023^[209]).

⁷⁵ Databases over outcome-based payments for mitigation have limitations, but an analysis by the World Bank in 2022 highlighted that only 5% international public climate finance is paid after results are achieved (World Bank, 2022^[293]).

credits, can have considerable sustainable development co-benefits (Thakur et al., 2018^[213]; Jagoe et al., 2020^[214]).

On the demand side, carbon credit markets could contribute to enhanced climate ambition. The possibility of using carbon credits has likely enabled many countries and companies to adopt net-zero commitments. For instance, to reach net-zero emissions by mid-century, many countries would likely need to balance domestic GHG emissions with overseas carbon dioxide removals – potentially with the use of carbon credits (Jeudy-Hugo, Lo Re and Falduto, 2021^[197]). Similarly, companies will find it challenging to completely decarbonise their operations and value chains, while maintaining profitability (McKinsey & Company, 2022^[215]). Carbon credit markets offer a vehicle for potentially low-cost abatement and can therefore make it more feasible for entities to take on net-zero ambitions. There are now over 3500 companies that have net-zero targets, with some mentioning the use of carbon credits (Net Zero Tracker, 2024^[216]; MSCI Carbon Markets, 2024^[102]).

On the international level, market-based co-operation under Article 6 could enable countries to raise their mitigation ambition, even if the framework is not yet fully operationalised. Indeed, in Parties' NDCs for 2030, over 120 Parties either plan to use, or consider using, voluntary co-operation (including Article 6) to meet their NDCs (UNFCCC, 2023^[137]). By 11 December 2023, over 40 countries had signed bilateral agreements or MOUs to participate in Article 6.2 co-operation (IETA, 2024^[6]), and 18 NDCs cited voluntary cooperation as a condition for achieving their mitigation targets (UNFCCC, 2023^[137]). However, carbon trading remains very limited in comparison to the GHG mitigation needed to meet 2030 NDCs. Many developing countries consider Article 6 as one way to support implementation of the conditional part of their NDCs. The estimated gap between conditional and unconditional NDCs is 3.5 Gt CO₂-eq in annual GHG mitigation per annum by 2030 (UNFCCC, 2023^[137]). By comparison, global carbon credit demand in 2022 was equivalent to 0.2 Gt CO₂-eq per annum. Unless there is a drastic increase in demand for mitigation outcomes under Article 6, the framework will likely play a limited role for mitigation action and ambition in this decade.

On the domestic level, carbon credit markets offer a flexible tool for incentivising GHG mitigation. Countries can use carbon credit markets to facilitate government support for mitigation (e.g. Australian Carbon Credit Unit Scheme) and provide flexibility to carbon pricing systems (e.g. Canada's Output-Based Pricing System) (OECD, 2023^[10]; Henderson and Frezal, 2020^[217]). Using carbon credits in combination with a carbon pricing instrument could have several benefits, including: (i) sharing the mitigation burden across more sectors and geographies; (ii) reducing the cost of compliance for regulated entities; (iii) making carbon pricing more politically acceptable; (iv) building capacity and delivering co-benefits in sectors outside the carbon pricing instrument (La Hoz Theuer et al., 2023^[76]). However, the use of carbon credits could also reduce the overall ambition level of a carbon pricing instrument (Carvalho et al., 2021^[218]),⁷⁶ and so the use of carbon credits is often subject to quantitative limits (La Hoz Theuer et al., 2023^[76]).

Ultimately, carbon credit markets need a source of demand or finance to drive mitigation. In comparison to the estimated levels of global finance for climate action in 2021 and 2022 (USD 1.27 trillion on average) (Buchner et al., 2023^[211]), the average annual value of VCMs in the same period⁷⁷ was small (USD 2 billion). While carbon credit markets are projected to grow, they will likely play a limited role in delivering mitigation finance (Ecosystem Marketplace, 2023^[4]).

⁷⁶ If carbon credits are priced lower than a carbon tax or permit under an ETS, the possibility to use carbon credits for carbon price compliance effectively reduces the incentives for obligated entities to address their direct emissions.

⁷⁷ There are limited data on the value of compliance carbon credit markets. However, considering they are much smaller than voluntary carbon markets in terms carbon credit volumes, their annual value is likely smaller than USD 2 billion.

Understanding environmental integrity in carbon credit markets

Carbon credit markets have several environmental integrity challenges,⁷⁸ which currently undermine the effectiveness of some carbon credit markets in supporting the net-zero transition. Environmental integrity in carbon credit markets requires several conditions to hold true for the generation of credits (supply-side integrity), the use of these credits (demand-side integrity) as well as their trading environment (market integrity). Carbon credit markets currently experience integrity challenges across these three elements, but emerging environmental integrity frameworks have the potential to drive improvements (Section 3.2).

Understanding integrity

In the context of carbon credit markets, *environmental integrity* tends to refer to climate impacts – whereas *integrity* tends to also include the consideration of other social and environmental impacts. This paper focuses on environmental integrity, using the following definition:

Core condition: Environmental integrity would be ensured if the engagement in the transfer of carbon credits leads to aggregate global GHG emissions that are not higher than if such transfers had not taken place. – based on (Schneider and La Hoz Theuer, 2019^[77])

Supporting conditions: Carbon credit markets enable greater ambition, do not displace more effective⁷⁹ measures, and are net zero-aligned.

This paper’s definition of environmental integrity includes supporting conditions, to explore dynamic aspects of carbon credit markets. For example, the effectiveness of carbon credit markets in delivering GHG mitigation depends on: (i) how markets influence participants’ mitigation ambition (“enable raised ambition”); (ii) the use of other potential mitigation policies (“do not displace more effective measures”); and (iii) an evolving understanding of how carbon credits market can support climate objectives under the Paris Agreement (“net-zero aligned”) (Kreibich et al., 2021^[219]).

The environmental integrity of carbon credit markets depends on various conditions and risks which can be addressed, but not fully eliminated. Environmental integrity risks can be related to the:

- Credit-generating activity itself (e.g. whether it is additional and represents real, permanent reductions);
- Requirements of the standards that issue the carbon credits (e.g. how emission reductions and removals are quantified and verified, what measures are taken to address non-permanence);
- Context in which the credits are generated (e.g. how the crediting activity relates to other mitigation efforts in the sector or country, stringency of the seller country’s NDC);
- Trading and use of carbon credits (e.g. whether carbon credits complement direct mitigation, whether the use of carbon credits supports accurate and unique claims) (Broekhoff et al., 2019^[141]).

Environmental integrity is not a binary outcome, as multiple factors influence the likelihood of carbon credit markets delivering climate benefits. Carbon credit markets rely on counterfactual scenarios of what would have happened in the absence of the carbon credit-generating activity. Such scenarios are unobservable and uncertain, making it difficult to fully eliminate environmental integrity risks (Martins Barata, 2016^[193]).

⁷⁸ In contrast, permit markets are not subject to uncertainties about additionality, baselines, permanence or other environmental integrity risks specific to baseline-and-credit systems. Nonetheless, tradeable units in cap-and-trade systems can also be subject to environmental integrity risks if, for example, the cap is set above business-as-usual emissions.

⁷⁹ Which measures are “more effective” will vary with national circumstances and existing mitigation policies.

Environmental integrity requires several conditions to hold true, and these can be categorised into supply-side, demand-side and market integrity (G7, 2023_[20]). These conditions are:

- **Supply-side integrity:** Carbon credit markets support supply-side climate action, with one carbon credit representing at least one tonne of carbon dioxide equivalent (1 t CO₂-eq) of additional and permanent emission reductions or removals.
- **Demand-side integrity:** Carbon credits are used in a way that complements, rather than displaces, demand-side climate action in line with a pathway toward overall net-zero GHG emissions, and claims are accurate.
- **Market integrity:** There is a well-functioning market with sufficient governance and transparency for environmental integrity risks to be identified and minimised, and double counting to be avoided.

The conditions above are connected, and if one of them is not met, it could undermine the overall environmental integrity of carbon credit markets. For example, if the market integrity and transparency is lacking, it is unlikely that carbon credit projects with high supply-side integrity will be able to differentiate themselves and gain premiums relative to low-integrity projects (Akerlof, 1970_[220]). That being said, if carbon credit markets operate with supply-side integrity (i.e. carbon credit quality is high), this reduces the risk that demand-side claims about climate performance are overstated. Carbon credit markets can therefore benefit from end-to-end systems (covering supply, demand and markets) to manage environmental integrity, with particular emphasis on the supply side.

In recognition of the need for end-to-end integrity, G7 countries in 2023 agreed a set of “Principles of High Integrity Carbon Markets”, which covers supply, demand and markets (Box 2.1). The G7 Principles were also followed by other plurilateral efforts to enhance carbon credit market integrity (Presidency of the French Republic, 2023_[221]; Government of the Netherlands, 2023_[32]). Market-led integrity initiatives have also provided similar signals. At COP28, initiatives for supply-side and demand-side integrity⁸⁰ presented an ‘end-to-end integrity’ framework for VCMs (We Mean Business Coalition, 2023_[63]).

Key environmental integrity risks (supply-side, demand-side and market)

Supply-side integrity risks

Proposed definition of supply-side integrity:

Carbon credit markets support supply-side climate action, with one carbon credit representing at least one tonne of carbon dioxide equivalent (1 t CO₂-eq) of additional and permanent emission reductions or removals.

Supply-side integrity could be compromised by wide range of risks associated with the mitigation activity, the crediting mechanism, or the country in which the activity takes place. This includes risks related to additionality, quantification, permanence, institutional arrangements, as well as how well carbon credit markets support the net-zero transition and supply-side countries’ mitigation efforts.⁸¹ Table A A.1 outlines some of the key elements of supply-side integrity.

If integrity provisions on one of the elements outlined in Table A A.1 are weak, this could undermine the overall quality of carbon credits. Supply-side integrity risks must therefore be managed in tandem. However, some elements may not always be material for an activity’s supply side integrity – for example, non-permanence risks are only relevant in cases where mitigation impacts could be reversed (e.g.

⁸⁰ These were the Greenhouse Gas Protocol (GHG Protocol), Science-Based Targets initiative (SBTi), Integrity Council for the Voluntary Carbon Market (ICVCM) and Voluntary Carbon Markets Integrity Initiative (VCMI).

⁸¹ While supply-side integrity in key frameworks (e.g. G7 (2023_[20]) & ICVCM (2023_[46])) also includes impacts on social and environmental objectives other than GHG mitigation, this paper focuses primarily on supply-side, demand-side and market integrity from a climate perspective.

enhancement of forest carbon stocks). Moreover, supply-side integrity elements like Paris alignment and support to seller country mitigation may be particularly relevant in the Article 6 context, even if they should not be disregarded in the VCM context.

Table A A.1. Key elements of supply-side integrity in carbon credit markets

Supply-side integrity element	Description	Comment
Additionality	Mitigation activities are additional if they would not have occurred in the absence of a market for credits. As this is a counterfactual scenario, additionality can be assessed using a variety of methods, such as barrier tests, financial, technological and regulatory analyses.	Demonstrating additionality of a mitigation activity is difficult as it requires comparing the activity with a counterfactual scenario. Assessments of additionality usually include some subjective components.
Quantification of emission reductions and removals	Emission reductions and removals are quantified via specific methodologies, which commonly include defining the accounting boundary (emission sources considered), establishing an emissions baseline, monitoring for actual emissions from the activity and accounting for leakage.	Most carbon crediting mechanisms have general requirements that emission reductions or removals should be estimated conservatively (i.e., erring towards underestimation rather than overestimation), but ensuring that this happens in practice is challenging.
Permanence	The risk of non-permanence is relevant for project types that increase or preserve carbon stocks (e.g. via biogenic or geological means ⁸²), and where the mitigation impact could potentially be reversed.	Carbon crediting mechanisms address non-permanence risks in two ways: reducing the risk of non-permanence, or mandating compensation in case that a reversal happens.
Institutional arrangements	Institutional arrangements include governance arrangements of the crediting mechanism, such as provisions to address conflicts of interest and requirements for public consultations. A key aspect of institutional arrangements is the accreditation, operational procedures and oversight of third-party auditors. Transparency is also important - including on decision-making processes and project documentation. Furthermore, carbon credit registries should uniquely identify, record and track mitigation activities and carbon credits.	The robustness of institutional arrangements influences the capacity of carbon crediting mechanisms and auditors to ensure integrity of carbon credits.
Paris alignment and contribution towards net zero	"Paris alignment" could have multiple implications for carbon credit supply, including: (i) adjusting baseline scenarios to be consistent with net-zero compatible emissions pathways and NDCs; (ii) rendering ineligible certain activities that lock in technologies and systems that have emissions incompatible with net-zero; and (iii) increasing reliance on emission removals over time, as opportunities to reduce emissions become more limited.	There is an ongoing discussion about whether and to what extent independent crediting mechanisms should align with Article 6 and – more generally – the new context of the Paris Agreement. Norms around the Paris alignment of carbon markets are likely to evolve, as progress is made in Article 6 negotiation and the implementation of Paris Agreement.
Support to seller country mitigation efforts (particularly relevant in the Article 6 context)	The extent of any support relates to several factors, including the modalities for issuing and sharing credits, how carbon credit markets relate to domestic policies, as well as potential perverse incentives created by carbon credit revenues. Furthermore, seller countries can put in place various arrangements to reduce the risks of "over-selling" mitigation outcomes.	Although it is not yet operational, the PACM framework includes several provisions to ensure carbon credit markets contribute to seller country mitigation efforts, including: (i) relatively short crediting periods; (ii) equitable sharing of mitigation outcomes; (iii) adopting baselines below business as usual; and (iv) automatic cancellation of 2% of mitigation outcomes.

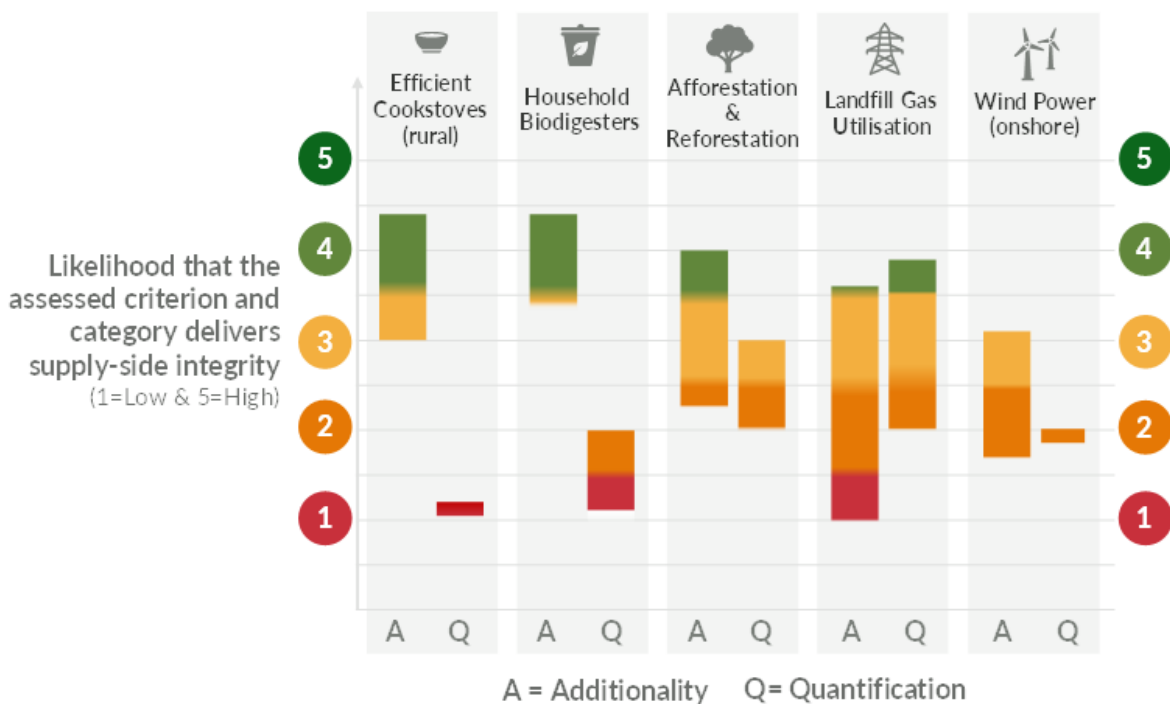
Sources: (Schneider et al., 2022^[140]; Schneider and La Hoz Theuer, 2019^[7]; ICVCM, 2023^[46]; UNFCCC, 2021^[8]; World Bank, 2021^[196]).

Most of the key elements in Table A A.1 feature in some form across the largest carbon crediting mechanisms, but they are operationalised in different ways. For example, mechanisms differ with regards to their measures to address non-permanence, and their additionality assessments. Differences in how integrity principles are operationalised has led to substantial variation in the quality of carbon credits, both

⁸² This mainly applies to projects affecting biogenic carbon stocks, such as afforestation projects, avoided deforestation projects or projects replacing the use of non-renewable biomass (e.g., cookstove or biodigester projects), and projects storing carbon in geological reservoirs, products or minerals, such as projects involving carbon capture and storage (CCS), carbon capture and utilisation (CCU) or enhanced weathering.

within and between crediting mechanisms, activity categories, and individual projects (CCQI, 2023^[50]). Figure A A.3 demonstrates this for the case of additionality and quantification risks across five types of carbon credits. For example, efficient cookstove projects tend to score well on additionality, but often have overestimated mitigation impacts.⁸³ This highlights that carbon credit-generating activities can perform well on one integrity element, but poorly in another. Furthermore, the large range of scores for landfill gas utilisation highlights that integrity provisions vary substantially across crediting mechanisms. Efforts are now underway to ensure supply-side integrity elements are operationalised more consistently across carbon crediting mechanisms (see Section 3.2.2 for details).

Figure A A.3. Variation in additionality and quantification risks by carbon credit category



Note: Bars on the diagram represent a range of Carbon Credit Quality Initiative (CCQI) scores for different types of carbon credits, including scores for different methodologies across five carbon crediting mechanisms: American Carbon Registry, Clean Development Mechanism, Climate Action Reserve, Gold Standard and the Verified Carbon Standard. While CCQI assesses seven categories of supply-side integrity risk, this diagram displays only additionality and quantification (“Robust quantification of emission reductions and removals”). The diagram highlights that there is considerable variation in supply-side integrity risks both within and between carbon credit types. Methodologies for assessing carbon credit quality vary, and CCQI is only one independent assessment entity among many.
 Source: Adapted from (Holler, Martins Barata and Schneider, 2023^[222]).

⁸³ This risk of over-quantification in efficient cookstove projects mostly comes from inflated assumptions about the fraction of non-renewable biomass (fNRB) that would be depleted and cause emissions in the absence of a cookstove project (Gwin, Lavelle and Ramesh, 2023^[294]). While much of this over-quantification risk could be eliminated through stricter methodologies, there would still be scope to make underestimations and overestimations due to data limitations and considerable variation in fNRB values by location (Sylvera, 2023^[295]).

Carbon crediting mechanisms play a central role in managing supply-side integrity risks in most carbon credit markets.⁸⁴ To issue credits, mitigation activities must register with a carbon crediting mechanism using an approved methodology. The activity must then demonstrate mitigation results and get these third-party verified to issue credits. In this process, carbon crediting mechanisms oversee the development of methodologies, registration of mitigation activities, recognition of relevant third-party auditors, operation of carbon credit registries, and potential dispute procedures against credit-generating activities (Broekhoff et al., 2019^[141]). Other actors can also support supply-side integrity, such as the seller country or jurisdiction, activity proponents, auditor accreditation bodies, MRV technology providers, trading platforms and ratings agencies. Furthermore, many carbon credit buyers conduct due diligence on carbon credit supply⁸⁵ as a complement to the certification by a carbon crediting mechanism (Hamrick and Myers, 2022^[223]).

Several actors independently assess supply-side integrity of carbon credits.⁸⁶ This includes carbon credit ratings agencies, which have different methodologies and scopes of credits that they assess (Wawrzynowicz, Krey and Samaniego, 2023^[51]). Overall, carbon credit ratings agencies estimate that around half of carbon credit-generating activities are of low quality.⁸⁷ However, these assessments generally do not include governmental mechanisms, and only cover a segment of the market.⁸⁸ Some of the risks highlighted by independent assessments of credit quality include:

- Limited additionality of credit-generating activities (common for e.g. renewable energy projects) (Calel et al., 2021^[134])
- Methodologies and monitoring, reporting and verification (MRV) systems that allow over-issuance of carbon credits (common for e.g. avoided deforestation projects) (Lo Re et al., 2019^[224]; Calyx Global, 2023^[225])
- Limitations in how non-permanent emission reductions or removals are accounted for (common for e.g. clean cookstove projects) (Ramesh et al., 2022^[145])
- Limitations in how double counting is addressed (common for e.g. overlap between clean cookstove and avoided deforestation projects) (CCQI & Calyx Global, 2023^[226]).

⁸⁴ In Article 6.2, carbon trading does not require a carbon crediting mechanism. Instead, the transferring and acquiring parties can define bespoke frameworks to manage the supply-side integrity of co-operative approaches and ITMOs.

⁸⁵ This can include in-house assessments, support from consultants, or ratings agency intelligence.

⁸⁶ This includes the Carbon Credit Quality Initiative, which assesses a combination of project types, crediting mechanisms, methodologies, country contexts and sometimes other factors. This also includes intelligence providers such as MSCI Carbon Markets and Abatable, as well as carbon credit ratings agencies such as BeZero Carbon, Calyx Global and Sylvera, which assess individual projects.

⁸⁷ “Low quality” refers to credit-generating activities rated B or lower by BeZero (57%) (BeZero Carbon, 2023^[296]), C or lower by Calyx Global (64%) (Calyx Global, 2023^[297]) and C or lower by Sylvera (44%) (Sylvera, 2023^[171]) – with data collected from each ratings agency in July-September 2023.

⁸⁸ Independent assessments of carbon credit quality are generally limited to mitigation activities that are registered with independent crediting mechanisms (such as Gold Standard) or international crediting mechanisms (such as the Clean Development Mechanism). So far, comprehensive assessments comparing the environmental integrity provisions of governmental crediting mechanisms (such as the China Certified Emission Reduction (CCER) scheme) with independent or international crediting mechanisms, have not been done. It is therefore difficult to make general comments about the quality of governmental mechanisms compared to independent or international mechanisms. Nonetheless, many governmental mechanisms are preceded by extensive analytical work by independent experts to inform the mechanism design and protocol development (Section 4.3.1). Furthermore, some governments (e.g. Australia (2023^[331])) have also conducted ex-post evaluations of their government-administered carbon credit markets, and are working to implement their recommendations.

Supply-side integrity risks in governmental carbon crediting mechanisms have not yet been systematically assessed to the same extent (I Care, 2022^[78]; Michaelowa et al., 2019^[79]), and may have different patterns of risk than those described above.⁸⁹

There are potential improvements to supply-side integrity on the horizon. Information available on carbon credit quality is improving, environmental integrity provisions in carbon crediting mechanisms are evolving, and increasingly, buyers are avoiding low-quality credits (Ecosystem Marketplace, 2023^[4]; Trove Research, 2023^[12]).

Demand-side integrity risks

Proposed definition of demand-side integrity:

Carbon credits are used in a way that complements, rather than displaces, demand-side climate action in line with a pathway toward overall net-zero GHG emissions, and claims are accurate.

A question at the core of demand-side integrity is whether the use of carbon credits complement or displace GHG mitigation. However, this question is difficult to answer, as patterns of carbon credit use vary, and transparency on the demand side of carbon credit markets is limited (Manuell, 2023^[227]).

Demand-side integrity can mean different things in the context of voluntary and compliance markets. For voluntary carbon markets, demand-side integrity relates to the behaviour of the carbon credit user. Four aspects of users' behaviour often feature in demand-side integrity frameworks for VCMs:⁹⁰

- What type of claim does the carbon credit support? (e.g. contribution⁹¹ or compensation claim)
- What action has the entity taken to address its direct GHG emissions? (e.g. how are direct GHG emissions quantified and what action is taken to reduce them?)
- How are carbon credits used to support the buyer's mitigation ambition and / or action? (e.g. complementary to, or in place of, direct mitigation efforts)
- Which type of carbon credits are used? (e.g. authorised or non-authorised mitigation outcomes)
- How transparent is the entity about their use of credits? (e.g. limited or more specific disclosures)

In compliance carbon markets, where entities can use carbon credits to meet a compliance obligation, credit users' behaviour is governed by the compliance scheme operator. Therefore demand-side integrity in compliance carbon markets depends more on decisions related to the scheme's design (Carvalho et al., 2021^[218]). Key questions related to demand-side integrity perspective in compliance markets are:

- Do carbon credit provisions affect the political acceptance and ambition level of the compliance instrument, and if so, how?
- What is the opportunity cost of directing potential compliance instrument revenue to carbon credits?
- What other policies could drive mitigation in the sectors designated to provide carbon credit supply?

Demand-side integrity in carbon credit markets has recently gained more attention, particularly the behaviour of corporate carbon credit users (Ecosystem Marketplace, 2021^[16]). This scrutiny has identified several potential demand-side integrity risks, including:

⁸⁹ Therefore, further research on supply-side integrity risks in governmental crediting mechanisms could be useful to inform effective mechanism design, as these are often linked to carbon pricing instruments.

⁹⁰ Such as the Voluntary Carbon Markets Integrity Initiative, Science Based Targets initiative, UN High-Level Expert Group on Net Zero, ISO Net Zero Guidelines, Race to Zero and more (Net Zero Tracker, 2023^[115]).

⁹¹ With a contribution claim, the buyer entity takes credit for contributing financially to mitigation efforts, rather than compensating their own emissions tonne-for-tonne (Fearneough et al., 2023^[37])

- **Misleading claims about the using entity’s climate performance, supported by carbon credits**

This can include claims like “carbon neutral” and “net zero”. Various national consumer protection bodies and international bodies have warned that such claims are often used in a misleading way, or require further substantiation (Trouwloon et al., 2023^[3]; Ahonen et al., 2023^[1]). In several cases, misleading claims have led carbon credit users to become subjects for lawsuits or penalties (Kaminski, 2023^[228]).

- **High or unknown reliance on carbon credits for net-zero targets⁹²**

At the end of 2023, around 3500 companies had set net-zero targets, but few disclose details about their potential use of carbon credits to balance residual emissions in the target year (Net Zero Tracker, 2024^[216]; MSCI Carbon Markets, 2024^[102]). The SBTi’s Net-Zero Standard sets out that an entity’s residual emissions in the net-zero target year should be around 10% of 2020 levels (depending on the sector) (SBTi, 2024^[229]). However, reviews of companies’ net-zero plans suggest that their expected residual emissions and reliance on carbon credits is often much larger (Noels and Jachnik, 2022^[114]; Day et al., 2023^[230]). The lack of transparency on how carbon credits support net-zero targets increases the risk of misleading communication.

- **Use of carbon credits with uncertain mitigation impact to compensate for direct emissions**

While some buyers are moving towards higher-quality carbon credits, there are still examples of entities who source carbon credits with known integrity concerns (Trencher, Blondeel and Asuka, 2023^[231]; White and Ratcliffe, 2022^[232]). Another concern is that carbon credits underpinned by time-limited and reversible storage of carbon in biomass are often used to compensate for the release of long-lived CO₂ emissions into the atmosphere (Filewod et al., 2023^[233]).

- **Limited transparency on the use of credits**

Where carbon credits support climate claims, it is often difficult for consumers and other stakeholders to obtain information on how carbon credits have been used (Trouwloon et al., 2023^[3]). Several registries allow for carbon credits to be retired without disclosing the retiring entity, and in cases where the retiring entity is known, there is often limited information on the purpose for retiring the credit (Gabbatiss, 2023^[103]). ICVCM’s Assessment Framework could lead to improved transparency on carbon credit use at the registry-level, but it remains unclear what information will be publicly accessible (ICVCM, 2023^[46]). There is a particular lack of transparency for renewable energy credits, for which over 80% of retirements are made anonymously (cCarbon, 2023^[234]). In some cases, entities provide information on their carbon credit use in corporate sustainability disclosures, but with limited specificity (Tuckman, 2023^[235]).

Demand-side integrity and supply-side integrity concerns are closely connected. If carbon credits are of high quality, this reduces the risk that demand-side claims are misleading (Filewod and McCarney, 2023^[236]).

Many concerns around demand-side integrity relate to the use of carbon credits to compensate for direct or future emissions. If carbon credits are used to compensate for direct emissions, this places additional importance on the accuracy of claims, and quality of underlying credits. Several stakeholders have also argued that compensation claims should be underpinned by carbon credits that have been subject to a corresponding adjustment (Box 3.1). To address potential concerns associated with compensation claims, stakeholders have proposed alternative models for carbon credit use (Fearneough et al., 2020^[27]). One alternative model is a “contribution claim”, where the buyer entity takes credit for contributing financially to mitigation efforts, rather than compensating for their own emissions (Fearneough et al., 2023^[37]). Another

⁹² While there are concerns around entities’ reliance on carbon credits in the net-zero target year (Noels and Jachnik, 2022^[114]), others have argued that there should be a clearer role for mitigation action beyond companies’ value chains (including through carbon credit use) on the pathway towards net zero (VCMI, 2023^[35]).

alternative is “discounting”, where the buyer entity purchases more than one carbon credit for every tonne of their own GHG emissions. The number of credits to retire depends on the level of supply-side integrity risk associated with the credit-generating activity and can be informed by an independent assessment of credit quality (Cross, 2023^[237]; Downey, 2023^[238]).

Beyond discussions around compensation claims, there is a more general debate about whether carbon credits complement or displace direct GHG mitigation efforts (Ecosystem Marketplace, 2023^[239]; Dufrasne and Faecks, 2023^[240]). On the one hand, carbon credits could be seen to displace direct mitigation, because of their relatively low prices, on average, compared to direct mitigation options (UK CCC, 2022^[110]). On the other hand, if an entity uses carbon credits to compensate for existing emissions, this means they assign a price on carbon in line with carbon credit prices. Such use of carbon credits is better than not addressing existing emissions at all (Trove Research, 2023^[241]). Recent assessments of companies’ progress to reduce GHG emissions suggests a correlation between companies that report reductions in their operational emissions and the use of carbon credits (Sylvera, 2023^[242]; Trove Research, 2023^[241]). This highlights that there is a large group of carbon credit users who use carbon credits as a complement to reductions in their Scope 1, 2 and 3 emissions. The causal relationship between carbon credits and direct mitigation efforts remains subject to further research (Dufrasne and Faecks, 2023^[240]).

There are both objective and subjective elements contained in the concept of demand-side integrity. The perceived demand-side integrity depends in part on several value judgements about the carbon credit user: What level of mitigation ambition is needed? Is progress on direct mitigation action sufficient compared to the use of carbon credits? Is the claim made accurate, and is there sufficient transparency on the carbon credits used? These questions can have conflicting answers in international frameworks, while national frameworks often provide answers with limited detail (Laine et al., 2023^[175]). In the absence of definitive guidance, the use of carbon credits is subject to contestation. Several corporates cite reputational risks as a reason for not buying carbon credits (WEF, 2023^[91]), so this lack of clarity on demand side integrity is impeding potential voluntary credit demand.

Market integrity risks

*Proposed definition of market integrity:*⁹³

There is a well-functioning market with sufficient governance and transparency for environmental integrity risks to be identified and minimised, and double counting to be avoided.

Market integrity has received less attention by integrity initiatives than supply-side and demand-side integrity. Nonetheless, well-functioning markets with sufficient governance and transparency are prerequisites for environmental integrity improvements (IOSCO, 2023^[142]). For example, strong governance frameworks are needed to avoid conflicts of interest, as well as to identify, prevent, and enforce against fraudulent activity. Moreover, transparency and effective signalling between supply and demand is required for carbon credit quality and prices to be effectively associated, which is needed to incentivise integrity improvements.

The relatively small size⁹⁴ of VCMs can lead to several issues related to their governance, transparency and functioning, and associated environmental integrity implications. Since markets are small, the cost to market operators of developing sophisticated market infrastructure often outweighs potential returns. This leads to limitations in carbon credit market structures and functioning. For domestic compliance markets

⁹³ All references to “market integrity” in this paper are made specifically in the context of environmental integrity in carbon credit markets. In most other contexts, market integrity refers to the degree to which markets operate in a fair and orderly way, with effective rules and enforcement (IOSCO, 2011^[298]).

⁹⁴ The value of transactions in VCMs averaged USD 2 billion per annum in 2021-22 (Ecosystem Marketplace, 2023^[4]).

that have existed several years, carbon credit trading tends to be under more mature systems for public administration and governance (PMR, 2021^[17]).

There is limited research on how market integrity influences environmental integrity in carbon credit markets. Multiple stakeholders have mapped market maturity challenges that prevent carbon credit markets from scaling further (McKinsey, 2021^[243]; TSVCM, 2021^[165]; Tjon Akon, 2023^[244]), or present vulnerabilities more broadly, including environmental integrity challenges (ISDA, 2021^[245]; IOSCO, 2023^[142]; Betz et al., 2022^[99]). This paper is primarily concerned with market integrity as a component of environmental integrity, so Table A.A.2 outlines selected challenges for market functioning that may have direct implications for the possibility of enhancing environmental integrity.

Table A.A.2. Potential implications of market functioning for environmental integrity

Challenges for market functioning	Description	Potential implications for environmental integrity
Limited data availability and accessibility	Project-level information: Information gaps exist in critical aspects ⁹⁵ for evaluating a project's environmental integrity. Intelligence providers independently assess environmental integrity, but they provide limited information free of charge. Market-level information: Over-the-counter trading dominates carbon credit markets, leading to limitations in pre-trade and post-trade information regarding carbon credit volumes and prices.	Project-level information: Lacking information on credit-generating activities could obscure potential environmental integrity concerns. Market-level information: Limited transparency on carbon credit market activity hinders price discovery and signalling between supply and demand. This weakens incentives for enhanced environmental integrity.
Lack of market participant expertise	Identifying high-integrity carbon credits may demand substantial expertise about their generation, trade, and potential environmental risks. Corporate buyers often face time constraints navigating market complexities.	Limited expertise among carbon credit buyers, coupled with information asymmetries between carbon credit buyers and sellers, raises the risk of sustained demand for low-quality credits.
Conflicts of interest	Issuance-level: Carbon crediting mechanisms derive a significant portion of their income from issued credits, and auditors of credit-generating activities are typically paid by project developers. Market-level: Market participants often have multiple roles - traders may have a proprietary interest in carbon credits; while market intelligence providers might simultaneously offer information on credit quality to buyers and receive payment from project developers for advice on improving credit ratings.	Issuance-level: Payment structures may discourage carbon crediting mechanisms from tightening methodologies, or encourage auditors to allow excessive issuances. Market-level: Conflicts of interest between intelligence providers and traders may undermine buyers' trust in market intelligence and hinder effective supply-demand signalling.
Lack of standardisation	The diversity of carbon credit supply complicates standardisation of carbon credit quality. In addition to quality standards, there is also a lack of standardisation in carbon credit attributes, documentation, contracts, and trading terms. Moreover, there is a lack of clarity on the legal and regulatory treatment of carbon credits.	Limited standardisation compounds information asymmetries in carbon credit markets. This could make it difficult for buyers to compare the quality of carbon credits, and for suppliers to gain recognition and attract demand for high-quality credits.
Fragmentation and limited interoperability of registries, trade and post-trade infrastructure	Carbon crediting mechanisms operate separate registries with limited compatibility. The Climate Action Data (CAD) Trust is working to consolidate registry information, but this effort is in early stages. Additionally, carbon market trade infrastructure is fragmented, with most trading happening over-the-counter (OTC).	Registry fragmentation could lead to errors like double counting. It also complicates the development of other data solutions that could support efficient supply-demand signalling. Fragmentation of trading infrastructure and liquidity pools could worsen other aspects of market functioning, including the lack of standardisation and oversight.
Limited market oversight	Oversight in carbon credit markets (particularly VCMs) is limited for several reasons, including limited data on market activity, limited resources for market surveillance as well as unclear roles and responsibilities for providing oversight. The ICVCM has been asked to ensure "strong governance" of participant eligibility, oversight and market functioning	Limited market oversight increases the risk of fraud and trading of carbon credits without genuine mitigation impacts. At the issuance-level, limited oversight of auditors' performance increases the risk of overstated carbon crediting levels.

⁹⁵ E.g. for avoided deforestation projects, information on project boundaries is often lacking (BeZero Carbon, 2023^[290]).

(ICVCM, 2022 ^[246]), but practical implications are uncertain. Financial market regulators usually oversee the secondary market for carbon credits, but oversight in the primary market (where most trading happens) is generally limited.
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Source: Summary of selected market maturity challenges outlined in (IOSCO, 2023^[142]; TSVCM, 2021^[165]; European Commission, 2022^[156]; Betz et al., 2022^[99]).

Carbon credit markets, particularly VCMs, face challenges related to transparency, standardisation, and governance issues that pose risks to environmental integrity. Many of these market challenges relate to information asymmetries (limited transparency, lack of standardisation, lack of market participant expertise), which in turn can inhibit to buyer confidence and carbon credit prices. In voluntary carbon markets, this situation resembles the market for lemons problem⁹⁶. Information asymmetries also exist in compliance credit markets, in part because of difficulties for auditors to interrogate the validity of information disclosed by project developers (Martins Barata, 2016^[193]). Governance and oversight are also prominent challenges for market functioning and environmental integrity in VCMs (IOSCO, 2023^[142]). While limited governance and oversight could increase environmental integrity risks, it has also allowed VCMs to operate with less red tape than CCMs. The relative simplicity and speed of VCMs has long been an important *raison d'être* for the market, as it can shorten lead times for credit-generating activities, reduce transaction costs and facilitate carbon credit investments and demand (Miltenberger, Jospe and Pittman, 2021^[247]).

Another key issue for market integrity is the avoidance of double counting. Double counting occurs if the same emission reduction or removal is counted more than once towards the achievement of mitigation targets or goals. Double counting can occur through double issuance, double use and double claiming.⁹⁷ A large part of the responsibility to avoid double counting sits on the supply side. Carbon crediting mechanisms can address many risks of double counting (notably double issuance) through registration procedures, registries and methodologies. However, several double counting risks also relate to the trading environment (i.e. market integrity) and credit users' behaviour (i.e. demand-side integrity).

Non-carbon impacts and integrity risks

Carbon credit markets can affect sustainable development objectives other than GHG mitigation (non-carbon impacts), on both the supply side and demand side. On the supply side, carbon credit markets provide a revenue source for many activities that significantly improve air quality, human health, access to energy, livelihoods, biodiversity protection, and climate adaptation (Hultman, Lou and Hutton, 2020^[248]; IPCC, 2022^[249]). However, other carbon credit-generating activities have limited co-benefits (e.g. HFC-23 destruction projects, direct air capture). In some cases, carbon credit-generating activities have caused environmental and social harm (Dunne and Quiroz, 2024^[250]). The net impact of carbon credit markets on

⁹⁶ The 'market for lemons' theory describes a situation whereby information asymmetries in a market can lead to adverse selection. If buyers cannot effectively distinguish high-quality goods ('peaches') from low-quality goods ('lemons'). This can create uncertainty and lower willingness-to-pay among buyers, and in turn a market that favours low-quality goods (Akerlof, 1970^[220]).

⁹⁷ Double issuance could happen if a mitigation activity registers with multiple standards, or if two mitigation activities indirectly overlap. Double use could happen if credits are duplicated in a registry, or if buyers use the same carbon credit for more than one target. Double claiming could happen if the impact of the credit-generating activity can also be counted towards, for example, a domestic mitigation target or scheme in the host jurisdiction (Schneider et al., 2022^[140]).

sustainable development also depend on the demand side, and counterfactual scenarios of what carbon credit buyers would have done in the absence of carbon credit markets.⁹⁸

Successful management of non-carbon integrity impacts depends on a number of factors, including (i) how these risks and impacts are assessed; (ii) how credit-generating activities are governed and revenues shared; (iii) how supply-side countries support the alignment of sustainable development and climate mitigation objectives; (iv) if buyers place importance on non-carbon integrity risks and social and environmental co-benefits (Holm Olsen and Arens, 2021^[251]).

Like with supply-side integrity, carbon crediting mechanisms play a central role for managing non-carbon integrity risks. Negative impacts are considered through environmental and social safeguard provisions, or by the requirements of projects to have “net positive impacts”.⁹⁹ Carbon crediting mechanisms vary considerably in their systems for avoiding negative environmental and social impacts of projects (CCQI, 2023^[50]). Provisions can include the identification, prevention, monitoring and validation of negative impacts, requirements to conduct stakeholder consultations, having grievance mechanisms and gender policies, specific safeguards for cultural heritage, labour rights physical and economic displacement, and more. In the case of Article 6, countries can agree their own provisions under Article 6.2, or use the Sustainable Development under the Paris Agreement Crediting Mechanism (which will be mandatory for PACM activities) (UNFCCC, 2023^[252]).

Furthermore, carbon credit buyers are increasingly interested in driving positive sustainable development impacts. Recent data suggest that carbon credits with third-party verified sustainable development co-benefits attract a 78% price premium compared to carbon credits without such benefits (Ecosystem Marketplace, 2023^[4]). Several carbon crediting mechanisms have developed their own tools to assess the SDG impacts of their projects, generally focusing on sustainable development benefits.¹⁰⁰

Most carbon credit market activities take place in developing countries and receive funds from buyers in developed countries - making equity an important consideration for the overall integrity of such markets. Currently, financial flows enabled through carbon credit markets are limited, but have the potential to generate revenues equivalent to several percentage points of GDP, e.g. for forest-rich developing nations (Yu et al., 2021^[207]; Piris-Cabezas, Lubowski and Leslie, 2023^[253]). If carbon trading was to reach such scale, there could be significant impacts for land use and ownership, and associated livelihoods for indigenous people and local communities (Böttcher et al., 2023^[254]). Carbon credits typically involve the transfer of the right to claim emissions reductions or removals, together with liabilities for project developers, and indirectly communities affected by the credit-generating activity (EY Law and Gold Standard, 2022^[255]; Streck, 2020^[256]).¹⁰¹ Considering the growing ‘land crunch’, with competing demands

⁹⁸ For example, if carbon credits with limited co-benefits are used to compensate for direct emissions and indirectly prolong the use of lignite-fired power production, such use of carbon credit markets is likely to cause net harm to other social and environmental goals (Kreibich et al., 2021^[219]). If carbon credits from clean cookstoves are used on a voluntary basis as a complement to direct mitigation efforts, such use of carbon credit markets is likely to provide substantial net benefits for sustainable development (Wissner et al., 2022^[299]).

⁹⁹ This is a requirement for projects to achieve the optional, complementary SD VISta and CCBS certifications, under the Verified Carbon Standard (Wissner and Schneider, 2022^[300]).

¹⁰⁰ For example, the demonstration of SDG impacts is a mandatory part of the project cycle under Gold Standard. Projects are required to demonstrate the contribution to a minimum of three SDGs. The Gold Standard also requires a structured assessment with comparison to a baseline scenario, third-party validation, and ex-post monitoring (Wissner and Schneider, 2022^[300]).

¹⁰¹ This is unlike results-based climate finance, through which countries provide payments for mitigation outcomes, without the transfer of a right to claim the emission reduction or removals (Böttcher et al., 2023^[254]). Results-based climate finance can still have lasting implications for local communities, such as measures to prevent potential reversals of mitigation outcomes (Granziera et al., 2022^[301]).

on land for resources, climate change mitigation and other uses (King et al., 2023^[257]), the management of land rights and equity will become increasingly important for the overall integrity of carbon credit markets.

Understanding the interplay between voluntary and compliance carbon markets

What are voluntary and compliance carbon markets?

Carbon credit markets consist of diverse sources of credit supply and centres for demand, driven by different motivations (see Figure A A.4). These markets can be categorised into compliance carbon markets (CCMs), where tradeable carbon credits are used to comply with an obligation or binding commitment, and voluntary carbon markets (VCMs), where such credits are used voluntarily. Compliance-motivated carbon credit demand can come from national commitments under the Paris Agreement, sectoral obligations (e.g. CORSIA), and compliance instruments (e.g. ETSs and carbon taxes). Voluntary carbon credit demand is driven by various actors, mostly companies,¹⁰² seeking to voluntarily contribute to GHG mitigation.

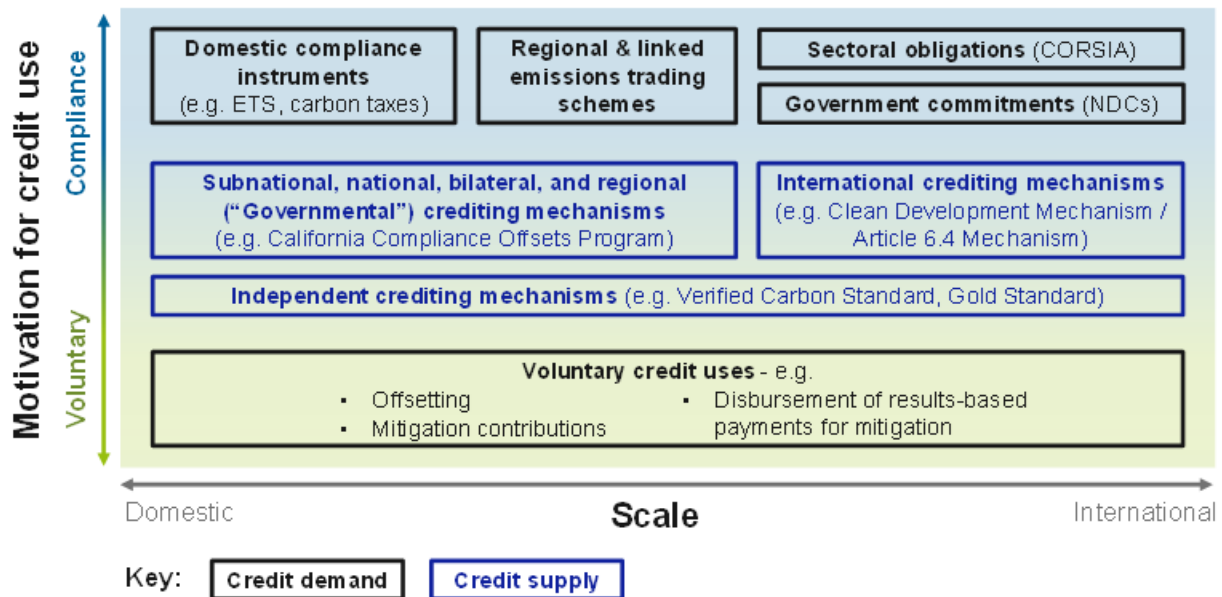
Carbon credit supply is generated by mitigation activities that issue credits under carbon crediting mechanisms. Such mechanisms could be established under, for example, international treaties and organisations (international crediting mechanisms), subnational, national and regional governments (governmental mechanisms) or by non-governmental organisations (independent crediting mechanisms). Historically, most supply has come from the international Clean Development Mechanism (CDM), but the largest crediting mechanism is now the independent Verified Carbon Standard (VCS), representing 42% of carbon credit issuances in 2018-2022 (OECD analysis).

Definitions of VCMs and CCMs vary,¹⁰³ and the categorisation of carbon credit use as "voluntary" or "compliance" is not always distinct with each category encompassing a diverse and fragmented set of markets. Carbon credit registries, intermediaries and trading venues for carbon credits often provide services catering both to voluntary and compliance-motivated buyers. Overall, this leads to partial overlaps between many VCMs and CCMs.

¹⁰² Other organisations, individuals and governments can also voluntarily purchase carbon credits, however, their aggregate demand is currently small in comparison to that of companies (Ecosystem Marketplace, 2021^[16]).

¹⁰³ See e.g. (Sullivan et al., 2021^[258]) (UK CCC, 2022^[110]) (World Bank, 2022^[266]) (CPLC, 2021^[305])

Figure A A.4. Typology of carbon credit supply and demand



Note: Carbon credit demand can be categorised as voluntary or compliance based on the motivation of use. Credit supply could serve both voluntary and compliance purposes, subject to eligibility.

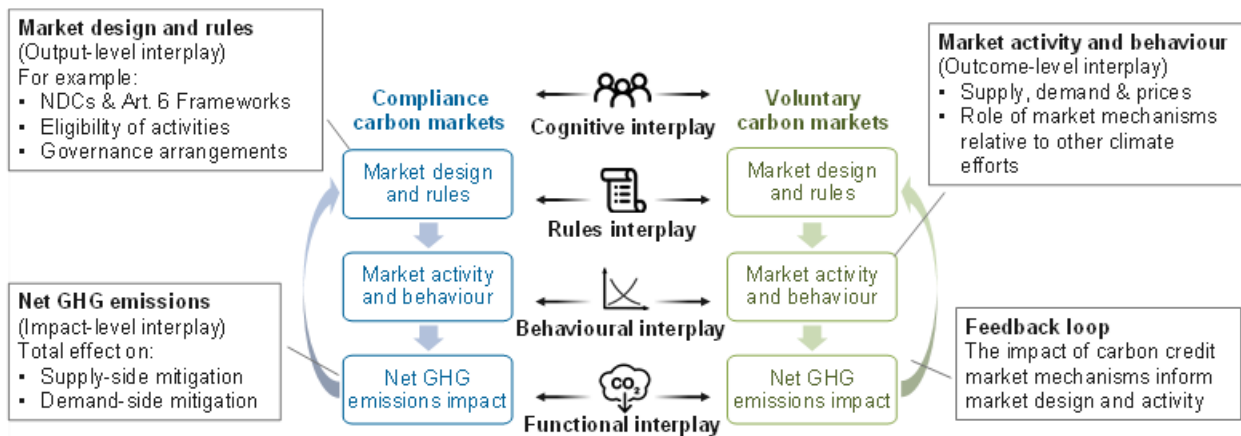
Source: Authors, adapted from (Sullivan et al., 2021^[258]).

How do voluntary and compliance carbon markets interact?

VCMs and CCMs have co-evolved and can interact on multiple levels. Figure A A.5 outlines a framework for how these markets exercise mutual influence (Gehring and Oberthür, 2009^[259]; Chen and Xie, 2023^[260]):

- **Cognitive interplay**
The stakeholder communities that constitute voluntary and compliance carbon markets overlap and exchange ideas.
- **Rules interplay**
Voluntary and compliance carbon markets take influence from each other with respect to how they are designed, including market infrastructure and rules relating to activity eligibility, methodologies, governance and more.
- **Behavioural interplay**
Interplay with respect to what market participants do to generate, trade, buy or use credits.
 - Behavioural interplay can be direct (decisions by CCM participants to generate, buy or use credits influence the market behaviour of VCM participants, or vice versa)
 - Behavioural interplay can also be indirect; mediated by market forces (actions by CCM participants affect credit prices, which in turn can influence the market behaviour of VCM participants, or vice versa).
- **Functional interplay**
Mitigation achieved by activity proponents and credit users in VCMs can affect the mitigation achieved through CCMs, and vice versa.

Figure A A.5. Conceptual framework for the interplay between voluntary and compliance carbon markets



Source: Authors' own illustration.

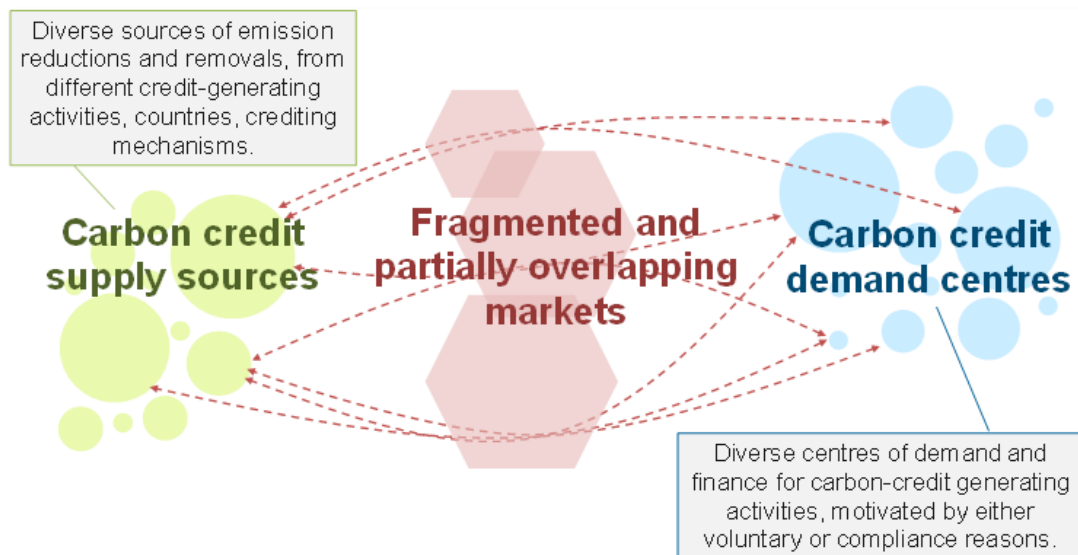
This paper focuses on two areas of carbon credit market interplay: rules interplay and behavioural interplay, as these are most relevant to government engagement for enhancing carbon market environmental integrity. VCMs and CCMs can influence each other with regards to their market design and rules. This includes rules for different markets' scope (such as the geographies where credit-generating activities take place), credit-generating activities (such as the eligibility of specific activity types) and environmental integrity provisions (such as additionality assessments). VCMs and CCMs can also interact with regards to their respective market activity and behaviour. This encompasses decisions relating to whether, and how, to generate, trade, buy or use credits. VCMs and CCMs also interact with regards to their market activity since they are more or less connected market segments for partially differentiated goods (carbon credits). The supply, demand, and prices of carbon credits in CCMs can affect the supply, demand and prices of carbon credits in VCMs, and vice versa.

There is a complex relationship between the carbon credit market design and rules on the one hand, and carbon credit market activity and behaviour on the other. The rules and design of carbon markets directly influence market activity. For example, when compliance instruments (e.g. CORSIA, Singapore carbon tax) grant eligibility to carbon credits from independent crediting mechanisms, this increases the overlaps and interplay between voluntary and compliance markets (GenZero and MSCI Carbon Markets, 2023^[59]). Market activity can also influence the rules and design. For example, large voluntary demand for certain carbon crediting activities (e.g. avoided deforestation projects) has allowed these activities to mature, and they are now increasingly becoming eligible for compliance uses (e.g. in Singapore, Colombia and Japan (Reklev, 2023^[261]; Greenfield, 2023^[262]). Furthermore, some countries (e.g. Chile, China) have co-opted carbon credit supply that was already present in the country, and made these eligible for compliance instruments (Ministry of the Environment, 2024^[81]).

Carbon credit market interplay is broad concept that is difficult to define. Interplay can happen both within and between VCMs and CCMs, as well as between carbon credit markets and other mitigation instruments. As such, there are reasons to question the usefulness of 'VCM-CCM interplay' as a concept for understanding carbon credit markets and their environmental integrity. First, carbon credit markets are generally fragmented, and there are many sub-markets with different characteristics within VCMs and CCMs (cCarbon, 2023^[234]). These sub-markets are sometimes more defined by geography and national policies (e.g. France's Label Bas Carbone and associated demand sources), than by whether the market is voluntary or compliance (Ministry of Ecological Transition, 2023^[263]). Second, markets can go from voluntary to compliance over time (e.g. Japan's GX League), but this transition may not materially change

the market's design and environmental integrity in other respects (ICAP, 2023^[264]). Third, some mechanisms with a large influence on rules and activity in carbon credit markets may not always meet the definition of a market. This includes bilateral voluntary co-operation under the Paris Agreement's Article 6.2 (Lo Re, 2022^[265]), or results-based financing mechanisms (World Bank, 2022^[266]), both of which could shape environmental integrity norms across VCMs and CCMs.

Figure A A.6. Model of carbon credit supply sources and demand centres



Source: Authors' own illustration.

A model for describing carbon credit market interplay more generally is presented in Figure A A.6. This model highlights that carbon credit markets consist of diverse sources of carbon credit supply (different activities, countries, crediting mechanisms), and a diverse range of demand centres (voluntary and compliance-motivated), with trading occurring in sometimes overlapping markets. Depending on the market segment, governments have varying degrees of influence, and may have varying levels of interest in addressing environmental integrity risks or enabling mitigation opportunities.

Implications of carbon credit market interplay for governments

- **Carbon credit markets are fragmented and interact to different extents.**

There is a large variation in environmental integrity provisions between market segments, both within and between VCMs and CCMs. This requires governments to take tailored policy approaches to enhance environmental integrity, recognising the specific market dynamics and integrity risks of each market segment, as well as how market segments interact.

- **Governments can influence carbon credit supply, demand and markets.**

While governments exercise more control over domestic compliance markets, they can also influence voluntary carbon markets. Since carbon credit markets interact and often span multiple jurisdictions, governments can usefully consider potential ripple effects of their efforts to enhance environmental integrity in specific market segments.

Annex B. Carbon credit market integrity initiatives

Table A B.1. Selected initiatives seeking to enhance environmental integrity in carbon credit markets

Name of initiative	Purpose and scope	Potential environmental integrity enhancements	Potential implications for interplay
Integrity Council for the Voluntary Carbon Markets (ICVCM)	<p>ICVCM is an independent governance body for the carbon crediting mechanisms. It does this by setting and enforcing threshold standards for supply-side integrity - the Core Carbon Principles (CCPs). The CCPs are: Effective governance; Tracking; Transparency; Robust independent third-party validation and verification; Additionality; Permanence; Robust quantification of emission reductions and removals; No double counting; Sustainable development benefits and safeguards; Contribution toward net zero transition.</p> <p>The CCPs are operationalised through an Assessment Framework (AF) - a comprehensive and sector-agnostic set of criteria that can be used to assess all carbon crediting mechanisms and methodology types (except jurisdictional REDD+, which will be subject to specific additionality and permanence provisions). The first CCP-labelled credits are expected in 2024.</p>	<p>The impact of ICVCM will depend on several factors, including market uptake, how the Assessment Framework is interpreted, potential premiums for CCP-labelled credits, and the speed at which ICVCM requirements are made more ambitious over time through "Continuous Improvement Work Programs". Overall, the ICVCM aims to enhance environmental integrity by:</p> <ul style="list-style-type: none"> - Improving carbon crediting mechanism-level governance and transparency; - Improving activity category-level quality; - Strengthening market oversight by auditing programmes, making spot checks and responding to complaints. <p>The 6 largest independent carbon credit registries have all signalled that they will seek to align with the CCPs (IETA, 2023^[47]). Furthermore, ICVCM has received official recognition by SBTi and VCMI as a framework for high-integrity credits (We Mean Business Coalition, 2023^[63]).</p>	<p>The implications for interplay have yet to be seen and depend on the degree to which countries refer to ICVCM for various compliance purposes. Governments could, for example:</p> <ul style="list-style-type: none"> - Use the ICVCM's CCP-label as one of several screening tools to determine which credits are eligible for a compliance instrument, or for the government's own use; - Align government-supported carbon credit supply with the CCPs to potentially attract additional demand from voluntary buyers. <p>It could take years until carbon credit supply from the Paris Agreement Crediting Mechanism scales, and in its absence ICVCM is one of few internationally applicable quality frameworks for carbon credit supply – whether for voluntary or compliance purposes.</p>
Voluntary Carbon Markets Integrity Initiative (VCMI)	<p>VCMI is a non-profit organisation which aims to drive net-zero aligned participation in voluntary carbon markets. It does this by developing a code for carbon credit-supported claims on the demand side, and support to developing countries with market access on the supply side.</p>	<p>Like ICVCM, the influence of VCMI on environmental integrity will depend on its uptake. The Claims Code aims to enhance demand-side integrity by:</p> <ul style="list-style-type: none"> - Providing a rulebook for how entities can use carbon credits as part of net zero commitments; - Providing guidance on how companies can 	<p>VCMI exclusively targets voluntary use of carbon credits, so its impact on the interplay between voluntary and compliance carbon markets is likely limited. If "Carbon Integrity" claims become a significant driver of carbon credit demand, VCMI's guidance on carbon credit quality could influence carbon credit supply and prices, which</p>

Name of initiative	Purpose and scope	Potential environmental integrity enhancements	Potential implications for interplay
	<p>On the demand side, the VCM Claims Code of Practice (Claims Code) is a rulebook on how entities can make use of carbon credits in line with the mitigation hierarchy, allowing them to make “Carbon Integrity” claims. The Claims Code requires entities to:</p> <ol style="list-style-type: none"> 1. Comply with foundational criteria (e.g. disclose their GHG emissions, set a net-zero target and implementation plan); 2. Demonstrate progress towards their near-term mitigation target and select a claim to make (Silver, Gold or Platinum); 3. Meet criteria for carbon credit use and quality; 4. Obtain third-party assurance. 	<p>communicate their use of those credits;</p> <ul style="list-style-type: none"> - Setting out a framework for third-party assurance of claims supported by carbon credits. <p>Furthermore, VCM states that the use of carbon credits for a “Carbon Integrity” claim should not be seen as offsetting, but rather “a contribution to both the company’s own climate goals and to global efforts to mitigate climate change”. While this is a move away from offsetting, VCM will also test a “Scope 3 Flexibility” claim in 2024, which could result in companies counting carbon credits towards their Scope 3 emissions.</p>	<p>could indirectly impact some compliance systems.</p> <p>Nonetheless, it could still have implications for governments. The VCM Claims Code and associated Monitoring, Reporting & Assurance (MRA) Framework provide a detailed framework for assessing whether the use of carbon credits is complementary to direct mitigation efforts. Some of these building blocks could inform potential government regulation of climate claims related to the use of carbon credits.</p>
<p>Science Based Targets initiative (SBTi) guidance on Beyond Value Chain Mitigation (BVCM)</p>	<p>SBTi is a non-profit organisation which defines best practice for and validates net-zero targets in line with climate science. Over 4,000 organisations have committed to setting emissions reduction targets through the SBTi.</p> <p>In February 2024, SBTi published two reports outlining how companies can support “Beyond Value Chain Mitigation” (BVCM), including through the use of carbon credits. BVCM is defined as “mitigation action or investments that fall outside a company’s value chain, including activities that avoid or reduce GHG emissions, or remove and store GHGs from the atmosphere”.</p> <p>SBTi’s BVCM Guidance sets out 4 steps:</p> <ol style="list-style-type: none"> 1. Set and work to deliver a net-zero target; 2. Establish a BVCM pledge; 3. Take action to deliver BVCM; 4. Report BVCM activities and outcomes. <p>The SBTi published the BVCM report as complementary guidance to its Net-Zero Standard, however, SBTi does not plan to validate BVCM claims.</p>	<p>SBTi’s guidance could enhance demand-side integrity by outlining ‘what good looks like’ for voluntary carbon credit use. SBTi’s Net-Zero Standard and BVCM Guidance aim to ensure that carbon credits are used as a complement to companies’ direct action to reduce their GHG emissions. As companies have been criticised for excessive reliance on the future use of carbon credits to achieve their net-zero targets (Day et al., 2023^[230]), SBTi’s guidance could help enhance the integrity of corporate climate commitments.</p> <p>Compared to VCM, SBTi places less emphasis on the use of carbon credits towards net-zero targets. The SBTi Net-Zero Standard requires companies to counterbalance any residual GHG emissions in the net-zero target year with permanent removal and storage of CO₂ from the atmosphere. The BVCM Guidance recommends that companies take responsibility for GHG emissions as they progress towards the net-zero target. Such BVCM action can include both carbon credits, but also other investments in mitigation action.</p>	<p>Like VCM, SBTi’s BVCM guidance targets voluntary use of carbon credits. It is likely to have a limited impact on compliance carbon markets.</p> <p>Still, governments could cross-reference SBTi’s BVCM guidance to encourage companies to use carbon credits alongside direct action to achieve a net-zero target.</p> <p>Potential future changes to the SBTi’s Net-Zero Standard could have large implications for carbon markets. In April 2024, the SBTi’s Board of Trustees indicated that they may revise the Net-Zero standard, potentially providing a clearer role for carbon credits. The intended revision would explore how ‘environmental attribute certificates’ (potentially including carbon credits) could support the mitigation of Scope 3 emissions, subject to guardrails and thresholds. If the Net-Zero Standard was to allow the use of carbon credits to towards Scope 3 emissions, this could lead to significant increases in carbon credit demand (MSCI Carbon Markets, 2023^[267]). This, in turn, could affect carbon credit prices across multiple market segments.</p>

Name of initiative	Purpose and scope	Potential environmental integrity enhancements	Potential implications for interplay
Climate Action Data Trust (CAD Trust)	<p>The CAD Trust is an independent entity, which links, aggregates and harmonises carbon credit registries' data in a meta-data layer infrastructure. This is done through an open-source and decentralised digital infrastructure that is publicly accessible in a user-friendly format.</p> <p>CAD Trust is less explicitly linked to environmental integrity than ICVCM, VCMI and SBTi. However, it is one of the most prominent initiatives targeting "market integrity" in carbon credit markets. Therefore, it is also presented in this table.</p> <p>CAD Trust seeks to improve market infrastructure in several ways, including by:</p> <ul style="list-style-type: none"> - Providing a common data taxonomy that enables reconciliation of data from different registries. - Providing visibility into corresponding adjustment procedures and the lifecycle of carbon credits from issuances to retirement. - Surfacing publicly available information on carbon credits and record status changes to provide information on how these are used. - Helping to operationalise processes under Article 6 of the Paris Agreement such as compliance reporting and registry data model development. 	<p>CAD Trust could support enhancements in market integrity by:</p> <ul style="list-style-type: none"> - Enhancing transparency on, and interoperability of, carbon credit registries; - Minimising human error and accounting risks (such as double counting) in fragmented carbon credit registries; - Facilitating the work of data services that reduce information asymmetries, such as auditing, due diligence, carbon credit ratings and more. <p>The impact of CAD Trust on market integrity will depend on a number of factors, including: the number of registries that connect to the meta-data layer infrastructure; the degree to which registries align with the common data taxonomy; the degree to which CAD Trust enables integration with an end-to-end digital ecosystem. So far, CAD Trust includes data from six (CDM Registry, Verra, EcoRegistry, BioCarbon Registry, Global Carbon Council and National Registry of Bhutan).</p>	<p>CAD Trust could have far-reaching impacts for the interplay between voluntary and compliance carbon credit markets, depending on how it evolves. For now, the registry primarily serves the function of improving transparency and providing a proof-of-concept for greater interoperability between carbon credit registries, and many large registries have yet to connect with the meta-data layer infrastructure.</p> <p>Over time, CAD Trust could potentially influence the design of market infrastructure and promote further integration of registries. If further registries connect and convergence towards the data taxonomy continues, further data infrastructure could be built to allow for registries to communicate not just with the meta-layer, but also with each other (TSVCM, 2021^[165]). If the registry infrastructure for voluntary and compliance carbon markets indeed becomes more integrated, it could lead to greater market overlaps.</p>

Source: ICVCM: (ICVCM, 2023^[268]; ICVCM, 2023^[46]; ICVCM, 2023^[34]; Merrill, 2023^[56]) | VCMI: (VCMI, 2023^[64]; VCMI, 2023^[116]; VCMI, 2023^[35]) | SBTi: (SBTi, 2024^[229]; SBTi, 2024^[269]; SBTi, 2024^[270]) | CAD Trust: (World Bank, 2024^[271]; CAD Trust, 2023^[94]).

Annex C. Description of data analysis on carbon credit supply

Data construction (2018-2022)

This paper presents statistics on carbon credit supply (issuances) for 2018-2022, which was aggregated, harmonised and analysed across multiple carbon credit registries. This analysis builds on data both from individual registries, as well as databases that aggregate carbon credit issuances across multiple registries. To produce a comprehensive dataset on carbon credit supply, data were collected directly from the registries of the Verified Carbon Standard, Gold Standard, American Carbon Registry and Climate Action Reserve, EcoRegistry and BioCarbon Registry. The data were harmonised and aggregated referring to methodologies developed by the Voluntary Registry Offsets Database (So, Haya and Elias, 2023^[272]). Data on international crediting mechanisms were collected from the CDM Registry (UNFCCC, 2023^[273]). Information on governmental crediting mechanisms were collected from the Carbon Pricing Dashboard (World Bank, 2023^[98]) and JCM database (JCM, 2023^[274]). In some cases, carbon credit-generating activities have transitioned from one carbon crediting mechanism to another, and this can cause carbon credit issuances to be recorded in more than one registry. Where such cases were easily identifiable, only the original issuance of carbon credits was included in the database, and attributed to the crediting mechanism where the first issuance was recorded. The data represent information available on 1 July 2023.

Data on carbon credit supply were assigned to a harmonised list of countries of origin, and categorised into governmental, international or independent crediting mechanisms (definitions in Annex D). Because governmental crediting mechanisms often rely on independent or international crediting mechanisms to varying degrees (PMR, 2021^[17]), defining 'governmental' crediting mechanisms required a case-by-case analysis of crediting mechanism design. In cases where the governmental rules and demand were likely to be a driver of activity registration and design, such carbon credit supply was categorised as 'governmental', even if this supply was issued via other mechanisms. For example, all ARB-eligible credits¹⁰⁴ issued via independent crediting mechanisms were categorised as governmental.

Data construction (longer time series)

The paper's Annex A also contains references to separate analyses of carbon credit supply including the years before 2018 and after 2022. These analyses used slightly different scopes and methodologies, partly because of data limitations for carbon credit issuances before 2018.

For example, Figure A A.1 refers to a data analysis commissioned by the OECD and performed by Öko-Institut. Figure A A.1 includes data from the seven largest carbon crediting mechanisms. This includes data on the Clean Development Mechanism (UNFCCC, 2023^[273]), Joint Implementation (UNEP CCC, 2023^[204]), ART TREES (ART TREES, 2023^[275]) as well as data from the Voluntary Registry Offsets

¹⁰⁴ Carbon credits that meet specific requirement in the Californian Compliance Offset Program, which is overseen California Air Resources Board (ARB).

Database (So, Haya and Elias, 2023^[272]) on Verified Carbon Standard, Gold Standard, American Carbon Registry and Climate Action Reserve. Data were then harmonised and activity categories assigned as per activity mappings by Öko-Institut. The analysis in Figure A A.1 used data as available on 8 May 2023.

Furthermore, Figure A A.2 required a different approach to the analysis for 2018-2022, considering data limitations for carbon credit issuances before 2018. For this diagram, data on five independent crediting mechanisms (American Carbon Registry, Climate Action Reserve, Gold Standard, Plan Vivo and Verified Carbon Standard) was collected from MSCI Carbon Markets (2024^[105]). This was complemented by international crediting mechanism data on the Clean Development Mechanism (UNEP-CCC, 2024^[38]) and Joint Implementation (UNFCCC, 2016^[205]). Finally, data on governmental crediting mechanisms were obtained from the Carbon Pricing Dashboard (World Bank, 2023^[98]). Data from the Carbon Pricing Dashboard only includes governmental crediting mechanism data from 2015 onwards. Any credits issued by governmental mechanisms (e.g., in California, China, and the UK) before 2015 are therefore not included in Figure A A.2. The analysis in Figure A A.2 used data as available on 8 January 2024.

Annex D. Glossary

Term	Use of the term in this paper	Reference / read further:
Additional / additionality	Emission reductions or removals from a mitigation activity are additional if the mitigation activity would not have taken place in the absence of the added incentive created by carbon credits.	(Schneider et al., 2022 ^[140])
Allowance markets / Permit markets	The predominant type of carbon market by emissions coverage and value, in which greenhouse gas emission allowances (permits) are traded in a market with a limit on total emissions. In allowance markets emissions are priced, unlike in carbon credit markets where emission reductions and removals are rewarded. Allowance markets can be connected to carbon credit markets, or exist in isolation. For example, the EU Emissions Trading System is a market exclusively for allowances, whereas the Western Climate Initiative includes trade in both allowances and carbon credits. Most allowance markets are compliance carbon markets, or voluntary pilot markets for a subsequent compliance system.	
Article 6.2	Article 6.2 provides a framework for bilateral co-operation under the Paris Agreement, through which Parties can co-operatively implement mitigation activities and transact Internationally Transferred Mitigation Outcomes (ITMOs). Such co-operation should be consistent with Article 6.2 guidance. Large parts of this guidance were agreed at COP26 (Decision 2/CMA.3) and COP27 (Decision 6/CMA.4), and further guidance is expected from future negotiations. Nonetheless, Article 6.2 gives participating countries considerable flexibility to design and execute co-operative approaches.	(UNDP & UNFCCC, 2023 ^[9])
Article 6.4 / Paris Agreement Crediting Mechanism	Article 6.4 provides a centralised mechanism for co-operation involving the transfer of mitigation outcomes, under the purview of the UNFCCC. The Paris Agreement Crediting Mechanism will effectively replace the Clean Development Mechanism (CDM) and has many similarities to the CDM, but is subject to several new requirements outlined in the Article 6.4 Rules, modalities and procedures (RMP) (Decision 3/CMA.3) as well as subsequent decisions by Parties (Decision 7/CMA.4) and the Article 6.4 Supervisory Body.	(UNDP & UNFCCC, 2023 ^[9])
Article 6.4 Supervisory Body (A6.4SB)	The Article 6.4 Supervisory Body is responsible for overseeing the Paris Agreement Crediting Mechanism and developing relevant procedures, and is accountable to the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA).	(Michaelowa et al., 2022 ^[276])
Authorisation / authorised	Under the Article 6.2 guidance (Decision 2/CMA.3) and 6.4 RMP (Decision 3/CMA.3), authorisation is applied to at least the following three elements: <ul style="list-style-type: none"> • The co-operative approach; • Entities participating in a co-operative approach under Article 6.2 or in a PACM activity. In this paper, authorisation is primarily discussed in the context of mitigation outcomes. • Mitigation outcomes for a use (i.e. towards the achievement of an NDC or towards other international mitigation purposes (OIMP)); The authorisation of a mitigation outcome towards a use turns this into an internationally transferred mitigation outcome (ITMO).	(Lo Re, Ellis and Greiner, 2022 ^[26])
Baselines	The emissions level against which emission reductions or removals of a mitigation activity are determined.	(Schneider et al., 2022 ^[140])
Beyond Value Chain Mitigation (BVCM)	Mitigation action or investments that fall outside a company's value chain, including activities that avoid or reduce GHG emissions, or remove and store GHGs from the atmosphere. Companies can deliver beyond value chain mitigation through a range of instruments including through the purchase and retirement of high-quality carbon credits and direct investments (e.g., equity, debt or project finance).	(SBTi, 2024 ^[269])
Carbon credit markets	Markets involving the trade in carbon credits, such as the California Compliance Offset Program. These markets reward reductions or removals in emissions, in contrast to allowance markets (e.g. EU ETS), where emissions are priced.	
Carbon crediting mechanisms / standards	A carbon crediting mechanism (also referred to as standard in this paper) creates a supply of tradable credits for each unit of verified emissions reduction or removal from a mitigation activity. These credits can be issued through domestic (collectively referring to subnational, national, regional or bilateral mechanisms), international, and independent mechanisms.	(PMR, 2021 ^[191])
Carbon credits	A tradeable intangible instrument that is issued by a carbon crediting mechanism, representing a	(ICVCM,

Term	Use of the term in this paper	Reference / read further:
	verified GHG emission reduction to, or removal from, the atmosphere equivalent to one metric tonne of carbon dioxide equivalent.	2023 ^[277])
Carbon markets	Markets involving trade in credits or allowances, each representing an amount of greenhouse gas emissions. Can refer to both carbon credit markets and emissions trading systems.	
Carbon pricing instruments	Carbon pricing instruments in this paper refers to climate policy instruments which directly put a price on greenhouse gas emissions by applying a price to a base that is directly proportional to emissions. This can include carbon taxes, ETs and carbon crediting mechanisms.	(OECD, 2022 ^[278])
Clean Development Mechanism	The Clean Development Mechanism (CDM), was defined under Article 12 of the Kyoto Protocol and allows countries and companies to acquire certified emission reduction (CER) credits, each equivalent to one tonne of CO ₂ , from emission-reduction projects in developing countries.	(UNFCCC, 2023 ^[279])
Compensate / compensation claim	A claim that an entity can make, that: <ul style="list-style-type: none"> • Is supported by investments in 'beyond value chain mitigation' (BVCM), for example through the use of carbon credits • Conveys to audiences that it delivered BVCM proportionate to a stated percentage of unabated value chain emissions; • Seeks to convey that the BVCM outcomes are counterbalancing those unabated value chain emissions; • Is based on the application of the tonne-for-tonne method to determine the nature and scale of the commitment to BVCM. 	(VCMI, 2023 ^[64])
Compliance carbon markets (CCMs)	In compliance carbon markets (CCMs), tradeable emissions units (such as carbon credits or emissions allowances) are used to comply with an obligation or binding commitment. These can be established by governments to set targets and enforce obligations for facilities or companies, or by international treaties to enforce sectoral obligations or obligations for Parties to the international treaty. CCMs include most allowance markets and some carbon credit markets.	
Compliance carbon pricing instruments	Any carbon pricing instrument that imposes some form of obligation on the regulated entity. This includes ETs, taxes and some carbon credit markets.	
Compliance demand	Demand for tradeable emissions units that is motivated by compliance with an obligation or binding commitment.	
Contribution claims	Claims made by entities who wish to take credit for contributing financially to mitigation efforts (for example by retiring carbon credits), rather than compensating for their direct emissions tonne-for-tonne.	(Fearneough et al., 2023 ^[37])
Corresponding adjustments	Corresponding adjustments is a double-entry bookkeeping system which ensures that internationally transferred mitigation outcomes (ITMOs) cannot be double counted (i.e. by both buyer and seller). This becomes a single-entry bookkeeping system in the case of mitigations authorised for use towards other international mitigation purposes – where the adjustment is only done by the seller country.	(Lo Re, Ellis and Greiner, 2022 ^[26])
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a market-based greenhouse gas mitigation measure for international aviation, established by the International Civil Aviation Organisation (ICAO). This involves the compliance use of carbon credits towards the aviation industry's sectoral obligation to reduce emissions.	(ICAO, 2024 ^[18])
Crediting levels	The quantity of credits generated by a specific activity compared to the calculated emission reductions or removals actually achieved.	(Lo Re et al., 2019 ^[224])
Demand-side integrity	Environmental integrity considerations that relate to buyers' decisions and behaviours in relation to the purchase, retirement, use, communication, and disclosure in relation to carbon credits.	
Double counting / double counted	A situation in which a single greenhouse gas emission reduction or removal is counted more than once towards achieving mitigation targets or goals. Double counting can occur in several ways, through double issuance, double use and double claiming. <p>Double issuance is a situation in which more than one carbon credit is issued for the same emission reduction or removal. Double issuance leads to double counting if more than one of these carbon credits is counted towards achieving mitigation targets or goals.</p> <p>Double use is a situation in which the same carbon credit is counted twice towards achieving mitigation targets or goals (e.g., if two entities claim emission reductions or removals from the cancellation of one carbon credit).</p> <p>Double claiming is a situation in which the same emission reduction or removal is claimed by two different entities towards achieving mitigation targets or goals.</p>	(Schneider et al., 2022 ^[140])
Emissions trading systems	ETs (also called cap-and-trade systems) are a type of carbon market which works by placing a quantitative limit (a cap) on the amount of GHG emissions in one or more sectors of the economy, while allowing for the trade in allowances (or permits) representing each unit of emissions.	(PMR, 2021 ^[191])

Term	Use of the term in this paper	Reference / read further:
Environmental integrity	A commonly used definition for this is: <i>Environmental integrity would be ensured if the engagement in the transfer of carbon credits leads to aggregate global GHG emissions that are not higher than if such transfers had not taken place.</i> However, this paper also considers environmental integrity aspects beyond this definition, such as whether carbon credit markets support mitigation in line with net-zero pathways and interact effectively with other policy instruments for climate mitigation.	(Schneider and La Hoz Theuer, 2019 ^[7])
Environmental integrity provisions	Measures to ensure carbon credit markets operate with environmental integrity, such as standards, rules and governance arrangements which aim to eliminate and address integrity risks.	
EU Emissions Trading System	The EU Emissions Trading System is an allowance market which works on the “cap and trade” principle and covers around 40% of the EU’s greenhouse gas emissions.	(European Commission, 2023 ^[280])
Governmental crediting mechanisms / standards	A crediting mechanism that is administered by one or more governments. Collectively refers to subnational (e.g. California Compliance Offset Program), national (e.g. Canada’s GHG Offset Credit System), regional (e.g. Indo-Pacific Carbon Offsets Scheme) or bilateral (e.g. Joint Crediting Mechanism) carbon crediting mechanisms.	(World Bank, 2023 ^[5])
Independent crediting mechanisms / standards	A carbon crediting mechanism that is administered by a non-governmental organisation (e.g. Gold Standard or VCS). Currently, the supply from independent crediting mechanisms is primarily used for voluntary purposes, although some compliance schemes grant eligibility to selected independent crediting mechanisms.	
Indirect linking of carbon pricing instruments	Carbon pricing instruments can be indirectly linked when multiple carbon pricing instruments allow part of the emission reductions to be achieved outside the instrument’s boundary, for example through a common crediting mechanism.	(Dellink et al., 2014 ^[281])
International crediting mechanisms / standards	A carbon crediting mechanism that is administered by an international organisation that is established with authority of national governments, such as UN agencies or the World Bank.	(World Bank, 2023 ^[5])
Internationally transferred mitigation outcomes (ITMOs)	ITMOs are a type of units of greenhouse gas emission reduction or removal which can be transferred under the Paris Agreement’s Article 6. They represent real, additional and verified mitigation outcomes that have been authorised for use towards an NDC or other international mitigation purposes.	Full definition: Paragraph 1 of the Annex I of Decision 2/CMA.3 (UNFCCC, 2021 ^[8])
Interplay	The overlaps and mutual influence that different carbon markets can have on each other – described in Annex A.	
Issue / issuance (of credits)	A carbon credit is issued when it is published to a carbon crediting mechanism’s registry, with a unique serial number, following the verification of greenhouse gas emissions reductions or removals by a credit-generating activity. Carbon credits can be sold, traded, retired, and canceled after they have been issued. Volumes of carbon credit supply are therefore usually measured in issuances.	(Streck, Dyck and Trouwloon, 2021 ^[282])
Leakage	The net change of greenhouse gas emissions or removals that are attributable to the mitigation activity but occur outside the boundary of that activity. These include, for example, indirect emission changes upstream or downstream of the mitigation activity or rebound effects	(Schneider et al., 2022 ^[140])
Market fragmentation	Market fragmentation refers to a situation in which there are multiple market centres, through which similar assets are bought and sold. In the case of carbon credit markets, this can refer to the fragmentation of carbon credits across trading venues, standards, jurisdictions and more.	(IOSCO, 2001 ^[283])
Market integrity	Environmental integrity considerations that relate to the structure and functioning of carbon credit markets, and to what extent these market conditions create a favourable environment for carbon credit markets to operate with environmental integrity.	
Methodologies	Documents established by a carbon crediting mechanism to quantify a project’s net emission reductions or removals. These documents are often named by carbon crediting mechanisms as baseline and monitoring methodologies, tools, protocols, or methodological guidelines	(Schneider et al., 2022 ^[140])
Mitigation outcome	In this paper, mitigation outcome is used as a common term for greenhouse gas emission reduction and removal.	
MRV systems	The system for monitoring the emissions of a credit-generating activity, reporting these to an accredited third party and ultimately verifying mitigation outcomes.	(Streck, Dyck and Trouwloon, 2021 ^[282])
Multilaterally agreed	Agreements reached through an international treaty (e.g. UNFCCC) or international organisation (e.g. ICAO).	
Net climate benefits	Net climate benefits in this paper focuses on mitigation, and refers to the sum of actions that cause climate harm (increase greenhouse gas emissions) and climate benefits (reduce or remove	

Term	Use of the term in this paper	Reference / read further:
	greenhouse gas emissions).	
Offset / offsetting	The act of compensating or cancelling out all, or a portion of, the GHG emissions released to the atmosphere through investments in activities that reduce or remove an equivalent amount of GHG emissions, and which are located outside the boundaries of the organisation or a particular product system. Such investments are often in the form of purchasing a carbon credit. Offsetting is done by purchasing and retiring an amount of carbon credits equivalent to the volume of GHG emissions that is being compensated.	(VCMI, 2021 ^[284])
Other international mitigation purposes (OIMP)	OIMP include “international mitigation purposes other than achievement of an NDC” and “other purposes as determined by the first transferring participating Party” (Decision 2/CMA.3, paragraph 1(f)). In practice, OIMP can include the use of ITMOs by private entities covered by the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA), or covered by other compliance or voluntary emission mitigation targets; or the domestic use of ITMOs by Parties under specific circumstances. Only seller countries must apply corresponding adjustments to mitigation outcomes authorised for OIMP.	(Lo Re, Ellis and Greiner, 2022 ^[285])
Paris Agreement's Article 6	Article 6 of the Paris Agreement recognizes that some Parties choose to pursue voluntary cooperation in the implementation of their nationally determined contributions, including through market-based approaches. Article 6 outlines different approaches for countries to co-operate in Articles 6.2, 6.4 and 6.8.	(Hamrick and Granziera, 2023 ^[285])
Permanent	Emission reductions or removals that have a climate effect lasting permanently, with a minimal risk of reversal. Many carbon removal activities that generate carbon credits rely on temporary (non-permanent) storage of carbon, with varying durations of storage and risks of reversal. Reversal risks can be managed and compensated with various measures to address non-permanence. Therefore, in practice, permanence is usually ensured through administrative and accounting procedures that can increase the likelihood that activities with non-permanent storage of carbon results in equivalent climate outcomes to activities with permanent storage. Cf. Non-permanence: A situation wherein the emission reductions or removals generated by a mitigation activity are later reversed, for example, due to a natural disaster, project mismanagement or changes in local conditions that make carbon storage no longer viable.	
Plurilaterally agreed	Agreements reached by ‘clubs’ of three or more countries, representing a subset of the countries that otherwise agree provisions through international organisations or treaties. For example, the G7 or the signatories of the Call to Action for Paris Aligned Carbon Markets.	
Polluter-pays carbon pricing instruments	A carbon pricing instrument which entails disincentivising greenhouse gas (GHG) emissions, usually in the form of a carbon tax or emissions trading system.	(Errendal, Ellis and Jeudy-Hugo, 2023 ^[286])
Registry	Registries allow the transfer of credits between accounts and the tracking of issuances and transfers. Certified greenhouse gas (GHG) emission reductions and removals are converted into carbon credits when they are issued in the GHG registry of the certifying carbon standard.	(Streck, Dyck and Trouwloon, 2021 ^[287])
Removals with long-term storage	Mitigation activities that remove carbon dioxide directly from the atmosphere and store this permanently, with very low risk of re-release into the atmosphere, such as direct air carbon capture and storage (DACCS) or bioenergy with carbon capture and storage (BECCS).	(Allen et al., 2020 ^[198])
Retirement (of carbon credits)	The permanent removal of a carbon credit in a registry for the purpose of claiming the associated emission reductions or removals towards compliance requirements or voluntary goals. Only one single use should be associated with each retirement and the use should be clearly specified.	(ICVCM, 2023 ^[277])
Scaled-up crediting approaches	The issuance of carbon credits against mitigation outcomes generated on a jurisdictional or sectoral level, or in relation to the implementation of a larger programme or policy.	
Sectoral obligations	An obligation to reduce or remove emissions that is imposed on the sectoral level (e.g. CORSA).	
Self-regulatory initiatives	Groups of firms in a particular industry or entire industry sectors that agree to act in prescribed ways, according to a set of rules or principles. These initiatives can also include actors outside the industry, such as NGOs and intelligence providers. In this paper, this term refers to integrity initiatives like ICVCM and VCMI.	(OECD, 2015 ^[288])
Seller country	The country from which a carbon credit is generated or sold, either for voluntary or compliance carbon markets. In this paper, seller country could refer to a first transferring Party under Article 6.2, a host Party under PACM, or the jurisdiction in which a carbon credit is generated outside the Article 6 framework.	
Supply-side integrity	Environmental integrity considerations that relate to the generation of carbon credits, to ensure that each credit represents at least one tonne of carbon dioxide equivalent (1 t CO ₂ -eq) additional and permanent emission reductions or removals that are not double counted.	
Use (of carbon credits)	In this paper, the use of a carbon credit refers to the act of retiring the credit, as well as any other action (such as complying with an obligation or making a climate claim) that is taken in conjunction.	

Term	Use of the term in this paper	Reference / read further:
Voluntary carbon markets (VCMs)	In voluntary carbon markets (VCMs), tradeable emissions are traded and used voluntarily, in the absence of an obligation or binding commitment. While this can include the use of allowances from emissions trading systems, it is most common that VCM refers to carbon credit markets.	
Voluntary demand	Demand for tradeable emissions units (mostly carbon credits) that is voluntary.	