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DEBT-FOR-CARBON (D4C) SWAPS: KEY DESIGN CONSIDERATIONS



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Executive Summary

Debt-for-Carbon (D4C) swaps are a novel climate policy instrument which combines international carbon market transactions with debt treatment. In a D4C swap, a country reduces its sovereign debt burden by making carbon credits available to a creditor either as a means of debt payment or a performance metric linked to financing conditions. In this paper, we discuss key design elements of a D4C swap and distinguish this instrument from debt restructuring. We develop and provide illustrative examples of two principal design options. Under Option 1, carbon credits serve as a means of payment that satisfies all or part of a debt obligation. In effect, the country settles part of what it owes by delivering credits instead of cash, which reduces pressure on foreign exchange reserves. Under Option 2, a debt swap creates fiscal space that finances mitigation programs capable of generating carbon credits over time. Here, the debt is refinanced or reprofiled on more favorable terms, and the resulting savings fund a mitigation program, with carbon credits being generated in the future as mitigation is achieved and serving as a performance metric.

These two options entail different governance, risk allocation, timing and accounting implications. We discuss the sequence of design choices for a D4C swap. The first one relates to the transaction perimeter which is determined by the debt situation of the host country, the type of debt considered and the identity and mandates of creditors. Secondly, one needs to define the policy objective of the D4C swap that can range between short term fiscal relief and financing of mitigation in the long term. Third, the host country needs to define whether carbon credits serve as current or future assets or indicators of achieved mitigation, whether they are kept in the host country or transferred internationally, and what carbon crediting program shall be used. Regarding the latter, differences in integrity and credit prices are significant. An important question is how carbon credit ownership is addressed in the context of benefit sharing among various stakeholders. Fourth, structuring the debt treatment can involve accepting carbon credits as an immediate in-kind payment for debt (Option 1), whereas under Option 2 debt relief is accruing over time. Fifth, structuring the carbon credit-component of the D4C swap requires defining where credits are coming from, and how credit accruals are linked to changes in the debt status. The sixth step involves defining credit transfer, settlement and registry arrangements. The seventh step allocates risks, related to carbon credit delivery, credit price and policy implementation. The last and eighth step defines the accounting and incentive framework, including whether the transaction is reported as climate finance. Indicative contractual provisions for each of the two options are provided in an Annex.

D4C swaps are no substitute for deeper debt restructuring given the scale of debt that far exceeds the volume of international carbon markets. They are best suited for countries not deeply mired in debt and institutionally able to manage such transactions. The two forms of D4C swaps described in this document could harness the carbon markets where they are attractive; they could thus outpace the debt-for-climate swaps much discussed in the past but rarely applied in practice.

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List of Abbreviations

AFD	Agence française de développement (French Development Agency)
ART/TREES	Architecture for REDD+ Transactions / The REDD+ Environmental Excellence Standard
CACs	Collective action clauses
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
D4C	Debt-for-Carbon
DAC	Development Assistance Committee (OECD)
DNA	Designated National Authority
DSA	Debt Sustainability Analysis
ECA	Export credit agency
G20	Group of Twenty
GCF	Green Climate Fund
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ITMOs	Internationally Transferred Mitigation Outcomes
KfW	Kreditanstalt für Wiederaufbau (German state-owned development bank)
MADD	Mitigation activity design document
MAIN	Mitigation activity idea note
MCUs	Mitigation contribution units
MDBs	Multilateral development banks
MRV	Measurement, reporting and verification
NDCs	Nationally determined contributions
NFTF	National Forest Transition Fund
NPV	Net present value
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
PACM	Paris Agreement Crediting Mechanism
PDD	Project design document
REDD+	Reducing emissions from deforestation and forest degradation, plus conservation, sustainable management of forests and enhancement of forest carbon stocks
SECO	State Secretariat for Economic Affairs (Switzerland)
tCO_2e	Tonnes of carbon dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar

1. The case for Debt-for-Carbon (D4C) swaps

1.1. The debt–climate constraint

A growing number of developing and emerging economies face a structural tension between debt sustainability and climate change mitigation and adaptation investment. Climate change impacts are already affecting growth, fiscal balances, and external accounts, while high debt burdens constrain the ability of governments to respond to climate change through public investment. This interaction has been widely documented in both policy and academic literature (World Bank, 2024; ActionAid, 2023; IPCC, 2022).

At the same time, international climate finance flows remain insufficient relative to needs, and access to concessional resources is limited and uneven (Abraham *et al.*, 2026). Recently, international public climate finance has started to be reduced due to budgetary pressures in many countries linked to the "multicrisis" that has emerged since the COVID-19 pandemic. As a result, many countries face an increasing trade-off between servicing external debt and financing climate action. This thus becomes a structural constraint, particularly for countries already in or at risk of debt distress (Misereor and Erlassjahr.de, 2024).

Debt-for-climate swaps have been proposed as one way to address this constraint by linking debt treatment to climate change mitigation and adaptation-related expenditures. Analytical work by the International Monetary Fund and others (Chamon et al., 2022; Georgieva et al., 2022) has shown that such instruments can create fiscal space and align financial flows with climate policy objectives. However, experience to date suggests that their impact has remained limited (Darouich et al., 2023).

1.2. Limits of existing debt-for-climate swap approaches

Existing debt-for-climate and debt-for-nature swaps have demonstrated that it is possible to link sovereign debt operations with environmental outcomes. Transactions such as the Belize Blue Bond and recent conservation-oriented debt conversions supported by The Nature Conservancy illustrate this potential (Desai, 2023; Jiang and, 2024; The Nature Conservancy, 2024). At the same time, several limitations have constrained their scalability.

First, most transactions have remained relatively small compared to overall debt stocks, limiting their macroeconomic relevance (Chamon et al., 2022). Second, they are often complex and time-consuming to negotiate, particularly when multiple creditors are involved (Volz et al., 2020). Third, the link between financial relief and climate change mitigation and adaptation outcomes is typically indirect, relying on expenditure commitments or policy actions rather than measurable results (Darouich et al., 2023). Finally, other forms of debt treatment, like refinancing through Eurobonds with no conditionality or debt swaps focused on development, health or education, are competing

with debt-for-climate swaps (Diwan and Devie, 2025). Civil-society actors have responded to these shortcomings by proposing high-integrity principles for debt swaps, emphasizing transparency, debt sustainability, and social and environmental safeguards (Iturralde et al., 2024).

A further and more basic constraint concerns the volume of debt that is actually available for swaps. Bilateral debt swaps depend on the participation of creditors with an explicit development or climate mandate, which hold only a relatively small share of developing-country debt, and dedicated bilateral facilities have frequently gone underused for lack of eligible claims. Germany's debt-swap facility, for example, allows up to EUR 150 million of repayments to be waived each year but has in recent years not come close to being fully used (Stutz, 2022). This suggests that D4C swaps may at best be a complementary, case-specific instrument rather than a systemic response to the debt–climate challenge.

Earlier attempts to connect carbon markets and debt operations highlight both the potential and the challenges of integrating market-based instruments into sovereign debt swaps. For instance, a windfarm project in Uruguay in the early 2000s, financed through a debt-for-efficiency swap and linked to the Clean Development Mechanism (CDM), demonstrated that debt swaps can be a source of project finance for carbon crediting programs. However, the project remained a small-scale example and was not replicated or scaled up (Cassimon et al., 2014). These experiences suggest that the absence of standardized, verifiable performance metrics has been a key constraint (Warland and Michaelowa, 2015).

Taken together, these limitations indicate that while debt-for-climate swaps can be useful instruments, they have not yet evolved into scalable mechanisms capable of addressing the broader debt–climate challenge.

1.3. Carbon credits as a relevant incentive in debt-for-climate swaps

The integration of carbon credits into debt operations through debt-for-carbon (D4C) swaps introduces a new linkage between finance and climate policy outcomes. Carbon credits – whether generated under Article 6 of the Paris Agreement or through voluntary carbon market programs – represent quantified and independently verified mitigation outcomes. They are supported by established systems for measurement, reporting, and verification (MRV), as well as registries that track issuance and transfer (UNFCCC, 2024a; UNFCCC, 2024b). This provides a level of standardization and transparency that is generally absent from many existing debt swaps.

Importantly, carbon credits can play multiple roles within the financial structure of a debt swap. They may function as a tradable asset, as a performance metric linked to financing conditions, or as a future revenue stream. At the same time, integrating carbon markets into sovereign debt swaps introduces new complexities. These include the valuation of credits, their interaction with nationally determined contributions (NDCs), and the legal treatment of non-cash repayment. Analytical work

has begun to explore these issues, but practical experience remains limited (GCF, 2024b; Sharma, 2025; Lee and Choi, 2024).

The approach outlined in this document is aligned with the conclusions of the *Financing for Sustainable Development Report 2026* (United Nations, 2026). The report highlights the growing need to link debt sustainability, climate investment, and risk-sharing mechanisms within a more fragmented and constrained global financial system and explicitly recognizes the increasing role of innovative instruments such as debt swaps and state-contingent debt. In this context, D4C swaps can be understood not as isolated instruments, but as part of a broader shift toward linking debt treatment to measurable development and climate change mitigation and adaptation outcomes.

1.4. How D4C swaps differ from other debt–climate instruments

The discussion paper *Debt-for-Carbon: Using Carbon Credits for Debt Relief* (Shishlov et al., 2026) identified two distinct options for D4C swaps:

- **Option 1: Carbon credits as payment**: Transfer of carbon credits to satisfy all or part of a debt obligation.
- **Option 2: Debt swap finances a carbon credit generation program**: Use of fiscal savings from debt swap for the financing of a mitigation program capable of generating carbon credits over time.

Because D4C swaps are located at the intersection of sovereign-debt practice and carbon market approaches, they can be easily confused with the specific instruments in these two fields. Two distinctions are thus discussed below in detail: the difference between a debt swap and a debt restructuring, and the perimeter that specifies a D4C swap.

Debt swap versus debt restructuring

Debt swaps and debt restructurings are distinct operations with different triggers, governance regimes and climate policy implications. Conflating them is a common source of confusion in the D4C swap discussion. The table below summarizes the core differences, drawing on IMF and Paris Club practice (IMF, 2024; IMF and World Bank, 2024; Paris Club and G20, 2020; Paris Club, n.d.).

Table 1. Key differences between debt swaps and debt restructuring

Dimension	Bilateral debt swap (incl. D4C)	Commercial debt swap (incl. D4C)	Debt restructuring
Purpose	Voluntary re-purposing of specific debt claims to support	Refinancing/buyback of commercial debt on cheaper terms, savings finance climate change	Resolve unsustainable debt burden; restore solvency or liquidity.

Dimension	Bilateral debt swap (incl. D4C)	Commercial debt swap (incl. D4C)	Debt restructuring
	climate/development outcomes.	mitigation, adaptation or nature protection projects.	
Trigger	Policy decision by debtor and specific creditor(s); no debt-distress requirement.	Policy decision by debtor, typically when targeted bonds trade at a discount, no debt-distress requirement.	Actual or imminent debt distress; often after IMF Debt Sustainability Analysis (DSA) concludes debt is unsustainable.
Governance	Bilateral or small-group agreement; outside comparability-of-treatment requirements.	Market transaction; new loan or bond supported through development finance institution (DFI)/MDB guarantee or political risk insurance; trust fund typically manages use of savings.	Multilateral: Paris Club Agreed Minutes; G20 Common Framework; bondholder mechanics – collective action clauses (CACs).
Creditor participation	Limited to creditors choosing to participate; others unaffected.	Bondholders can choose to sell/buy country debt, are not involved in negotiation of climate change mitigation/adaptation commitments.	All external creditors expected to deliver comparable treatment.
Treatment of principal	Specific claims modified (cancellation, reprofiling, rate reduction) in exchange for climate commitment.	Debt bought back below face value using cheaper, longer-term new debt; the resulting debt reduction is usually small.	Haircuts, maturity extension and/or coupon reduction across the perimeter; calibrated to restore DSA.
Climate change mitigation/ adaptation relevance	Central by design – swap is structured around a climate-change mitigation/adaptation target .	Central by design, mitigation/adaptation is to be achieved by specific expenditure commitments or policy milestones rather than specified in the debt terms themselves.	Incidental – climate change mitigation/adaptation outcomes only if explicitly integrated (rare).

The appropriate scope of a D4C swap

A D4C swap is limited to an agreement with a bilateral creditor or the buyback of commercial debt involving carbon credits and is therefore not a general debt-restructuring framework. D4C swaps can be applied in countries with manageable debt situations. For countries whose debt is

unsustainable, comprehensive restructuring under the G20 Common Framework is preferable to a debt swap (IMF, 2024).

The concept of D4C swaps does not require the invention of new legal primitives. It can be implemented through amendments to existing debt instruments and recognized carbon market procedures, drawing on precedents such as the French development agency's *Contrats de Désendettement et de Développement* and earlier CDM-linked operations (Cassimon, Prowse and Essers, 2014).

D4C swaps do not need a bespoke approach to defining the integrity of carbon credits. Credit quality, determined by additionality requirements, eligible baseline and monitoring methodologies and verification requirements continue to be governed by the chosen crediting framework (Article 6.2, 6.4 or a voluntary program). D4C swaps do not automatically generate international public climate finance in the sense of the UNFCCC reporting frameworks. Whether and how a D4C transaction contributes to international public climate finance depends on design choices discussed in this document.

1.5. Our approach

This document builds on previous work on D4C swaps undertaken by Perspectives (Shishlov et al., 2026, Weber et al., 2024; Darouich et al., 2023). It focuses on how D4C transactions can be designed and implemented in practice. Specifically, we will:

- describe how a D4C transaction can be structured, step by step,
- identify the key design choices that determine feasibility and impact, and
- illustrate how different D4C swap configurations may be applied in specific contexts.

The intention is to support policymakers, creditors, and practitioners in moving from high-level ideas to concrete transaction structures, while making explicit the trade-offs and constraints involved.

2. Designing a Debt-for-Carbon swap

The following section outlines core design choices that underpin a D4C swap. These decisions must ultimately converge into a legally and financially coherent transaction structure. In practice, transaction development requires iterative refinement, including testing whether proposed structures remain consistent with creditor requirements, debt sustainability frameworks, and the operational realities of carbon markets in each country. The specific structure therefore depends on the context of the debtor country and must be designed on a case-by-case basis.

2.1. Establishing the transaction perimeter

Before defining financial terms or eligible carbon credits, a D4C swap must be situated within a clearly defined transaction perimeter, i.e., determining what type of sovereign debt swap is being undertaken, which debt instruments are covered, and which creditors should be involved. These choices shape the feasibility and complexity of the transaction.

The first question concerns the **debt situation** of the debtor country. Is the fiscal situation stable enough to make a standalone debt swap a suitable tool for mobilizing finance for climate change mitigation or adaptation projects? As discussed above, if the debtor country's debt is unsustainable, comprehensive debt restructuring is needed. Standalone debt swaps involve a limited number of creditors, often bilateral, who agree to modify specific debt claims in exchange for climate change-related outcomes. In this setting, transaction design can be relatively flexible, as it is not constrained by system-wide requirements for comparability of treatment of all creditors, as is the case for comprehensive debt restructurings (Paris Club, n.d.).

The second question concerns the **type of debt instrument** under consideration. External public debt can take multiple forms, including bilateral and multilateral loans, syndicated loans and market-based instruments such as bonds (Jubilee Debt Campaign, 2020). These instruments differ in their legal characteristics, transferability, and the mechanisms available for modification. Tradable debt instruments may require bond buy-back and reissuance with new terms and non-standard features such as carbon-linked performance. Once a buyback under a debt swap becomes publicly known, market prices for the targeted bonds may rise as holders anticipate the purchase demand, reducing the savings generated by the swap (Aboneaaj, Estes and Landers, 2022; The Nature Conservancy, 2024). In contrast, bilateral debt is typically the most adaptable to conversion-type operations as they involve individual countries on the creditor side.

A third dimension relates to the **identity and mandates of creditors**. Public bilateral creditors may have greater flexibility to incorporate climate change-related considerations into debt operations, particularly where these align with climate, development or foreign policy objectives. Multilateral lenders have generally not been involved as creditors in debt-for-nature or debt-for-climate swaps

due to concerns about potential credit rating downgrades (Nedopil and Sun, 2025). Multilateral institutions, like the World Bank, enjoy preferred creditor status, meaning they are always repaid, also during debt restructurings. The preferred creditor status allows MDBs to have exceptionally high credit ratings. While not in the role of the creditor, multilateral institutions are still central to many debt swaps. They can provide grants, guarantees and political risk insurance for the swapped debt that creates the savings financing climate and nature projects (Weber *et al.*, 2024). Lastly, private creditors may be willing to engage in a D4C swap under certain conditions, e.g., if they are interested in trading carbon credits, but typically require clear risk-return profiles and standardized delivery structures.

Taken together, these elements define the outer boundary within which a D4C swap can be designed. Attempting to introduce carbon credit-linked features without first clarifying this perimeter risks misalignment between the financial and climate components of the transaction. In practice, early D4C operations are likely to focus on configurations where creditor structures are relatively simple, legal pathways are clear, and institutional constraints are manageable. Establishing the transaction perimeter therefore determines which transaction structures are feasible, which actors need to be involved, and which constraints will shape subsequent choices in both the financial and carbon dimensions.

2.2. Defining the policy objective of the transaction

Once the transaction perimeter is established, the next step is to define the **policy objective** of the D4C swap. The choice of objectives determines how the financial and carbon credit components of the transaction are structured and how success should be assessed. In practice, policy objectives tend to fall into three broad categories.

The first is **short-term fiscal relief**. In this case, the primary objective is to reduce immediate debt-service pressures or improve liquidity. Climate change mitigation outcomes are integrated into the transaction as a condition or counterpart to that relief. This objective is most closely aligned with structures in which carbon credits are used directly as payments (Option 1) or where relief is front-loaded. However, it also imposes constraints: the carbon credit component must be capable of delivering value within relatively short timeframes, which limits the range of eligible activities.

The second is **financing of mitigation programs over time**. Here, the objective is not immediate fiscal relief but the creation of sustained investment in mitigation activities that generate measurable outcomes. Debt treatment serves to create fiscal space or to reallocate resources, while carbon credits enable monitoring performance and, in some cases, generating future revenues. This objective aligns more naturally with programmatic approaches and with the development of carbon-crediting pipelines (Option 2).

The third is **alignment of sovereign finance with climate change mitigation commitments**, including NDCs and broader transition strategies. In this case, the transaction is designed not only to deliver specific mitigation outcomes but also to support policy coherence, institutional development, and long-term transition pathways in one or several sectors. Carbon credits may be used as a tool to enhance transparency and accountability, rather than as a primary source of financial value.

These categories are not mutually exclusive. A single transaction may pursue multiple objectives, for example by combining initial liquidity relief with longer-term program financing. However, attempting to optimize across all objectives simultaneously can lead to overly complex structures and diluted incentives. Analytical work on debt-for-climate instruments has highlighted that clarity of purpose is a key determinant of both feasibility and effectiveness (Chamon et al., 2022; Darouich et al., 2023; Shishlov et al., 2026).

We do not assume that a carbon-linked use of fiscal space is preferable to alternative uses such as health, education or food security; that comparison is a sovereign policy judgment. Including carbon credits in the debt swap structure may, however, unlock a particular creditor's participation, because the creditor values the verified mitigation outcome, or the climate-finance recognition, that the carbon linkage makes possible.

Finally, the choice of objective must be consistent with national policy frameworks. This includes alignment with NDCs, sectoral strategies, and public financial management systems. In cases where international transfer of mitigation outcomes is envisaged, governments must also consider the implications for domestic climate change mitigation targets generated by the need for corresponding adjustments and long-term transition planning. Experience with Article 6 cooperation suggests that these decisions are inherently strategic and cannot be treated as purely technical (Government of Ghana and Government of Switzerland, 2020; UNFCCC, 2024a).

In summary, defining the policy objective is a central design choice. It determines the structure of the transaction, the role of carbon credits within it, and the criteria against which its success should be evaluated. Where the primary objective is fiscal relief, carbon credits are more likely to be treated as a financial asset or substitute for payment. Where the objective is program financing or policy alignment, carbon credits are more likely to function as a performance metric or as a potential future revenue stream.

2.3. Host-country strategic choices

Alongside the macro-level policy objective, the debtor country must resolve three strategic choices that shape both the transaction and its climate-policy consequences. These choices are not purely technical: they affect sovereign climate ambition, future flexibility under the Paris Agreement, and domestic political economy.

Retention versus international transfer of mitigation outcomes

The first choice is whether the mitigation outcomes generated by the underlying program are retained domestically in the form of voluntary credits or mitigation contribution units (MCUs) under Article 6.4 or authorized for international transfer as Internationally Transferred Mitigation Outcomes (ITMOs) under Article 6.2. Retention enables the use of the mitigation embodied in the credits toward the host country's NDC. International transfer under Article 6.2 of the Paris Agreement triggers a corresponding adjustment and thus requires an extra mitigation effort to achieve domestic NDC compliance (UNFCCC, 2024a; Government of Ghana and Government of Switzerland, 2020). Option 1 structures will often favor authorized mitigation outcomes/ITMOs where the creditor seeks Paris Agreement-aligned accounting treatment and ITMOs, although voluntary credits could in principle be used where both parties accept their legal, accounting and integrity treatment. It should be noted that prices for authorized units (ITMOs) are likely to be substantially higher than for comparable voluntary credits, although activity type differences (e.g. emission reduction vs. removals) may even be higher, as discussed below. Option 2 structures leave more flexibility, including full domestic credit use. A related risk is overselling, i.e., a country that authorizes more mitigation for international transfer than is consistent with its own NDC may part with its lowest-cost abatement and later struggle to meet its target. The volume authorized for a D4C transaction should therefore be set in alignment with the country's NDC and long-term low-emission development strategy.

Crediting framework selection

The second choice is the crediting framework under which mitigation outcomes are generated and recognized. Frameworks include cooperative approaches under Article 6.2, the centralized Paris Agreement Crediting Mechanism (PACM) under Article 6.4, and the plethora of voluntary carbon market programs – there are several dozen relevant programs; the differentiation is particularly high in the context of removal credits. Each framework implies different governance pathways, approval processes and rules for credit use (UNFCCC, 2024a; UNFCCC, 2024b). Also, credit prices and underlying environmental integrity of credits differ massively. Credits for direct air capture removals trade at up to USD 1000 while avoided deforestation credits applying old baseline and monitoring methodologies may be sold at less than one US dollar. The transparency of many programs is rather limited, making it difficult to compare them without incurring significant transaction costs. Existing activity pipelines, institutional capacity (including of the Designated National Authority, DNA) and the preferences of potential creditors who are not interested in low-quality carbon credits tend to narrow the choice quickly to a few high-quality credit frameworks in practice. The Article 6.4 methodology pipeline is still at an early stage, which in practice limits the set of activities able to supply credits in the near term (Michaelowa et al., 2025).

Credit ownership and benefit sharing

The third choice relates to who owns the credits before any transfer and how benefits are shared with project proponents and local communities. Credit rights depend on the host-country legislation. Experiences with benefit-sharing arrangements – particularly in REDD+ jurisdictions – all shape what is legally and politically feasible in the future (Streck, 2020; GCF, 2025). A D4C transaction should not presuppose that the state owns mitigation outcomes. Explicit domestic legal clarity on credit ownership will be a necessary condition for a D4C swap. If this does not exist, the state may contractually define a compensation to private carbon rights owners, which will of course reduce the net revenues the state may generate in the context of D4C arrangements.

These three choices interact. Together they determine how the carbon credit component of the transaction is positioned within the country's overall climate strategy and what room remains for future cooperative action.

2.4. Defining the role of carbon credits in the D4C swap

Once the policy objective is defined, the next step is to determine the **role that carbon credits play within the transaction**. The same mitigation activity can underpin very different financial structures depending on how carbon credits are used. In practice, carbon credits can play two principal roles within a D4C transaction.

A first possibility is that carbon credits function as a **financial asset used to satisfy a debt obligation (Option 1)**. In this configuration, credits are transferred either directly or through an intermediary to the creditor as a substitute for cash payments. Their role is therefore analogous to that of a repayment instrument, with value determined through negotiation or reference to market benchmarks. This approach creates a direct link between debt service and verified mitigation outcomes, but requires that carbon credits be treated, legally and economically, as an acceptable form of repayment under the specific debt swap agreement.

A second possibility is that debt relief finances mitigation programs capable of generating carbon credits over time (Option 2). In this configuration, credits may serve as a **performance metric** and potentially as a future revenue stream. In this case, debt treatment is linked to the achievement of predefined mitigation outcomes. Carbon credits issued as a result of these activities would not be transferred to the creditor, unless this is explicitly agreed upon. They would rather serve as evidence that mitigation-related commitments of the debt swap have been met. The financial value of these credits does not directly enter the debt transaction but may support the sustainability of the overall structure by providing revenues to the debtor which would improve its fiscal position over time. Precedence of this structure exists with the debt for efficiency swap in Uruguay that financed a wind park, which ultimately led to the issuance of Certified Emission Reductions (CERs) under the CDM (Cassimon, Prowse and Essers, 2014).

This approach may combine upfront/base relief with staged performance-linked relief in line with the accrual of mitigation. This is closer in logic to **performance-based financing instruments**, such as sustainability-linked financing or REDD+ results-based pilots (GCF, 2025; Chen, Hinken and Löffler, 2026).

When carbon credits are used as a repayment asset as is the case in Option 1, their price becomes central to the transaction. When they function as a performance metric as in Option 2, valuation is indirect, embedded in the conditionality of debt relief. When they serve as a future revenue stream, valuation depends on expectations about market development and project performance.

Using credits as payment components transfers delivery and price risk more directly into the debt contract. Using them as a performance metric allows for more flexibility in structuring conditionality. Treating them as a future revenue stream shifts risk toward longer-term projects and market dynamics.

In practice, clearly defining the role of carbon credits at an early stage of the debt treatment is essential. It provides the bridge between the policy objective defined in the previous subsection and the financial and contractual structures that follow.

2.5. Structuring the debt relief

Once the role of carbon credits within the D4C transaction is defined, the next step is to structure the **debt treatment itself**. Debt treatment for debt relief can take three basic forms in debt swaps: reduction of the principal amount of the debt, changing payment schedules by extending maturities and including grace periods, and reducing the interest rate (Aboneaaj, Estes and Landers, 2022). All three options can reduce the net present value (NPV) of the debt and effectively reduce the cost of borrowing. The choice among these options depends on the debtor's needs – whether liquidity, solvency, or cost of capital – and on the creditor's preferences and constraints. Further, the availability of carbon credits determines whether they can be used to satisfy debt principal payments and/or interest payments under Option 1. For instance, in the case of large quantities of highly valued carbon credits, they can be used to satisfy both interest payments and principal payments, effectively reducing the debtor country's debt stock. Alternatively, lower volumes of carbon credits could be transferred in place of interest payments.

It is worth being precise about what Option 1 does and does not achieve for debt sustainability. Where credits are applied to interest, the debt stock is unchanged and Option 1 simply changes the medium in which the coupon is paid. Where they are applied to principal, the stock is retired to the extent of the value delivered, exactly as a cash repayment would reduce it. In neither case is the creditor asked to accept less than its claim, so Option 1 is best understood as repayment or servicing in an alternative medium rather than as debt relief in the sense of a reduction in the creditor's claim. Its value to the debtor is nonetheless real and can be substantial: it allows a government to

discharge hard-currency obligations using carbon credits that it may be unable to sell at competitive prices in the open market. Where those credits have a low opportunity cost to the debtor – for instance because the voluntary market is oversupplied – but a higher value to a compliance-seeking creditor under Article 6, the swap extinguishes scarce hard-currency debt at low real cost to the debtor without the creditor accepting a loss. The gain arises from this difference in valuation, and from the easing of the hard-currency liquidity constraint, rather than from a reduction in the creditor's claim. Because carbon credits have no single market price, the reference price at which credits are accepted is negotiated; the parties can set it to embed a concessional element if the creditor wishes, in which case Option 1 carries a degree of de facto relief. For a sovereign with a manageable debt position, and given the small share of debt service involved, such a concession does not raise the distressed-exchange concerns discussed in Section 2.8.

A key design question concerns the **timing of relief**. Debt treatment may be provided upfront, creating immediate fiscal space, or it may be staged over time. In the latter case, part of the relief may be conditional on the achievement of predefined outcomes, including those related to mitigation performance. This introduces a contingent element into the debt structure, bringing D4C swaps closer in form to state-contingent debt instruments, where repayment terms adjust based on observable variables (Chamon et al., 2022).

In practice, D4C swaps can be understood as combining two components. The first is a **base treatment**, which defines the core financial adjustment to the debt. The second is a **performance-linked component**, which adjusts the extent or timing of relief based on agreed conditions. These conditions may be linked directly to carbon outcomes, such as the delivery of credits or verified emission reductions or to intermediate milestones, such as steps of the implementation of mitigation programs.

This layered structure creates flexibility but also introduces trade-offs. A larger upfront reduction in debt service may improve liquidity but reduces the scope for performance-based incentives. Conversely, heavily back-loaded or conditional relief can strengthen the link between climate outcomes and financial terms, but may be less attractive to debtor countries facing immediate fiscal pressures.

Another important consideration is the **consistency of the debt treatment with broader debt frameworks**. In standalone transactions, this primarily concerns internal coherence and creditor acceptance. In restructuring contexts, however, debt treatment must be consistent with debt sustainability objectives and, where applicable, with requirements for comparability of treatment across creditors. However, as discussed earlier, introducing D4C swaps in such contexts is not recommended (IMF, 2024).

The structuring of debt treatment also interacts closely with the role of carbon credits defined in the previous subsection. Where the credits are used as a mode of repayment, the financial structure must accommodate non-cash settlement and define how the value of credits is determined and formally recognized. Moreover, the legal characterization of credit transfers requires careful consideration. Depending on the structure, carbon credits may be treated as an in-kind settlement of debt service, as an asset transfer under a parallel agreement, or as part of a broader financial arrangement. The precise treatment will depend on applicable legal frameworks and creditor requirements, and remains an area where limited precedent exists. Where carbon functions as a performance metric, the debt structure must incorporate conditionality and clearly define triggers for adjustments. Where carbon credits are expected to generate future revenues, the financial structure must allow for time lags between investment and returns.

While a wide range of debt treatments can in principle be combined with carbon credit-linked features, simpler structures, such as partial reprofiling or concessional adjustments with limited conditionality, are likely to be more feasible in early applications than highly contingent or multi-layered arrangements.

2.6. Structuring the carbon credit component of the D4C swap

Once the debt treatment is defined, the carbon credit component specifies how mitigation outcomes are generated, verified, issued as credits and transferred or used (depending on the structure). The feasibility of the entire transaction depends on whether the carbon credits are credible, and their accrual is aligned with the timing and structure of the debt relief. At a minimum, this requires defining three elements: the **source of mitigation outcomes**, the **crediting framework**, and the **timeline of carbon credit issuance relative to debt obligations**.

A first distinction concerns the source of carbon credits. In some transactions, credits do **already exist** or are expected to be issued in the near term from operational or advanced-stage mitigation activities. In others, carbon credits **will only be generated in the future** through new mitigation programs. This distinction is central, as it directly affects delivery risk, timing, and the role carbon credits can play in the transaction. This leads to a clear differentiation between two types of structures.

In what corresponds to Option 1, carbon credits accrue from an existing or near-term pipeline of credits. The transaction relies on the ability of the debtor country to deliver a defined volume of carbon credits within a timeframe that aligns with debt-service obligations. The emphasis is therefore on eligibility and availability of carbon credits that have already been issued.

In what corresponds to Option 2, the credits would be generated by a future pipeline of mitigation activities. Debt treatment enables or accelerates implementation of these activities. This would require policy action to harness activity development. In this case, the key aspect is to establish the

conditions to mobilize activities through which carbon credits can be generated, verified, and potentially monetized in the future.

A second element concerns the choice of carbon crediting framework as discussed above. Each framework implies different governance structures, approval processes, and rules for the use and transfer of credits (UNFCCC, 2024a; UNFCCC, 2024b). For Option 1 structures, the choice of framework is closely linked to transferability. Where carbon credits are intended to be transferred to creditors, particularly across borders, Article 6.2 provides a flexible basis for bilateral arrangements, subject to corresponding adjustments and reporting requirements. Voluntary carbon markets may also be used, although their interaction with national accounting frameworks must be carefully managed.

For Option 2 structures, the framework must support the development of new mitigation activities. This often requires greater emphasis on additionality determination and the use of baseline and monitoring methodologies and related MRV systems. In some cases, this may extend beyond project-based crediting to include sectoral or policy-based approaches, as explored in recent work on policy crediting under the Paris Agreement (Michaelowa et al., 2025).

A third element is the alignment of carbon credit generation timelines with debt timelines. Carbon crediting typically involves a sequence of project development, validation, monitoring, verification, and issuance (see Annex 1), which may take several years and cannot always be planned precisely. By contrast, debt-service obligations follow fixed schedules. In Option 1, this mismatch must be minimized. The transaction must rely on carbon credits that can be delivered with a high degree of certainty within the required timeframe. This tends to favor existing carbon credits or projects with established credit issuance records. In Option 2, the mismatch is inherent to the structure. Debt relief is provided upfront or in stages, while carbon credits are generated over a longer horizon. This requires mechanisms to bridge the gap between financial commitments and future carbon credit generation, such as milestone-based triggers or phased implementation.

There are two broad ways to bridge this gap. The first, illustrated in the Option 2 archetype in Section 3, is to decouple relief from credit generation altogether: relief is delivered up front through the debt treatment, while credits accrue later and serve as a performance metric and optional revenue stream rather than as settlement. The second is to pair the swap with a dedicated investment facility – for instance, using the savings generated by the swap to service a parallel sustainability-linked loan that finances the mitigation investment itself, broadly as in Barbados's 2024 debt-for-climate-resilience operation (GCF, 2024a). The second approach can mobilize capital for investment-heavy programs but adds structural complexity, and is better suited to later-stage transactions than to early pilots.

Across both options, the integrity of the carbon credit generation is a critical constraint. Carbon credits must be demonstrably real, additional, and verifiable, and must comply with recognized standards. Concerns regarding carbon credit quality, particularly in parts of the voluntary carbon market, highlight the importance of clear eligibility criteria and robust governance. These issues have been widely discussed in both policy and academic literature (GCF, 2024b; Sharma, 2025).

Finally, the carbon credit generation approach must be consistent with national climate policy. This includes decisions on whether mitigation outcomes are authorized for international transfer or retained for domestic use. Under Article 6, such decisions directly affect how outcomes are accounted for in relation to NDCs, and therefore have strategic implications beyond the transaction itself.

In summary, structuring the carbon credit generation requires aligning three dimensions: the availability of mitigation outcomes, the rules governing carbon credit issuance and use, and the timing of their generation relative to debt obligations.

2.7. Defining transfer, settlement, and registry arrangements

Once the carbon credit generation is defined, the transaction must specify how carbon credits and financial obligations are actually transferred and settled. This step translates the structure into operational terms. It requires clarity on who transfers what, through which systems, at what moment, and under which conditions. In conventional sovereign debt operations, settlement involves financial transfers between debtor and creditor according to agreed schedules. In D4C transactions, settlement may involve both financial flows and transfers of carbon credits. These flows may occur in parallel, be substituted for one another, or be sequenced over time. The design of transfer and settlement arrangements depends directly on the role of carbon credits defined in Section 2.4 and on the approach to carbon credit generation described in Section 2.6.

In structures corresponding to Option 1, carbon credits are transferred to the creditor (or to a designated intermediary acting on its behalf) as part of debt service. This requires that carbon credits be issued, verified, and available for transfer within the relevant timeframe. Settlement therefore involves:

- the issuance of carbon credits into a recognized registry,
- the transfer of those carbon credits to the creditor's account (or to an intermediary structure),
- the recognition of that transfer as fulfillment of a debt-service obligation.

The use of registry systems is central to the orderly transfer of carbon credits. Registries ensure traceability, prevent double-counting, and provide the infrastructure through which carbon credits

can be transferred across jurisdictions. Where carbon credits are transferred internationally under Article 6, registry operations must be consistent with reporting and accounting requirements under Article 6 of the UNFCCC, including the application of corresponding adjustments (UNFCCC, 2024a).

In structures corresponding to Option 2, settlement operates differently. Debt relief is not directly settled through carbon-credit transfers. Instead, financial relief creates fiscal space that is allocated to mitigation activities, while carbon credits are generated over time and may be used separately. In this case, settlement primarily concerns the financial leg of the transaction, such as reduced debt service or reallocated payments, while carbon credits are issued and managed within the domestic or international carbon market system.

This distinction has practical implications. In Option 1, the credibility of the transaction depends on the ability to deliver carbon credits as agreed. In Option 2, credibility depends on the governance of the program and the integrity of the carbon credit pipeline, rather than on immediate transfer.

In both structures, intermediaries may play an important role. These can include multilateral development banks, dedicated facilities, or special-purpose vehicles that act as trustees, coordinators, or risk mitigators. For example, an intermediary may receive carbon credits on behalf of a creditor, manage their sale or use, or oversee compliance with agreed conditions. Similarly, financial flows may be channeled through escrow accounts or dedicated funds to ensure that resources are used as intended. The design of such arrangements must balance transparency, enforceability, and operational feasibility. While intermediary structures can reduce risk and facilitate coordination, they also add complexity and may introduce additional costs or governance challenges.

A further consideration concerns the timing of settlement. In Option 1, settlement is typically linked to the delivery schedule of carbon credits, which must align with debt-service obligations. In Option 2, settlement of the financial leg may occur upfront or in stages, while carbon outcomes materialize over a longer period. This temporal separation requires clear rules to link financial commitments with future carbon credit performance, particularly where subsequent adjustments depend on verified outcomes.

Finally, registry and settlement arrangements must be consistent with broader accounting frameworks. This includes ensuring that transfers of carbon credits are properly recorded, that corresponding adjustments are applied where required, and that financial and carbon flows are transparently documented. These requirements are essential not only for environmental integrity but also for maintaining the confidence of both creditors and carbon market participants.

In summary, defining transfer and settlement arrangements requires translating the conceptual structure of the transaction into concrete operational steps. The distinction between Option 1 and Option 2 is particularly evident at this stage: the former relies on the direct transfer of carbon credits

as part of settlement, while the latter relies on financial settlement combined with the generation and potential use of carbon credits over time. In practice, straightforward transfer and settlement arrangements are likely to be preferred in early pilot transactions. More complex intermediary or multi-layered structures may offer additional risk mitigation but can quickly increase transaction costs and implementation challenges.

2.8. Risk allocation and mitigation

D4C transactions introduce a set of risks that differ in both nature and intensity from those encountered in conventional sovereign debt swaps. These risks arise from the integration of carbon market mechanisms, characterized by uncertainty in delivery, pricing, and regulation, into financial contracts that are typically designed around fixed obligations. A central task of transaction design is therefore to **allocate these risks explicitly** and to define how deviations from expected outcomes are handled. Without such clarity, transactions may either fail to attract participation or become vulnerable to disputes during implementation.

Several categories of risk are particularly relevant. Delivery risk concerns the possibility that the expected volume of carbon credits is not generated within the agreed timeframe. This is especially critical in structures where credits are directly linked to debt service. Price risk arises from uncertainty in the value of carbon credits, which may fluctuate due to market conditions or regulatory developments. Policy and regulatory risk reflects the evolving nature of carbon market rules, particularly under Article 6 of the Paris Agreement, as well as changes in domestic climate policy. Sovereign and institutional risks relate to the ability of governments to implement commitments over time, including coordination across institutions. Integrity risk reflects concerns about whether credits meet recognized standards, while timing mismatch captures the structural difference between carbon market project cycles and debt-service schedules. Finally, legal risks relate to the legal treatment of carbon credits in a transaction. These risks are present in both types of D4C transactions but are distributed differently depending on how carbon is used within the structure. The table below provides a structured overview.

Table 2. Key risk categories and allocation in D4C transactions

Risk category	Description	Option 1: carbon credits as payment	Option 2: swap finances carbon program	Typical mitigation approaches
Delivery risk	Carbon credits not generated in required volume/timing	High – directly affects debt service	Medium – affects performance triggers over time	Buffers, substitution clauses, diversified credit sources
Price risk	Carbon credit price deviates from expected value	High if implicit pricing used	Indirect – affects program revenues	Fixed price agreements, price corridors, conservative valuation
Policy / regulatory risk	Changes in Article 6 rules, eligibility, or domestic policy	High – affects transferability and validity of credits	Medium – affects program design and future issuance	Flexibility clauses, reopener provisions, alignment with UNFCCC guidance

Risk category	Description	Option 1: carbon credits as payment	Option 2: swap finances carbon program	Typical mitigation approaches
NDC / accounting risk	Impact on national targets due to carbon credit transfer	High if ITMOs transferred	Lower if credits retained domestically	Strategic authorization decisions, partial transfer approaches
Sovereign / implementation risk	Failure to meet commitments due to fiscal or political constraints	Medium–high	High (long-term program dependency)	Phased implementation, institutional safeguards, third-party oversight
Integrity risk	Carbon credits fail to meet quality standards	High – affects acceptability as payment	High – affects credibility of program	Strict eligibility criteria, recognized standards, independent verification
Timing mismatch risk	Misalignment between carbon credit issuance and debt schedule	High – critical constraint	Structural – inherent to model	Use of existing credits (Option 1), milestone-based relief (Option 2)
Legal risk	Uncertainty in legal enforceability of carbon credit-linked provisions and contract structure	High – non-cash settlement and credit delivery clauses may lack precedent and clarity under governing law	Medium – linked mainly to conditionality, fund governance, and contractual enforceability	Clear contractual definitions, governing law analysis, standardized clauses, legal opinions

The table illustrates that risk allocation differs fundamentally between the two transaction types. In structures where carbon credits are used as a repayment asset (Option 1), risks are concentrated around short-term delivery, valuation, and transferability. These risks must be tightly managed, as they directly affect the debtor's ability to meet contractual obligations. In program-based structures (Option 2), risks shift toward longer-term performance, institutional capacity, and policy stability. The success of the transaction depends less on immediate delivery of credits and more on the ability to establish and sustain credible mitigation activities over time.

Transaction design must reflect these differences. In Option 1, contractual provisions typically focus on ensuring delivery through buffers, substitution mechanisms, or conservative assumptions regarding credit availability. In Option 2, greater emphasis is placed on governance arrangements, milestone-based conditionality, and verification frameworks that can support performance over longer time horizons. Verification plays a central role in both cases. Independent validation and verification processes, consistent with the chosen crediting framework, are required to assess whether agreed conditions have been met. This is particularly important where financial terms are contingent on carbon outcomes.

A further risk specific to the debt leg concerns credit-rating treatment. Where a transaction reduces the value of a creditor's claim, rating agencies may classify it as a distressed exchange and therefore as a default event. An exchange is generally treated as distressed where the sovereign is already under stress – reflected in missed payments, impaired market access or deeply discounted bonds – and the operation helps it avoid an otherwise-likely default. On this basis, the Belize (2021) and Ecuador (2023) debt-for-nature conversions, both involving deeply discounted bonds (discounts of roughly 45 and over 60 percent respectively) and yields above 20 percent, were classified as

distressed exchanges, whereas the Barbados (2022) and Gabon (2023) conversions, undertaken by sovereigns that retained market access at more moderate yields, were not (Nestmann, 2023). This risk is most relevant to Option 2 commercial structures, where a buyback below par reduces bondholder claims. It is contained by scoping D4C to sovereigns with manageable debt and modest discounts, and by financing much of the relief through credit enhancement rather than deep bondholder haircuts. Option 1 structures, settled at or near par for a non-distressed sovereign and involving only a small share of debt service, do not raise the same concern. Where a country's debt is genuinely unsustainable, comprehensive restructuring – not a swap – remains the appropriate route.

In summary, risk allocation is a central element of a D4C transaction design. It determines how uncertainty is distributed across parties and whether the structure remains robust under real-world conditions.

2.9. Defining accounting treatment and incentives

The final step in structuring a D4C transaction is to determine how it is treated within **debt accounting, climate change mitigation accounting, and fiscal frameworks**. This step has direct implications for incentives on both the debtor and creditor side and often determines whether a transaction is politically and institutionally feasible.

From a sovereign debt perspective, the primary concern is how the transaction affects debt stocks, debt-service profiles, and debt sustainability indicators. Where debt is canceled or reprofiled, the impact can be assessed using standard debt-management tools. However, the introduction of carbon credit-linked features, particularly where settlement involves non-cash instruments or contingent elements, raises additional questions about valuation and recognition. These issues are especially relevant in cases where transactions are embedded within broader debt treatment processes assessed by institutions such as the IMF (Chamon et al., 2022).

From a climate policy perspective, the treatment of mitigation outcomes depends on whether carbon credits are transferred internationally or retained domestically. Where carbon credits are transferred under Article 6 of the Paris Agreement, they are subject to corresponding adjustments, meaning that the associated emission reductions or removals cannot be counted toward the host country's NDC (UNFCCC, 2024a). This creates a direct trade-off between using mitigation outcomes for domestic targets and using them within an international transaction. In contrast, where carbon credits are not transferred to the creditor, mitigation outcomes may remain available for domestic accounting or for future strategic use. This distinction is central to the design of D4C transactions and directly affects their attractiveness to debtor countries.

A third dimension concerns climate finance accounting, which plays an increasingly important role in shaping creditor incentives. Where carbon credits are used as a repayment asset (Option 1), the

transaction is generally structured as an exchange of assets and is unlikely to be recognized as climate finance. By contrast, where debt relief supports domestic mitigation activities and carbon credits are not transferred (Option 2), there may be a basis for considering the transaction as contributing to climate finance, depending on applicable definitions and reporting frameworks (GCF, 2024b; Sharma, 2025). In this sense, D4C structures that retain mitigation outcomes domestically may offer a pathway to mobilize climate finance through debt treatment rather than through direct budgetary transfers. The boundaries of what qualifies as climate finance, and the definitional ambiguities involved, are discussed in Shishlov and Censkowsky (2022).

This distinction has practical implications. Many creditor governments face budgetary constraints that limit their ability to provide grants or concessional finance. Debt relief, particularly in the form of reduced and/or deferred debt-service obligations, may be easier to accommodate within existing fiscal frameworks. If such relief can be recognized, in whole or in part, as climate finance, it may create an additional incentive for creditor participation (Weber *et al.*, 2024).

At the same time, the interaction between debt relief, carbon markets, and climate finance accounting raises important challenges. These include the risk of double counting between climate finance and carbon market transactions, as well as inconsistencies with existing frameworks for official development assistance. Earlier experience with carbon market mechanisms, such as the use of CDM revenues in development finance, highlights the complexity of these interactions (Cassimon et al., 2014).

The incentive structure of a D4C transaction therefore depends on how these different accounting frameworks are aligned. For debtor countries, the key question is whether the transaction provides sufficient financial benefit without undermining mitigation objectives under the NDC. For creditors, the question is whether the transaction can be justified within fiscal, legal, and policy constraints. In practice, achieving this alignment requires explicit design choices. These include decisions on whether credits are transferred or retained, how debt relief is structured and reported, and how the transaction is positioned within broader climate finance commitments. In practice, this creates a structural distinction between the two approaches discussed by us: Option 1 transactions are typically not recognized as climate finance, while Option 2 structures may, under certain conditions, be reported as climate finance. This distinction can significantly influence creditor preferences and transaction design.

In summary, accounting treatment is a central element of transaction design that shapes incentives and determines feasibility.

2.10. From design choices of D4C swaps to transaction structure

Based on the preceding discussions, we summarize the design choices in this section. They are interdependent and must ultimately converge into a coherent transaction structure. A typical structuring process involves five key steps:

1. **Fix the policy objective and debt constraint.**

The starting point is the debtor country's fiscal situation and the primary objective of the transaction (e.g. liquidity relief, program financing, or policy alignment). This determines whether immediate or staged relief is required and constrains the feasible structure of the transaction.

2. **Define the role of carbon credits.**

Carbon credits must be assigned a clear function within the transaction: as a repayment asset, as a performance metric, or as a future revenue stream. This is the pivotal design choice, as it determines how risks are allocated and how the financial and carbon market components interact.

3. **Test feasibility against carbon pipeline and timing constraints.**

The availability and timing of mitigation outcomes relative to debt-service obligations is often the binding constraint. Where near-term carbon credit delivery is uncertain, structures relying on in-kind repayment become difficult to implement. Where mitigation outcomes are long-term, programmatic approaches are more appropriate.

4. **Structure the debt treatment accordingly.**

The form of debt treatment (e.g. reprofiling, interest reduction, or partial cancellation) must be consistent with both the policy objective and the role of carbon credits. Where carbon credits are used as payment, debt contracts must accommodate non-cash settlement. Where carbon credits are used as a performance metric, debt treatment must incorporate conditionality and staged relief.

5. **Align carbon credit generation, transfer, and risk allocation.**

The carbon credit generation approach, registry arrangements, and contractual provisions must be designed to ensure that mitigation outcomes can be generated, verified, and, where relevant, transferred in a manner consistent with the financial structure. Risk allocation and mitigation mechanisms are defined at this stage.

In practice, iterations across these steps are required. Early D4C transactions are most likely to emerge where these five elements can be aligned without excessive complexity, particularly with respect to timing, institutional capacity, and creditor requirements.

3. Two generic options for D4C swaps

This section applies the design framework developed in Section 2 to two illustrative archetypes: an Option 1 structure where credits serve as payment for debt and an Option 2 structure where the swap finances one or several activities destined to generate carbon credits. The archetypes are deliberately stylized. They do not refer to specific countries or transactions and should not be used to infer numbers for any real-world deal. The purpose is to show how the design choices in Section 2 can be brought into coherent transaction structures, and how different objectives, creditor configurations and carbon market activity pipelines point to different overall transactions. The choice between the two archetypes is driven by the type of debt involved, the maturity of the country's carbon-market institutions and creditor appetite, rather than by any income classification.

All numbers, volumes and rate parameters in the archetypes below are illustrative only. They are chosen to exhibit the mechanics of each structure and should not be read as a recommended term sheet. Actual transactions will require country-specific financial modeling, legal drafting and creditor engagement.

3.1. Option 1 – credits serve as payment for a debt

Table 3. Illustrative transaction snapshot – Option 1

Component	Illustrative structure
Debtor profile	Country with manageable debt and an existing Article 6 pipeline
Creditor profile	A single bilateral official development assistance (ODA) creditor with climate mandate is involved in the transaction
Eligible debt	USD 200m bilateral loan
Debt treatment	Up to 40% of interest payable in carbon credits
Carbon credit source	Existing/near-term Article 6 pipeline
Crediting framework	Article 6.4 Emissions Reductions authorized under Article 6.2 as ITMOs
Settlement mechanism	Registry-to-registry ITMO transfer
Corresponding adjustment	Yes
Indicative carbon volume	Up to 250,000 tCO_2e/year
Valuation approach	Floor + indexed corridor
Dominant risks	Delivery risk, price risk
Main mitigation tools	Substitution clause; cash fallback
Climate finance treatment	Generally, not counted as climate finance
Strategic trade-off	Reduced hard-currency service vs. need for extra mitigation to cover the corresponding adjustment

Parties. A country with a manageable debt situation and an existing Article 6.4 project pipeline (at least one registered activity approaching first issuance), a functioning national registry, and a Designated National Authority (DNA) for Article 6 authorization. The counterpart is a single bilateral ODA creditor with a climate mandate and policy latitude to accept non-cash settlement (stylized as

an AFD-, SECO- or KfW-type lender), with a declared interest in acquiring Article 6.2 outcomes for its government's Paris commitments (the agency acting on behalf of the Party that holds the Article 6 account). These bilateral creditors may be used by their host governments to source credits for compliance.

Context. The eligible debt is an illustrative USD 200 million bilateral loan with a 7-year residual maturity and a 4.5% fixed coupon, giving scheduled semi-annual debt service of approximately USD 19–21 million in years 3–7. This is total debt service. The share payable in credits – up to 40 percent of the interest component, which is smaller and declines as the loan amortizes – is calibrated so that the indicative volume of up to 250,000 credits per year reflects the early-year interest rather than total service. The transaction is not embedded in a debt-restructuring perimeter.

Policy objective. Short-term fiscal relief through a reduction of hard-currency debt service on the existing loan, combined with delivery of verified mitigation outcomes to the creditor. The debtor may be interested in this use of its carbon credits because of market oversupply and the inability to sell its credits at competitive prices.

Role of carbon credits. Credits function as a financial asset used to satisfy debt-service obligations. Their transfer in a given year substitutes for the corresponding cash interest payment at an agreed reference price.

Debt treatment. The existing loan agreement is amended (no new instrument is issued) so that, from year 3 onwards, up to 40% of each scheduled interest payment may be satisfied by delivery of eligible carbon credits at the debtor's election. Any shortfall against the scheduled credit volume must be cured in cash within 10 business days at the baseline coupon terms. There is no principal haircut and no maturity extension.

Carbon credit generation. Eligible credits are those issued under a specified Article 6.4 methodology, registered in the host national registry, and authorized by the debtor's DNA for international transfer under Article 6.2 with corresponding adjustment. Indicative eligible volume reaches up to 250,000 tCO_2e per year for the residual life of the loan. This volume is illustrative and ambitious relative to Article 6 transfers concluded to date. It presupposes a scaled, high-integrity pipeline rather than a single early-stage activity.

Transfer and settlement. Credits are transferred through registry-to-registry transfer from the host-country registry to the creditor's Article 6 account, with settlement dates aligned to scheduled debt-service dates. Valuation uses a floor price of USD 15/tCO_2e, a reference index that is a weighted average of two external benchmarks over a 30-day reference period ending ten business days before each payment date, and a 50/50 split of any upside above USD 25/tCO_2e. Indicatively:

- Month 0: loan amendment negotiated in parallel with an Article 6.2 bilateral cooperation arrangement (where not already in place).
- Month 6: amendment executed; Article 6 authorization for the earmarked credit volume issued by the DNA.
- Years 3–7: annual settlement cycle; credits transferred via registry-to-registry transfers, with corresponding adjustment applied at the moment of transfer.

Risk allocation. Delivery risk is addressed by conservative annual volume commitments, a substitution clause permitting delivery from alternative eligible projects of equivalent integrity, and the cash-payment fallback noted above. Price risk is bounded by the floor-and-corridor valuation structure. Policy risk (Article 6 rule changes, methodology updates) is addressed by a reopener clause. The floor price should be calibrated so that the creditor does not accept a materially lower expected value than the agreed cash-equivalent obligation, while preserving an incentive for the debtor to deliver credits rather than settle fully in cash.

Accounting and incentives. The transfer foregoes domestic counting of the corresponding mitigation outcomes against the host country NDC. The creditor records receipt of ITMOs under its Article 6 arrangements; the transaction is not reported as climate finance and should not be positioned as a climate-finance contribution. The fiscal benefit to the debtor arises from the displacement of hard-currency debt service by carbon credits that the country can procure domestically at lower real cost than the hard-currency coupon represents. Because this operation changes the form of payment rather than the size of the claim, and is undertaken at par by a sovereign that is not in distress, it should not be read as a distressed debt exchange or as a reduction in the debt stock; the benefit to the debtor is the substitution of scarce hard currency, not debt relief.

Key feasibility constraints and failure modes. This structure depends critically on the existence of a reliable pipeline of carbon credits with predictable issuance. It becomes difficult to implement if (i) credit delivery is uncertain or delayed, (ii) Article 6 authorization is politically constrained, or (iii) agreement on valuation cannot be reached. In such cases, creditors are unlikely to accept carbon credits as a substitute for cash payments, and fallback to conventional restructuring or financing mechanisms may be required.

What this archetype illustrates. This is a small, bespoke, bilateral operation that uses carbon credits in kind for part of debt service. Feasibility depends on a credible Article 6.4 credit pipeline with delivery certainty, mutual agreement on the valuation mechanism, and a creditor-country accounting treatment of the received credits that is consistent with its own climate, fiscal and ODA rules. The central strategic trade-off is explicit: the host country reduces its hard-currency debt service (while having to harness extra mitigation to cover the corresponding adjustment), and the creditor receives an Article 6 outcome it does not count as climate finance. Both sides should assess

this trade-off against their respective NDC and finance strategies. In particular, the host should size the authorized volume within its own NDC so that the transaction does not amount to overselling.

3.2. Option 2 – the D4C swap finances a carbon credit program

Table 4. Illustrative transaction snapshot – Option 2

Component	Illustrative structure
Debtor profile	Country with manageable debt and a national REDD+ strategy
Creditor profile	Existing bondholders; new commercial lenders; DFI/MDB as credit enhancer.
Eligible debt	USD 120m in commercial debt
Debt treatment	Debt refinancing benefiting from credit enhancement
Fiscal mechanism	National Forest Transition Fund
Carbon credit source	Future jurisdictional REDD+ program
Crediting framework	Domestic/jurisdictional program with optional Article 6 pathway
Settlement mechanism	Financial settlement only
Corresponding adjustment	No (unless future transfer authorized)
Role of credits	Performance metric + optional future revenue stream
Dominant risks	Institutional/MRV/program risk
Main mitigation tools	Milestone conditionality; governance safeguards
Climate finance treatment	Credit enhancement potentially reportable as climate finance
Strategic trade-off	Stronger NDC retention vs slower monetization, relief depends on availability of credit enhancement

Parties. A country with a manageable debt situation (explicitly not in distress), significant forest cover, and a national REDD+ strategy; a jurisdictional carbon crediting program (for example, ART/TREES-compatible) is at the design stage, and the national carbon credit registry is at an initial development stage. The counterparts are commercial bondholders and a DFI/MDB supplying credit enhancement for the swap in the form of guarantees or political risk insurance. An arranging bank and a dedicated special-purpose vehicle structure the transaction, following the pattern of recent sovereign debt-conversion deals (see Section 2.8).

Context. Eligible debt is an illustrative USD 120 million outstanding Eurobond (coupon 8%, bullet maturity in 7 years), trading at around 90 percent of face value. Commercial swaps of this kind have so far involved sovereigns that retain market access, which is the relevant precondition here.

Policy objective. Generate fiscal space to finance a multi-year jurisdictional mitigation program. Carbon credits serve as a forward performance metric rather than as immediate payment. The objective is financing climate mitigation programs, not liquidity.

Role of carbon credits. Credits serve as a performance metric: issuance of credits and completion of project-cycle milestones serve as evidence of program performance and are not linked to the debt terms, which are settled up front. At the outset of the transaction, no credits yet exist.

Debt treatment. A new credit-enhanced loan or bond is issued through the special-purpose vehicle (with the sovereign as the ultimate obligor), and its proceeds fund a voluntary tender offer for the targeted bonds. Because participation is voluntary, only part of the stock is captured: here USD 90 million of the USD 120 million is tendered at 90 percent (USD 81 million in cash), with the balance remaining outstanding. The new financing is covered by DFI/MDB political risk insurance or guarantee. The new loan also covers transaction costs and a debt service reserve. The credit enhancement allows a coupon of around 5.5%, a 15-year maturity and a 5-year grace period. Because the new borrowing broadly replaces the repurchased bonds, gross debt is little changed and principal reduction is negligible; the relief is in net present value terms, from the lower coupon and the longer maturity. The resulting debt-service savings are channeled to the National Forest Transition Fund (NFTF) under a climate change mitigation funding agreement. Missed milestones trigger higher payments into the NFTF. These milestones are program-implementation steps (for example, MRV system set-up and verified disbursement) rather than carbon-credit price or delivery outcomes; the higher payments are additional, capped debtor contributions defined in the climate funding agreement and do not change the debt-service schedule. Whether the operation creates net fiscal space depends on the net present value of the reduced debt service after guarantee fees, transaction costs and the fund commitment; the figures here are illustrative, and a pilot would require full country-specific cash-flow modeling.

Carbon credit generation. Fiscal savings are ring-fenced in a National Forest Transition Fund (NFTF) governed under domestic public financial management rules, with annual reporting to creditors on deployment against an agreed work plan. The NFTF co-finances the jurisdictional REDD+ program alongside other donor support. Carbon credits generated by the program are retained by the host country for NDC delivery; no corresponding adjustment is triggered. As a jurisdictional REDD+ program, the credits are exposed to forest-sector integrity risks – non-permanence and reversals, leakage, and baseline uncertainty – and their credibility, and the question of who may benefit, also depend on jurisdictional accounting and on safeguards and benefit-sharing for local and Indigenous communities. An optional later-stage decision point preserves the possibility that a portion of future credits may be authorized for international transfer under Article 6.2 once the program has established an issuance track record; this is not a contractual obligation.

Transfer and settlement. There is no carbon credit transfer to bondholders or lenders or credit enhancers. Settlement is financial: the refinanced coupon and maturity schedule supplies ongoing relief. Carbon credits themselves remain in the domestic registry. Indicatively:

- Month 0-6: arranger and credit enhancer mandated; due diligence; climate funding agreement and NFTF architecture negotiated.
- Months 6-12: credit enhancement approved; new loan disbursed; bond buyback launched and settled; NFTF established and seeded from a portion of loan proceeds or donor support, with later contributions funded from debt-service savings.
- Months 12–24: NFTF operational; first tranche of expenditure disbursed; MRV system design finalized.
- Years 2–5: program implementation; first carbon credit issuance plausible in year 5.
- Years 5-20: mitigation implementation, carbon credits issuance.

Risk allocation. Dominant risks are program establishment risk (capacity, MRV, methodology completion) and long-run institutional risk. These are addressed through technical assistance, staged conditionality, time-bound milestones, and a two-year performance review. The credit enhancer bears the covered portion of sovereign non-payment risk on the new loan, on the terms of the guarantee; lenders bear neither program nor carbon risk. The debtor bears transaction costs and the risk that bondholder participation in the buyback is low. Carbon credit price and delivery risk are secondary because credits are not used as settlement. The buyback is sized and priced to remain an ordinary liability-management operation and not a distressed exchange (see Section 2.8): the debtor is not in distress, the discount is modest, and most of the relief comes from the credit enhancement rather than from bondholder haircuts.

Accounting and incentives. Retention allows the mitigation to count toward the host-country NDC. Credit enhancement offered by an MDB or DFI may be reportable as public international climate finance, depending on creditor reporting rules, concessionality treatment, additionality, and applicable OECD Development Assistance Committee (DAC) or UNFCCC reporting guidance. This may need to be negotiated explicitly and documented at signature.

Key feasibility constraints and failure modes. This structure depends on the ability to establish and govern a credible mitigation program over time. It becomes difficult to implement if (i) institutional capacity to manage the program is weak, (ii) MRV systems cannot be operationalized within a reasonable timeframe, (iii) credit enhancement cannot be secured on adequate terms or (iv) ring-fencing of fiscal savings cannot be credibly enforced. In such cases, the link between debt treatment and climate outcomes may weaken, reducing both credibility and effectiveness.

What this archetype illustrates. This is a swap in which fiscal savings finance a mitigation program while carbon credits serve as a delayed, optional revenue stream and as an MRV tool for the program. The relief is not contingent on carbon market outcomes; creditors bear no carbon price or delivery risk. Credit-ownership questions are less central to debt settlement but still need to be resolved for domestic program governance and benefit sharing. For early D4C pilots in contexts

where debtor capacity to deliver credits is unproven, this structure is generally more robust than in-kind settlement. The feasibility question sits with NFTF governance and MRV readiness.

What distinguishes this structure from a conventional debt-for-nature swap is that the underlying program is designed from the outset to generate creditable mitigation outcomes: the carbon-crediting architecture supplies the MRV discipline against which program performance is judged, keeps the mitigation available for the host country's NDC, and preserves an optional future Article 6 revenue stream. The debt mechanics may resemble a debt-for-nature swap, but it is the carbon-crediting design that makes the outcomes measurable, transferable and, potentially, monetizable.

3.3. Comparison of the two archetypes

The two archetypes differ across each of the design choices introduced in Section 2:

Table 5. Comparison of D4C swap Option 1 and Option 2 archetypes.

Design dimension	Option 1	Option 2
Debt situation	Manageable; bilateral concessional loan	Manageable; commercial debt trading at a discount
Policy objective	Short-term fiscal relief + delivery of verified outcomes	Programmatic financing of mitigation pipeline
Role of carbon credits	Asset used as payment	Performance metric (program monitoring); relief not contingent on credits
Debt treatment	Non-cash settlement clause on existing loan	Refinancing, generating savings through credit enhancement
Carbon credit generation	Existing activity pipeline; Article 6.2 authorization each year	Activity pipeline to be built; retention with optional future transfer
Transfer/settlement	Annual credit transfer aligned with debt service	Financial settlement only; credits recorded domestically
Dominant risk	Delivery and price risk in each tranche	Program establishment and long-run institutional risk
Climate finance recognition	Unlikely (asset exchange)	Possible for eligible components; negotiated explicitly

These archetypes are not exhaustive. Real transactions will blend elements from both and may involve additional creditors, guarantors, or intermediaries. Their value here is to make the design choices in Section 2 concrete and to show where the main feasibility constraints arise.

Conclusion

The case for Debt-for-Carbon (D4C) swaps rests on a simple observation: many developing and emerging economies face a structural tension between debt service and climate change mitigation investment that existing instruments have not resolved at scale. D4C transactions do not invent new legal primitives. Their novelty lies in the integration of debt-swap practice with established carbon market infrastructure, around carbon credit integrity, Article 6 authorization, corresponding adjustment, and MRV.

There are two distinct approaches to designing a D4C swap. Option 1, in which carbon credits are used as a means of payment, is appropriate where a credible carbon credit pipeline already exists, where delivery risk can be limited by substitution and cash payment fallbacks, and where the host country is able to mobilize extra mitigation to cover the corresponding adjustment that comes with international transfer of credits. Option 2, in which a debt swap creates fiscal space that finances mitigation programs capable of generating carbon credits over time, is better suited to contexts with manageable debt but weaker carbon market institutions. Here the emphasis is programmatic rather than liquidity, and on retaining mitigation outcomes for domestic NDC delivery.

These archetypes are not fixed templates. Real transactions will blend elements from both and adapt to the specific debt instrument, creditor mandate and crediting framework at hand. The most productive way to develop the instrument is therefore not to seek a single canonical structure, but to pilot carefully sized debt swaps that exemplify each archetype, document the practical experience, and test the design choices in Section 2 against real-world constraints.

Several questions remain open and will be best answered by practice. How should D4C transactions be classified in sovereign debt statistics? Under what conditions can Option 2 transactions be recognized, as a whole or in part, as public international climate finance by creditor governments? How should valuation mechanisms evolve as Article 6 markets mature, and how should integrity standards for eligible credits be maintained over time? We hope to provide policymakers, creditors and practitioners a framework against which pilot transactions can be designed, compared, and evaluated. Early pilot transactions should prioritize legal simplicity and institutional feasibility over financial optimization, as the main objective at this stage is to establish credible precedents.

D4C swaps have a relevant potential to harness the power of the international carbon markets to address debt challenges that so far hold back climate change mitigation in many countries. They can be a harbinger of new approaches where carbon markets serve as a catalyst to mobilize public finance.

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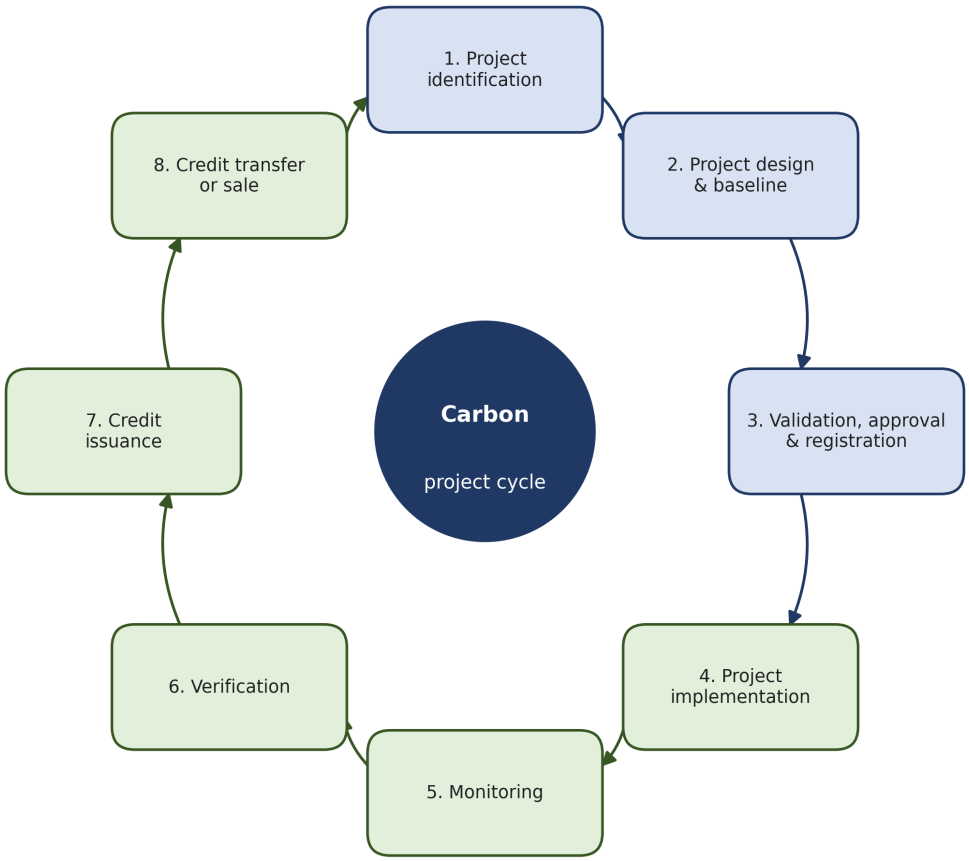
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Annex 1: Carbon project lifecycle

This section explains how carbon credits are generated. Its purpose is to provide readers unfamiliar with carbon markets a clear understanding of the sequence of steps required to generate carbon credits. This explanation is necessary for understanding how carbon credits are generated and what key carbon project milestones can be used as performance indicators. Stages 1-3 (blue) in the figure below are one-off activities completed during project preparation, while stages 4-8 (green) are recurring over the crediting period.

Figure 1. Carbon project lifecycle.



1. **Project identification.** Mitigation opportunities are identified within sectors such as energy, land use, or industrial processes. Projects must demonstrate potential to generate measurable emission reductions. This stage may include eligibility screening, analysis of the NDC, development of mitigation activity idea note (MAIN).
2. **Project design and baseline definition.** Project developers prepare project design documents describing the mitigation activity and defining the baseline against which emission reductions will be measured. This includes selecting appropriate methodology and

developing a project design document (PDD) / Mitigation activity design document (MADD), including baseline setting and additionality analysis.

3. **Validation, approval and registration.** An independent validator assesses whether the project meets the requirements of the relevant carbon crediting standard. A third party issues a validation report for the activity design after successful technical review. The mitigation activity is confirmed and approved by the host country (especially under Art 6.4), followed by the project being formally registered under a carbon crediting program.
4. **Project implementation.** The mitigation activity is implemented and begins generating emission reductions.
5. **Monitoring.** Emission reductions are monitored according to the approved methodology.
6. **Verification.** Independent auditors verify the monitored emission reductions.
7. **Credit issuance.** Carbon credits are issued by the carbon crediting program.
8. **Credit transfer or sale.** Issued credits / ITMOs may be transferred to buyers or used for compliance or voluntary carbon market purposes.

Annex 2: Indicative contractual provisions for D4C swaps

This annex does not provide legal advice. Specific contractual language must be developed with qualified legal counsel based on the governing law and structure of the debt instrument. Implementing a D4C swap may require amendments to the original debt agreement to recognize carbon credits or mitigation outcomes within the contractual framework. The specific legal formulation will depend on the type of debt instrument and governing law. The elements below highlight provisions that may require modification or clarification.

Governing law and ancillary approvals

The governing law of the underlying debt instrument shapes the legal characterization of carbon credits, the enforceability of non-cash settlement, and the availability of remedies. Amendments may also be conditional on consents, waivers or ratifications outside the contract itself, including:

- creditor-side approvals (e.g. parliamentary, board, ECA or development-finance authority)
- debtor-side approvals (e.g. parliamentary ratification of debt amendment; budget law)
- Article 6 authorization by the host Designated National Authority
- tax and withholding treatment of non-cash settlement under applicable domestic law
- where relevant, comparability-of-treatment considerations vis-à-vis other creditors.

Payment provisions

Standard sovereign debt agreements typically require monetary repayment of principal and interest. For D4C swaps, payment provisions may need to be amended to recognize alternative forms of performance, such as:

- delivery of verified carbon credits
- revenues generated from carbon credit sales
- mitigation performance indicators linked to repayment schedules.

The agreement may therefore specify the conditions under which carbon credits are considered an acceptable form of payment or performance.

Valuation mechanisms

Where carbon credits are used as repayment assets, the contract may need to define:

- the pricing mechanism applied to carbon credits
- the reference carbon market or price index
- procedures for updating valuation parameters over time.

Performance and verification requirements

Contracts may include provisions specifying:

- eligible carbon crediting standards
- monitoring, reporting, and verification procedures
- independent verification requirements
- procedures in case mitigation outcomes fall short of expectations.

Events of default and carbon-specific exceptions

Debt agreements typically define events that constitute default. For D4C swaps, it may be necessary to clarify whether the following events constitute default or trigger alternative provisions:

- delays in carbon credit issuance
- verification delays
- carbon market disruptions

Force majeure and regulatory change

Carbon credit generation may be affected by regulatory or methodological changes or by physical events affecting the underlying mitigation activity (for example, fire, drought or other natural disturbances relevant to land-use projects). Contracts may therefore include provisions addressing:

- changes in carbon market rules
- modifications to crediting methodologies
- regulatory restrictions on carbon credit transfers.

Registry and transfer arrangements

Where carbon credits are transferred to creditors, the agreement may specify:

- the registry used for transfer
- authorization procedures
- custody and settlement mechanisms.

Dispute resolution mechanisms

Contracts may clarify dispute resolution procedures related to:

- credit eligibility
- valuation
- verification outcomes

Annex 3: Option-specific drafting notes

The provisions above apply to both D4C archetypes. The drafting emphasis, however, differs between Option 1 (credits as payment) and Option 2 (swap finances a carbon program).

Option 1: payment-focused drafting

Agreements should focus on (i) a payment clause that recognizes the delivery of a defined volume of eligible credits as satisfaction of the corresponding debt-service obligation; (ii) a reference price corridor or formula for valuation; (iii) a substitution mechanism permitting delivery from alternative eligible projects of equivalent integrity; and (iv) a residual cash-payment obligation for any shortfall. In general, the payment clause should amend the existing debt instrument to recognize an alternative form of performance, rather than create a new instrument.

Option 2: performance-focused drafting

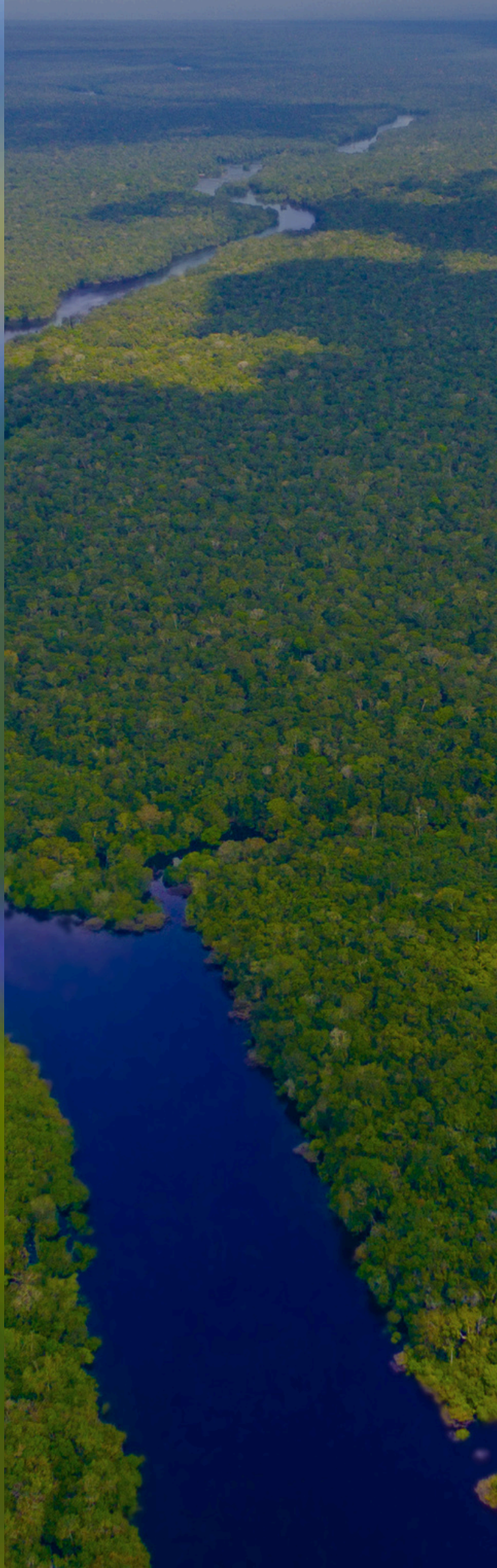
Agreements should focus on (i) a base treatment of the existing debt applied at signature; (ii) milestone-based triggers for any additional staged relief, tied to issuance of carbon credits or verifiable program or project-cycle steps (see Annex 1); (iii) ring-fencing arrangements for the fiscal savings to ensure they flow to the intended mitigation activities; and (iv) independent verification requirements for each milestone.

Common non-default and force-majeure provisions

For both options, the agreement should clarify that delays in credit issuance or verification, changes in Article 6 rules or methodological updates, and disruptions to reference carbon markets do not automatically constitute events of default. Instead, these events should activate defined alternative-performance procedures (cure periods, substitution, recalibration). The agreement should also provide an orderly exit pathway if the crediting framework becomes unavailable, including a return to cash payment on agreed terms.

What the agreement should not do

The agreement should not (i) attempt to treat the D4C operation as a jurisdiction-wide standard affecting all sovereign creditors of the country, (ii) embed carbon-delivery obligations in sovereign bond documentation without appropriate bondholder engagement, or (iii) substitute for a comprehensive restructuring where one is required. These constraints follow directly from the distinction set out in the beginning of the guide.



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