IETA | eos ESTRATÉGIA & SUSTENTABILIDADE

Working Paper
June 2026

WORKING PAPER 03

Carbon Market Frameworks for Brazil 2.0

Integrating the SBCE with international cooperation under Article 6 of the Paris Agreement — an analytical assessment of four pathways.

About this paper

THIS PAPER BUILDS UPON PREVIOUSLY PUBLISHED **IETA BRAZIL INITIATIVE WORKING PAPERS** ON CARBON MARKET FRAMEWORKS AND THEIR SOCIO-ECONOMIC IMPACTS FOR BRAZIL. DRAWING ON ENGAGEMENTS WITH MULTIPLE STAKEHOLDERS FROM PUBLIC AND PRIVATE SECTORS, IT COMPILES THE FINDINGS INTO ONE REVIEWED AND COMPREHENSIVE DOCUMENT TO INFORM DISCUSSIONS ON HOW THE COUNTRY CAN BEST CONSIDER THE DIFFERENT CARBON MARKET INSTRUMENTS TOWARDS THE EFFICIENT ACHIEVEMENT OF ITS CLIMATE COMMITMENTS.

THE WORK ASSESSES FOUR POTENTIAL PATHWAYS FOR THE INTEGRATION OF THE **SBCE**, THE **VOLUNTARY CARBON MARKET**, AND **ARTICLE 6** MECHANISMS, MODELLED BY EOS CONSULTING USING THE IMACLIM-BR COMPUTABLE GENERAL EQUILIBRIUM MODEL.

For further information about the modelling and analysis, please refer to:

Working Paper 01 — Carbon Market Frameworks for Brazil

Working Paper 02 — Socio-economic Impacts of Carbon Market Frameworks for Brazil

Working Paper 03 — Appendix A

PREPARED BY

IETA BRAZIL INITIATIVE

MODELLING

EOS CONSULTING

ISSUED

JUNE 2026

IETA BRAZIL INITIATIVE · SPONSORS

MAKING NET ZERO POSSIBLE

Contents

A quantitative assessment of four carbon market frameworks for Brazil

This working paper presents the findings of a quantitative assessment of carbon market frameworks for Brazil, developed in partnership with EOS Consulting using the IMACLIM-BR computable general equilibrium model. Building on two previously published working papers, this updated version introduces a fourth analytical scenario and strengthens modelling assumptions.

Four pathways were assessed, representing a spectrum of policy choices for integrating Brazil's carbon market with international cooperative approaches under Article 6 of the Paris Agreement. All pathways share a common analytical foundation: zero illegal deforestation by 2030, GDP growth of approximately 2.7% per annum through 2035, CORSIA Phase II in force from 2027, and a domestic carbon price trajectory consistent with NDC achievement (US$19/$tCO_2e$ in 2030; US$26.55/$tCO_2e$ in 2035). Pathway 1 serves as the regulatory reference scenario, in which Brazil prioritises SBCE consolidation and defers Article 6 engagement until after the country has demonstrated its NDC achievement. Pathways 2, 3, and 4 introduce progressively integrated use of Article 6, targeting hard-to-abate industrial sectors, nature-based solutions, and a combination of both, respectively.

Key results

Pathway 1 confirms macroeconomic and environmental stability under a domestic consolidation strategy — GDP reaching BRL 15.1 trillion by 2035, purchasing power of the poorest 20% growing 1.70×. However, this pathway foregoes the additional revenue, investment, and mitigation potential that international cooperative approaches can unlock.

Pathway 2 demonstrates that Article 6 engagement targeting hard-to-abate sectors generates an incremental GDP gain of 1.07% (BRL 15.29 trillion), BRL 71.6 billion in foreign investment, and 106.1 $MtCO_2e$ in ITMO exports by 2035, while maintaining NDC compliance.

Pathway 3 directs Article 6 cooperation toward nature-based solutions, primarily ARR, with authorisation revenues cross-financing domestic REDD+ activities. GDP reaches BRL 15.34 trillion by 2035, with BRL 53.1 billion in net foreign investment and 109.2 $MtCO_2e$ in ITMO exports. Purchasing power gains among the poorest income class are the highest across all pathways.

Pathway 4 delivers a balanced and ambitious outcomes across all dimensions assessed. By combining elements of Pathways 2 and 3 under an Article 6 engagement framework, in which 50% of mitigation outcomes are retained domestically and only measures with marginal abatement costs at least 10% above the domestic NDC price trajectory are eligible for international transfer, the scenario generates positive economic and social results.

GDP of BRL 15.32 trillion by 2035 (+1.2% gain over Pathway 1), net emissions of 928.7 $MtCO_2e$ by 2035, positioning Brazil significantly below the NDC upper bound and approaching its lower bound, attributable to the domestic retention of 121.3 $MtCO_2e$ of additional mitigation outcomes unlocked by Article 6 engagement; 104.6 $MtCO_2e$ in ITMO exports in 2030 and 121.3 $MtCO_2e$ in 2035, generating flows of BRL 42.1 billion in foreign investment in 2030 and BRL 71.6 billion in 2035. Finally, Pathway 4 generates 190,000 additional FTE jobs relative to Pathway 1 in 2035, reflecting the combined contribution of capital-intensive industrial activities and labour-intensive ARR.

The results consistently support a few policy conclusions. First, SBCE consolidation can enhance credible international engagement, and a well-designed Article 6 engagement can help the country achieve its climate commitments and increase its climate leadership and ambition. Secondly, Brazil's structurally high cost of capital makes international cooperative approaches a strategic necessity rather than a supplementary option, highlighting that Article 6 engagement should not be contingent upon the full completion of the SBCE regulatory process. Thirdly, although the results of this work can inform Brazil's Article 6 engagement, consideration for ITMO authorization should be not limited to the categories assessed by this paper as other activities, such as REDD+ projects, JREDD+ programmes, landfill gas recovery, among others, may as well deliver critical short, medium and long-term climate and socioeconomic impacts that eventually justify their inclusion in positive lists in well-structured alternative approaches.

Nevertheless, some structural characteristics of the modelling approach and their consequential limitations should also be noted. Full NDC compliance is an exogenous modelling premise across all four pathways, not; the marginal abatement cost framework underlying the model does not fully capture the co-benefits, supply chain effects, and sectoral complementarities of specific activity categories. Carbon and commodities price trajectories, both domestic and international, are forward-looking and subject to regulatory, geopolitical, and market uncertainty. The 50% domestic retention rule adopted in Pathway 4 is a fixed modelling parameter and may not reflect the investment needs of all project types; sensitivity analysis on alternative retention ratios and other forms of conditioned authorizations are foreseen as interesting and relevant additions.

Taken together, the results of this study reinforce that Brazil has a unique strategic opportunity to position itself as a global leader in international carbon markets. By aligning robust domestic instruments with well-designed international engagement, the country can simultaneously reduce the cost of its own NDC's achievement, raise its climate ambition, and contribute decisively to the global economic efficiency of the mitigation effort.

This work is part of a series of working papers produced by IETA Brazil Initiative. For further information on the previous pieces and on this piece's appendix, please access the documents listed at the beginning of this paper:

01

Introduction

Building on two previously published working papers, this Phase II review expands and compiles the findings into one reviewed and comprehensive document — and introduces a hybrid scenario, **Pathway 4**, to assess how SBCE, VCM and Article 6 can work together.

Introduction

Building upon previously published IETA working papers on carbon market frameworks and its socio-economics impacts for Brazil, and on engagements with multiple stakeholders from public and private sectors, this paper expands and compiles the work findings into one reviewed and comprehensive document to inform discussions on how the country could best consider the different carbon market instruments towards the efficient achievement of its climate commitments.

The first working paper established the analytical foundation for this study. It assessed Brazil's emissions profile, economic structure, and climate commitments against the backdrop of global carbon market developments, identifying critical challenges, from halting deforestation and scaling native vegetation restoration to decarbonizing hard-to-abate sectors. Drawing on international benchmarks, it proposed three initial potential pathways combining SBCE implementation, VCM promotion, and Article 6 engagement, positioning early action on carbon markets as a strategic imperative that should not be contingent on the full completion of the SBCE regulatory process.

The second working paper translated those conceptual findings into measurable outcomes: it quantified the economic, environmental, and social impacts of the three proposed pathways, finding that, while domestic SBCE consolidation provides the integrity and predictability foundations on which international instruments can safely rely, different pathways demonstrate that strategic engagement with Article 6 can significantly expand Brazil's economic, social, and environmental potential. Taken together, the results pointed to the complementarity between industrial decarbonization and nature-based solutions and signalled the need to explore a more comprehensive, integrated scenario.

The new scenario — referred to as the hybrid **Pathway 4** — was developed to deepen the assessment of market design alternatives. In this pathway, approximately 50% of the credits generated remain in the country to contribute directly to NDC compliance, while the remaining share may be authorised for international use, subject to rigorous environmental integrity and regulatory alignment criteria.

Beyond assessing an additional pathway, the analytical framework has been substantially strengthened: greater transparency on assumptions, clearer articulation of revenue flows and economic beneficiaries, and practical case illustrations grounding the analytical findings in concrete implementation contexts.

By partnering again with EOS Consulting, the work employed the IMACLIM-BR computable general equilibrium model and was enhanced by the contributions of active carbon market stakeholders who shed light on carbon market opportunities that could be unlocked by an efficient carbon market framework in the country.

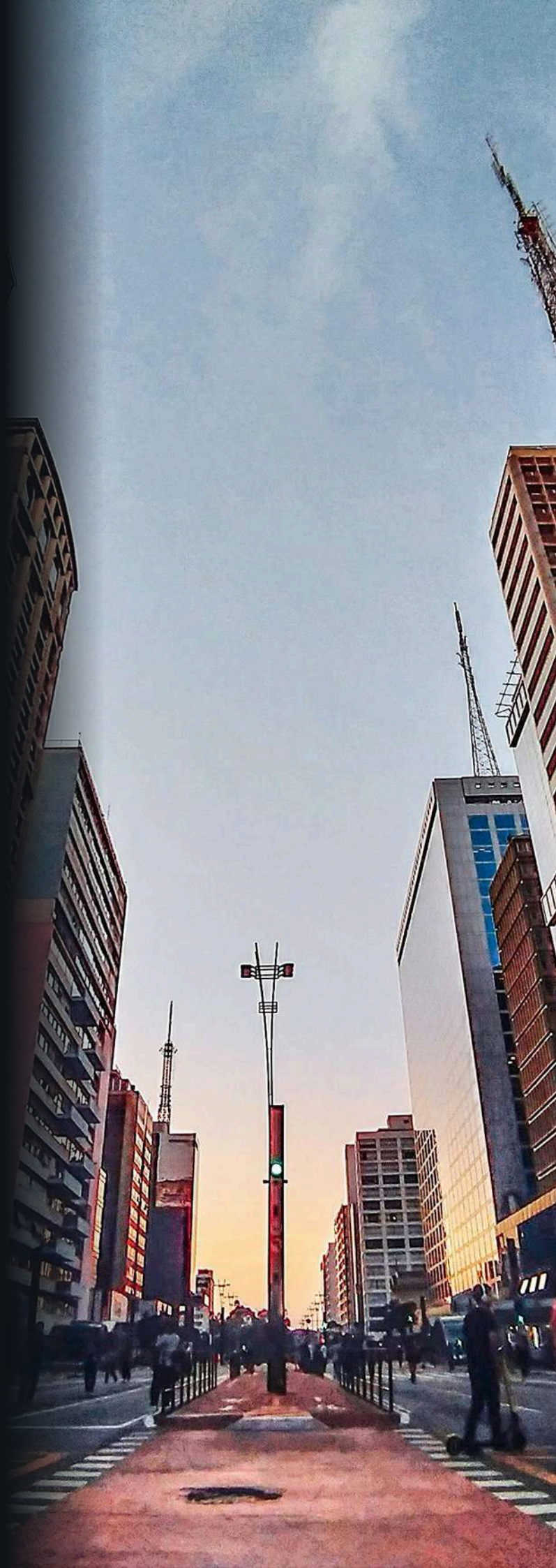
Still, this work should be seen as an ongoing exercise, whose main value lies in indicating possible pathways for Brazil's engagement in carbon markets. The study contributes to aligning the analysed scenarios with the national climate policy framework, including the "Plano Clima Mitigação" and the development of the SBCE, as well as assessing the role of international mechanisms in promoting economic efficiency, environmental integrity, and implementation feasibility.

Finally, the work seeks to provide a robust analytical foundation for public policy debate and market design decisions, supporting the construction of a coherent, efficient, and high-integrity carbon market framework capable of simultaneously advancing Brazil's long-term decarbonisation objectives and sustainable growth.

02

Scenarios & analytical approach

Four mutually-reinforcing pathways for an integrated carbon-market architecture, modelled in IMACLIM-BR and calibrated against ongoing public-policy discussions on the SBCE and PMI Brazil.



Scenarios and Analytical Approach

The first qualitative assessments highlighted that early action on Article 6 engagement and VCM promotion should not be contingent upon the full completion of the SBCE regulatory process. Strategic pilot initiatives and specific market promotion measures can already be deployed in the process of SBCE operationalization to generate credible market signals that increase private sector climate investments and provide learnings to refine policies and operational arrangements.

The following quantitative work assessed three potential approaches that the country could consider for promoting the best use of carbon market instruments towards the achieving of their NDCs considering the national specific circumstances of Brazil. Such proposed frameworks were not intended to function in isolation; rather, they were seen as mutually reinforcing pillars of an integrated carbon market architecture – able to enhance investment signals, expand financing opportunities, and ensure that all efforts contribute coherently toward the cost-effective achievement of Brazil's NDC. They were though to ideally fit into the time frame of the initial phases of implementation of the SBCE, and intended to remain dynamic, evolving alongside the implementation of sectoral allocation plans and other regulatory developments. As such, they are particularly relevant to the current context of the country, while allowing for adjustments as market conditions, technologies and policies evolve.

This reviewed analysis compares such initial assessments with a fourth potential pathway for a carbon market framework in Brazil (Figure 1) and seeks to assess the socio-economic impacts that each of them can represent for Brazil.

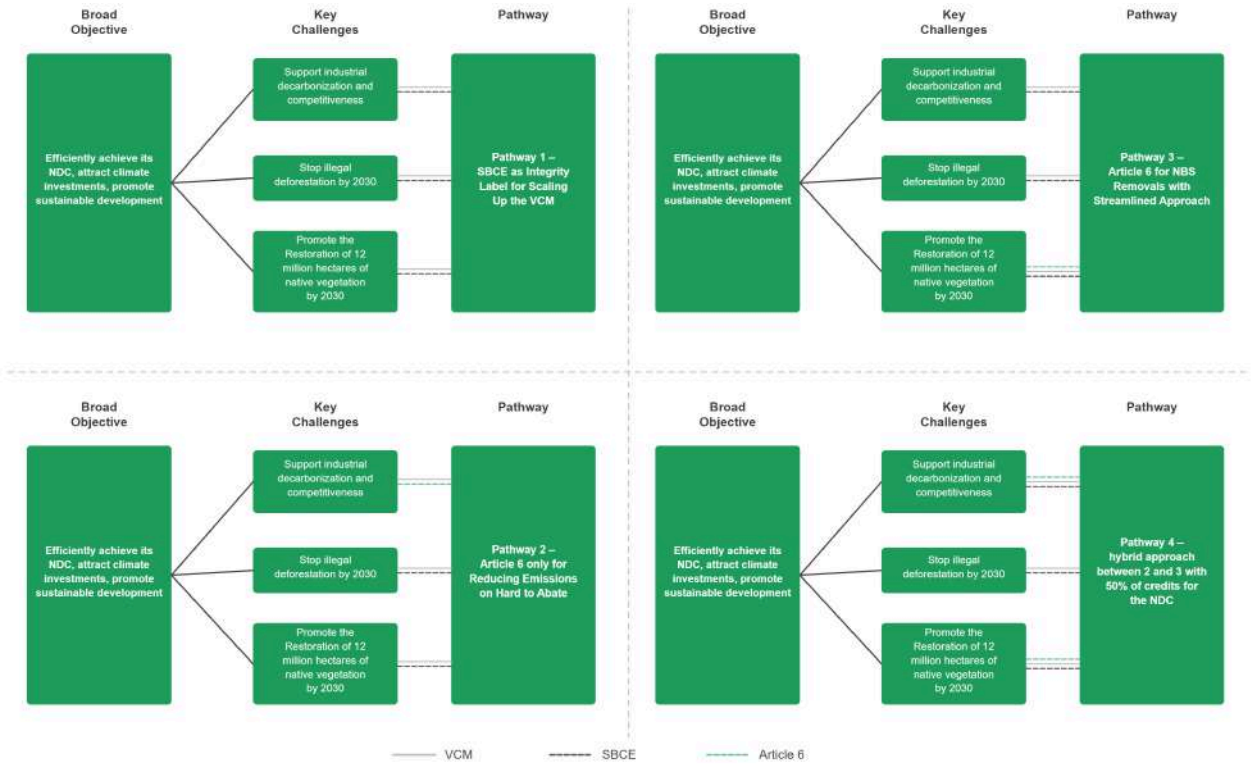


FIG. 01 Potential pathways for Brazil's carbon market frameworks.

Source: IETA & Eos

The pathways assessed represent a spectrum of policy choices for integrating Brazil's domestic carbon market with international cooperative approaches under Article 6 of the Paris Agreement. While each pathway differs in its design logic and targeted sectors, they share a common analytical foundation: all scenarios assume zero illegal deforestation by 2030, GDP growth of approximately 2.7% per annum through 2035, CORSIA Phase II in force from 2027, and a domestic carbon price trajectory consistent with NDC achievement (US$19/tCO₂e in 2030, US$26.55/tCO₂e in 2035). The oil price trajectories are consistent with IEA's "Announced Pledges" scenario: US$ 72/barrel in 2030, US$ 63/barrel in 2040 and US$ 58/barrel in 2050. Across the pathways, net emissions are projected to decline from 1,824 MtCO₂e in 2025 to approximately 1,050 MtCO₂e in 2035, consistent with Brazil's NDC target.

It is worth noting that the oil price trajectories adopted in the model reflect long-term assumptions consistent with international transition scenarios but are subject to considerable uncertainty. Persistent upward price shocks could affect results through multiple channels: in the short and medium term, higher oil prices tend to increase transport costs and production costs across fossil fuel-dependent supply chains, generating inflationary pressure with potential negative effects on real income, consumption, and sectoral competitiveness. From a structural perspective, higher oil prices carry ambiguous implications for the energy transition: while they increase the economic attractiveness of energy efficiency, electrification, biofuels, renewables, and fuel switching, potentially accelerating low-carbon investment, they may also expand the revenues and political economy incentives associated with fossil fuel production, creating lock-in risks and delaying structural transition decisions.

Pathway 1 established the regulatory reference scenario. It assumes that Brazil will prioritize the domestic consolidation of its Emissions Trading System (SBCE) and expand its engagement within the VCM before engaging with international carbon markets under Article 6 of the Paris Agreement. ITMO authorizations are therefore only considered after the country has demonstrated achievement of its NDC commitments, and not as a step towards achieving them cost-efficiently.

Pathway 2 assumes that ITMO exports could be used to support decarbonisation in hard-to-abate sectors, financing projects that would not otherwise occur in the short term due to their high costs. In this scenario, domestic efforts to achieve the NDC would focus on less costly GHG reductions and removals, with ITMO authorisation only considered for credits priced above the estimated carbon price needed to achieve the NDC. This scenario calculated the potential for additional reduction beyond the NDC, considering the carbon price trajectory required to achieve Brazil's NDC, the EU ETS price trajectory as an upper-limit reference for the potential sale value of ITMOs, and a price marginally below the EU ETS as the ITMO sale price (Figure 2). It is important to highlight that the carbon price trajectories adopted in the model were calibrated on the basis of recognised studies, such as AGORA (2024) and Centro Clima (2023).

FIG. 02 Carbon price trajectories and the Article 6 business opportunity, 2025–2050.
Source: EOS Consulting, based on Centro Clima (2023) and AGORA (2024)

Aligned with PLANAVEG's goal of restoring 12 million hectares of native vegetation by 2030, **Pathway 3** considers ITMO authorisations for ARR activities, authorising a share of mitigation outcomes in this sector to attract international investment, scale up projects, and stimulate the development of a robust restoration supply chain. It proposes an authorisation fee to attract investors and streamline the implementation of native forest restoration projects, with the fee revenues being reinvested to support and scale complementary high-integrity domestic REDD+ activities and, eventually, to compensate the impact of the corresponding adjustments applied (Figure 3).

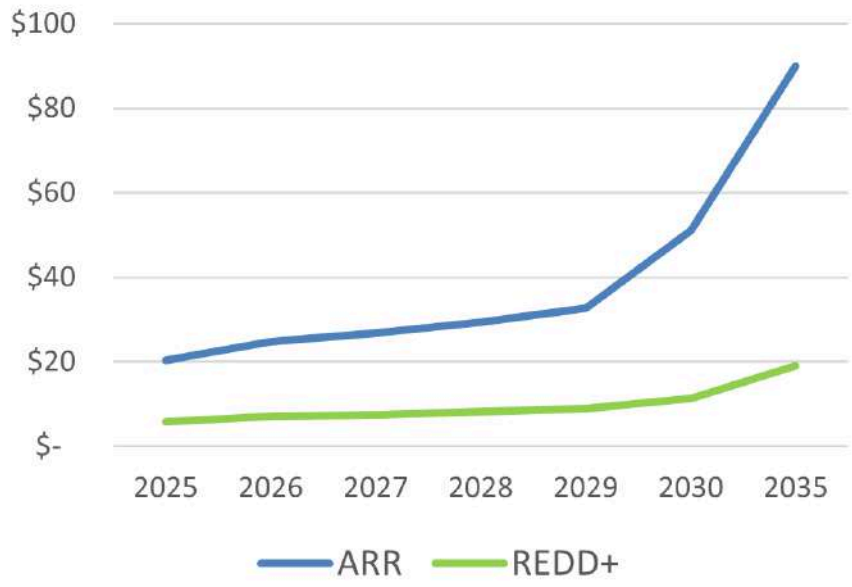


FIG. 03 Estimated carbon price trajectory for ARR and REDD+ in the VCM.

Source: EOS Consulting, based on average market price estimates (S&P Global, Fastmarkets, and AlliedOffsets).

This scenario assumes that the government could consider initially authorizing a volume of mitigation equivalent to 5% of the PLANAVEG target, which would result in an estimated potential authorisation of 327 $MtCO_2e$ between 2026 and 2030. Given the higher volume of domestic mitigation generated by the fulfilment of commitments within the country, by 2035 this authorised volume could increase its share to 10% of the PLANAVEG target, whilst maintaining the level of authorisations. For Scenario 3, it is assumed that the average cost of restoring native vegetation in public and private areas, in present value terms, is US$ 16.87/tCO_2e in 2030 and US$ 19.32/tCO_2e in 2035, considering the Amazon biome, a cost that should be read alongside the opportunity costs of competing land uses, which represent a key driver of restoration viability at scale. In parallel, a price trajectory is considered that aligns with the global premium to be paid for high-integrity ARR credits, estimated at US$ 51.08/tCO_2e in 2030 and US$ 90.04/tCO_2e in 2035.

In this context, the application of a 20% authorisation fee on transactions — calibrated on the typical price differential between REDD+ and ARR credits — allows for the structuring of a cross-financing mechanism, in which the revenue generated by the authorisation of ARR credits supports high-integrity domestic REDD+ activities. In practical terms, this logic implies that for each hectare restored via ARR, it would be possible to additionally finance the conservation of one hectare via REDD+, expanding the net climate impact of the mechanism. This equivalence was assumed for modelling purposes and based on observed price differentials, but it may be possible that this revenue stream is sufficient to ensure even more ambitious conservation commitments.

It is equally important to acknowledge the limitations embedded in the analysis. Carbon price trajectories, both domestic and international, are inherently forward-looking and subject to policy developments, market dynamics, and geopolitical factors that cannot be fully anticipated. The quantitative results should therefore be read as indicative ranges to inform policy deliberation, not as precise forecasts. In addition to the three pathways analysed, the results point to the potential of a hybrid approach that combines elements of Pathways 2 and 3. Such a strategy would simultaneously accelerate industrial decarbonisation and scale up nature-based solutions, maximising economic, social and environmental benefits.

MARKET'S PERSPECTIVES

Biomas · Unlocking Ecological Restoration at Scale through Corresponding Adjustments

Large-scale ecological restoration projects in Brazil present high upfront capital expenditure (BRL 20,000–50,000/ha), long investment cycles, and exposure to foreign exchange risk. The offtake market remains highly concentrated, limiting the revenue predictability that long-term restoration investments require. Article 6 mechanisms address this structural gap directly: demand signals from buyer countries indicate potential ITMO demand of up to 570 $MtCO_2$ annually by 2040–2050, complemented by CORSIA, up to 1,500 $MtCO_2$ by 2035. Article 6 markets are linked to compliance needs and national targets, offering stronger demand signals and longer-term revenue visibility. For high-integrity restoration projects, corresponding adjustments are the critical enabling mechanism: without them, projects remain largely confined to voluntary market dynamics; with them, they can access compliance-driven demand, combining climate outcomes with biodiversity conservation and socioeconomic co-benefits for local communities.

Mombak · Scaling Carbon Removal through Article 6 Cooperation

Brazil is emerging as a significant supplier of high-integrity carbon dioxide removal (CDR). Yet, medium-term VCM demand is expected to concentrate and approach saturation for premium credits, while the price differential between domestic values and international willingness to pay signals a structural financing gap that Article 6 mechanisms could address.CDR projects can deliver climate outcomes alongside multiple co-benefits. ARR activities can advance large-scale restoration of deforested areas in the Amazon, generating higher employment intensity than prior land uses, formal job creation, and income diversification for rural landowners and fostering biodiversity of fauna and flora. ERW activities can integrate carbon removal into productive agricultural landscapes, improving soil chemistry and reducing dependence on imported inputs. Predictability on authorizations enable access to compliance-driven demand and upfront financing for projects of this kind and the benefits they generate.

Future Climate Group · Mobilizing Climate Finance for Large-Scale Landscape Recovery

Landscape restoration initiatives, such as Todos pelo Araguaia led by the Government of Mato Grosso and focused on the revitalization of the Upper Araguaia Basin, are critical for promoting water security, agricultural production, and environmental resilience. Such programs can integrate the recovery of degraded lands, restoration of riparian zones, promotion of agroforestry systems, and active engagement of landowners and local communities. Beyond that, establishing carbon projects integrated with such programs and restoration targets can unlock a long-term pipeline for carbon removal credit generation, embedded in a broader strategy to mobilize capital for sustainable land management and green infrastructure. Article 6 represents a natural pathway to scale initiatives of this kind. Beyond carbon removal, such initiatives can deliver measurable co-benefits, illustrating how jurisdictional programs can function as scalable investment platforms that align climate mitigation outcomes with broader socio-economic development objectives.

The new **Pathway 4** assessed in this paper combines elements of Pathways 2 and 3, simultaneously leveraging Article 6 to enable decarbonization in hard-to-abate sectors and to expand nature-based solutions, initially focusing on ARR, as described in Pathway 3. As a core premise, 50% of the mitigation outcomes remain in Brazil to contribute directly to the fulfilment of the NDC, whilst the remainder may be authorised for international use, subject to environmental integrity criteria and regulatory alignment. Regarding this last premise, it is important to note that the interaction between the authorisation of ITMOs and NDC compliance was explicitly addressed in the modelling, allowing for a more precise assessment of the trade-offs between decisions on mitigation exports and domestic compliance with climate targets.

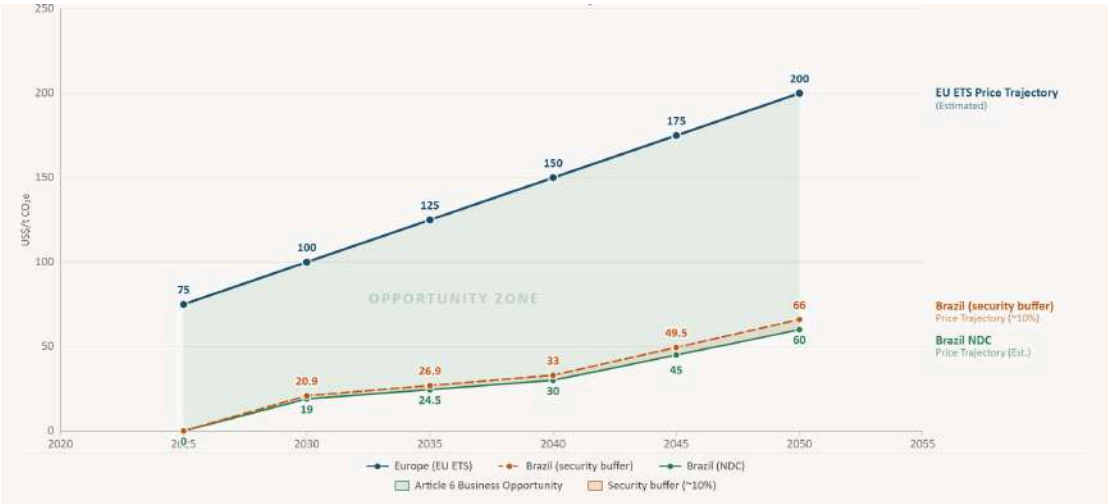


FIG. 04 SBCE and EU ETS forecast price trajectories (Pathway 4).

Source: EOS Consulting, based on MF (2025)

At the heart of this pathway is an overarching principle that reflects a fundamentally pragmatic orientation: one focused on cost-effectively accelerating NDC achievement by unlocking private investment in high-cost mitigation activities that would not otherwise occur under domestic or voluntary market incentives alone. Private investments in emission reductions or removals that meet pre-defined criteria and fulfil the SBCE quality requirements for generating CRVEs would unlock ITMO authorization for up to 50% of the mitigation outcomes generated by eligible projects. The remaining share is retained domestically, available to contribute to Brazil's NDC.

MARKET'S PERSPECTIVES

BeZero Carbon · Using CCPs and CORSIA as reference points for authorisation in Brazil

International frameworks that apply methodology-level assessments can play a role as reference points in Brazil's approach to authorising carbon credits for international use. From a global market perspective, they help maintain the fungibility and flexibility of the supply-side of the market to pivot to a range of demand pools. However, these market labels do not need to be treated as automatic or sufficient proxies for integrity.

In this context, granting corresponding adjustments to credits aligned with recognised frameworks is likely to improve access to international demand and reinforce pricing premiums for higher-integrity supply. This is particularly relevant for CORSIA, where supply remains constrained by host country authorisations and eligible credits continue to command a compliance-driven premium. In practice, Brazil can leverage a multi-layered approach to align with recognised international frameworks to maintain market compatibility, while tailoring to the national context by overlaying additional safeguards. This could include independent, project-level risk assessment and strong transparency and registry systems when granting corresponding adjustments. Eventually, the combination of international alignment and project-level, risk-based scrutiny can contribute to build long-term market confidence.

While the application of a common quality criteria to determine which carbon credits are eligible for use within domestic compliance systems has become increasingly common practice, such an approach has yet to be consistently reflected in Article 6.2 bilateral agreements. In this context, a sensitive balance is desired between ensuring common criteria to preserve the credibility of international markets and over-restricting the engagement frameworks by applying methodological constraints that may undermine broader market participation. This qualitative discussion is one natural next step in the process of developing and refining Brazil's Article 6 engagement framework.

It is important to note that the carbon price trajectories adopted in the model have been recalibrated based on ongoing public policy discussions in Brazil, including proposals relating to the regulation of the SBCE and institutional analyses of the implicit carbon prices required to meet the NDC, through the PMI Brazil initiative. Therefore, the EU ETS trajectory remains as in Pathway 2, but the national trajectory is slightly modified to align with PMI Brazil.

Furthermore, for Pathway 4, the assumption of a security buffer is adopted as a conservative criterion for the authorisation of credits under Article 6. Specifically, only emission reductions whose marginal abatement cost is at least 10% higher than the carbon price trajectory estimated by the Ministry of Finance under PMI are considered eligible for international trading. This mechanism ensures that the most cost-effective mitigation options for domestic NDC compliance remain fully available to Brazil, whilst allowing the country to capture additional revenue under a conservative Article 6 engagement strategy.

The inclusion of ARR activities within this pathway reflects a design choice rather than a standard application of the hard-to-abate eligibility criteria: given the significant social co-benefits associated with forest restoration and the implementation challenges, ARR was treated as an exceptional case warranting differentiated engagement under Article 6. This results in a more balanced pathway that promotes both technological and nature-based decarbonisation solutions. Other activities may also deliver critical climate and socioeconomic impacts that justify similar differentiated treatment, and may be subject of further studies.

It is worth noting that the pathways assessed in this study are part of an ongoing and non-exhaustive exercise on potential options that could facilitate a robust initial engagement of Brazil with Article 6.

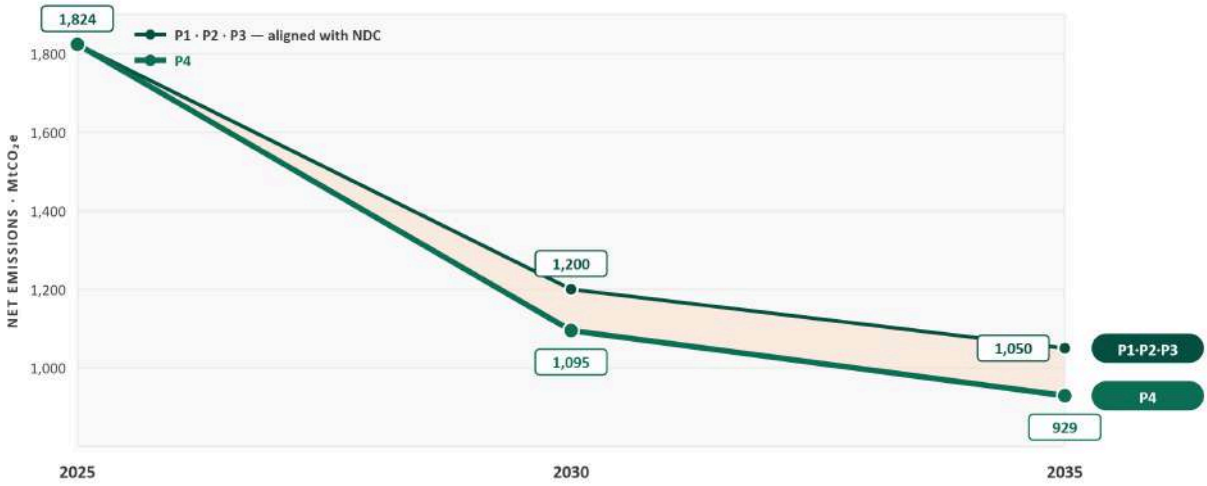


FIG. 05 Net emissions (MtCO2e) in each proposed pathway, compared to the upper limit of Brazil's NDC.

Source: EOS Consulting / IMACLIM-BR

03

Results and discussion

Macroeconomic, environmental and social outcomes for Pathways 1, 2, 3, and 4 — modelled with IMACLIM-BR and compared against the reference scenario of domestic SBCE consolidation.

The simulations conducted with the IMACLIM-BR model assessed the economic, social, and environmental impacts of the four proposed pathways for the integrated implementation of the SBCE, the international cooperative approaches under Article 6 of the Paris Agreement, and the strengthening of the VCM. Results are presented comparatively, taking Pathway 1, focused on the domestic consolidation of the SBCE and its gradual integration with the VCM, as the reference scenario for analysing the other pathways.

Pathway 1 represents the regulatory reference scenario, in which Brazil opts to engage with Article 6 only after achieving its NDC in terms of sequencing, not considering it as mechanism to support such achievement and focusing firstly on establishing robust rules for carbon credits to become CRVEs under the SBCE to increase investment directed towards mitigation activities in the country.

In this scenario, GDP grows from BRL 11.6 trillion in 2025 to BRL 15.1 trillion in 2035 (2023 BRL), reflecting an average expansion rate of approximately 2.7% per year, consistent with the projections of the "Plano Clima Mitigação" and the "Plano de Transição Ecológica". GDP per capita increases from BRL 54.5 thousand to BRL 69.4 thousand over the same period, indicating real gains in income and productivity. The unemployment rate stabilises between 7.6% and 8.1%, with around 110.7 million full-time equivalent (FTE) jobs by 2035. The trade balance remains slightly positive, around 1.15% of GDP in 2035, and sectoral inflation remains under control.

On the environmental front, net emissions fall from 1,824 $MtCO_2e$ in 2025 to 1,050 $MtCO_2e$ in 2035, in line with Brazil's NDC target of a 59–67% reduction relative to 2005 levels. The emissions intensity of GDP decreases from 0.16 $kgCO_2e$/BRL in 2025 to 0.07 $kgCO_2e$/BRL in 2035, demonstrating a structural decoupling between economic growth and greenhouse gas emissions.

From a social perspective, household purchasing power grows significantly, especially among lower-income groups. The poorest 20% of the population see their purchasing power increase 1.70 times between 2015 and 2035, as a result of expanded domestic consumption, price stability, and increased real income.

Overall, the results for this pathway indicate a framework of macroeconomic and environmental stability, serving as an important reference for the development of regulations capable of unlocking investment towards NDC achievement and building the foundation for future engagement with Article 6.

However, by focusing primarily on the domestic consolidation of the SBCE and its potential to expand demand and investment in the VCM, this pathway limits the potential for additional revenues and investment flows — particularly to support the achievement of short-term climate commitments — that could be unlocked through international cooperation and are explored in Pathways 2, 3, and 4. The macroeconomic stability projected under Pathway 1 is conditional on the maintenance of a fiscal trajectory compatible with reduced uncertainty, stable real interest rates, and preserved public and private investment capacity. As a long-term modelling exercise, the results are subject to significant uncertainty regarding the evolution of fiscal conditions, particularly given pressures on public expenditure, debt dynamics, cost of capital, and the financing requirements of structural climate transition policies.

The results of Pathway 1 should therefore be interpreted as a reference trajectory under relatively stable macroeconomic conditions, not as an unconditional projection. Importantly, this fiscal risk reinforces the relative attractiveness of Pathways 2, 3, and 4: mechanisms capable of attracting external capital, reducing the marginal cost of mitigation, and complementing domestic financing capacity would gain additional strategic relevance in a context of greater fiscal constraint.

Some of the short-term commitments referred to are anchored in a goal of zero illegal deforestation across all biomes by 2030 and the restoration of 12 million hectares of native vegetation by 2030, not to mention Brazil's NDC of reducing from 59% to 67% of all GHG emissions by 2035, relative to a 2005 baseline. These and other climate goals and related policies were more deeply assessed in our previous working paper, "Carbon Market Frameworks for Brazil".

Pathway 2 introduces Article 6 mechanisms as instruments of international financing for mitigation efforts in hard-to-abate industrial and energy sectors, fostering technology transfer, foreign investment, and the acceleration of industrial modernisation.

MARKET'S PERSPECTIVES

Mitsui · Leveraging Article 6 for Industrial Decarbonization and Energy Security

Brazil is well positioned to scale renewable power generation, bioenergy, and advanced biofuels, leveraging its natural resource base and established industrial capabilities to reduce dependence on imported strategic inputs. Article 6 cooperation can play a catalytic role in these pathways by improving project bankability, reducing investment risk, and enabling access to international demand. Beyond energy systems, the integration of carbon capture and storage into industrial processes, such as ethanol production, and the deployment of approaches such as carbon farming, BECCS, and biochar offer additional avenues for durable emissions reductions, particularly relevant in Brazil given biomass availability and land-use dynamics.

Taken together, these opportunities position Article 6 not merely as a supplementary market mechanism, but as a strategic channel for aligning international demand with Brazil's domestic mitigation and removal potential. By enabling access to compliance-driven markets and supporting technology deployment in hard-to-abate sectors, international cooperation under Article 6 can enhance both the cost-effectiveness and ambition of Brazil's NDC, mobilizing private investment and international expertise toward activities that advance climate goals alongside energy security and industrial competitiveness.

In this scenario, GDP records an incremental gain of 1.07% in 2035 over the reference scenario, reaching BRL 15.3 trillion, supported by foreign investment inflows of BRL 53.8 billion in 2030 and BRL 71.6 billion in 2035, stemming from ITMO transactions and industrial partnerships. The trade balance improves slightly, reaching 2.09% of GDP, reflecting the expansion of industrial activities and technological services associated with climate innovation.

The export of ITMOs totals 99.7 $MtCO_2e$ in 2030 and 106.1 $MtCO_2e$ in 2035, with corresponding adjustments ensuring environmental integrity and NDC compliance. Before the application of these adjustments, emissions would reach 944 $MtCO_2e$ in 2035, compared to 1,050 $MtCO_2e$ after adjustment, to ensure the achievement of the NDC as well as the transparency and credibility of the process.

It is important to note that the measures assessed in this pathway — typically hard-to-abate — do not belong to the least-cost portfolio for achieving Brazil's NDC. While not a priority in the short-term for domestic mitigation, they are attractive to developed countries, where marginal abatement costs are significantly higher. In this context, Article 6 enables Brazil to convert cost differentials into financing and technology-learning opportunities.

From a social perspective, household purchasing power follows a trajectory similar to that of Pathway 1, with a slight income increase among middle-income classes and greater generation of skilled jobs. The technological transition exerts a moderate inflationary effect (≈ +1.04%), while contributing positively to productivity, fiscal revenues, and industrial sophistication.

In summary, while Pathway 2 demonstrates that the strategic use of Article 6 can combine industrial decarbonisation, foreign capital attraction, and macroeconomic gains — positioning Brazil as a competitive provider of mitigation outcomes and low-carbon technologies — its benefits tend to be initially concentrated in capital-intensive sectors and may take longer to translate into broad-based social and environmental gains.

TABLE 1 · Mitigation options sectorally in ITMO exports and their aggregate share in hard-to-abate sectors, in 2030 and 2035. · Source: EOS Consulting / IMACLIM-BR

SECTOR	ITMOS POTENTIAL 2030 ($MTCO_2E$)	ITMOS POTENTIAL 2035 ($MTCO_2E$)	SECTORAL PARTICIPATION (%)
O&G	7.74	10.33	**8%**
Transports	53.06	70.74	**53%**
CCS	34.61	46.14	**35%**
Steel	1.50	2.00	**1%**
Other Industries	0.83	1.11	**1%**
Chemical	2.33	3.10	**2%**
Total	**100.06**	**133.41**	**100.0%**

To complement the previous assessments, **Pathway 3** explores a more inclusive use of international cooperation — one that leverages Brazil's comparative advantages in nature-based solutions to deliver short-term, large-scale mitigation outcomes with the potential to foster rural development, biodiversity protection, and community resilience.

Pathway 3 directs Article 6 cooperation towards nature-based solutions (NBS), especially ARR, reinvesting authorisation revenues into high-integrity domestic REDD+ activities. In macroeconomic terms, GDP reaches BRL 15.34 trillion in 2035, representing 1.40% above Pathway 1, as a result of the dynamism of forestry chains and the multiplier effect of local investments. The trade balance remains in surplus (1.2% of GDP), and employment levels grow slightly, reaching 111 million FTE jobs in 2035.

The volume of ITMOs exported is 109.2 $MtCO_2e$ in 2030 and remains at the same level in 2035, being relatively small compared to the total mitigations to be generated by achieving the target, but the net revenues generated are significant, estimated at BRL 30.1 billion and BRL 53.1 billion respectively, reflecting the high market value of ARR credits (US$51/$tCO_2e$ in 2030; US$90/$tCO_2e$ in 2035).

The combination of relatively lower restoration costs and higher international prices generates a significant economic differential, creating attractive margins for investors over time. Such transaction margins tend to expand over the analysed horizon, driven mainly by the expected appreciation of high-integrity ARR carbon credits in the international market allowing reinvestments into further mitigations.

From a social perspective, the purchasing power of the poorest population achieves the greatest gain among all pathways, growing 1.74 times between 2015 and 2035, driven by job creation in forest restoration (generally requiring lower qualifications), the appreciation of the rural economy, and the socio-environmental co-benefits of community-focused carbon projects.

The inflationary impact is slightly higher (index 1.09 compared to Pathway 1), due to the increase in domestic demand, the rise in average wages as a result of lower unemployment, and the appreciation of agricultural inputs, but it remains within stable and manageable macroeconomic limits.

Treatment of REDD+ and JREDD+ · Their importance for Brazil's carbon market framework

REDD+ credits can come either from project-based REDD+ or jurisdictional REDD+ programmes, which have different, yet complementary roles. While project-based REDD+ generates credits from focused interventions, jurisdictional programmes aggregate mitigation outcomes across entire landscapes or administrative units, typically under governmental oversight and aligned with accounting approaches that speak to the national NDC frameworks. In this sense, jurisdictional credits, in light of their programmatic scale, alignment with governmental accountability, and national MRV systems, may present certain advantages in the context of ITMO authorisation and international transfer arrangements, particularly if countries adopt approaches consistent with those reflected in CORSIA eligibility requirements. While CORSIA does not broadly accept REDD+ credits, it explicitly recognizes certain jurisdictional approaches, including the Architecture for REDD+ Transactions (ART) and specific scenarios under Verra's Jurisdictional and Nested REDD+ (JNR) framework. In this sense, considering the importance that such activities might represent for the feasibility of CORSIA in the short and medium-term, the possibility of providing authorizations to such activities should also be assessed and considered. Still, this does not diminish the relevance of project-based REDD+ activities, which can play a complementary role alongside jurisdictional programmes in mobilising finance, delivering mitigation outcomes, and advancing broader climate objectives under different Article 6 implementation approaches.

Pathway 3 therefore confirms that Brazil can consolidate its position as a global provider of high-integrity nature-based solutions, combining economic gains, environmental restoration with conservation and reducing regional inequalities. This approach favours broad social and environmental gains, promoting territorial inclusion, income generation in rural areas, and the strengthening of traditional communities.

Pathway 4 combines elements of Pathways 2 and 3, simultaneously leveraging Article 6 to enable decarbonisation in hard-to-abate sectors and expanding nature-based solutions. As a central premise, only 50% of the mitigation outcomes generated by approved projects are authorised as ITMOs, while the remaining share of credits contributes directly to the achievement of Brazil's NDC. This approach seeks to balance the capture of opportunities in international carbon markets with the preservation of the economic and environmental efficiency of the domestic strategy.

It is worth clarifying that, unlike the 20%-authorization fee that had been adopted in Pathway 3, in which the revenue generated by the authorisation of ARR credits supports high-integrity domestic REDD+ activities, Pathway 4 does not assume the application of such a fee — the 50% authorization rule constituting the sole constraint applied in terms of authorisation volumes for eligible activities.

From an economic perspective, the scenario presents significant revenue generation potential from the international commercialization of these credits, estimated at approximately BRL 42 billion in 2030 and BRL 72 billion in 2035, reflecting both the expected appreciation of high-integrity carbon credits and the complementarity between different mitigation sources.

TABLE 2 · Mitigation potentials, distribution between export under Article 6 and domestic use, and associated revenues – Pathway 4 (2030 and 2035) · Source: EOS Consulting / IMACLIM-BR

CATEGORY	2030				2035			
	TOTAL POTENTIAL $MTCO_2E$	YEARLY EXPORTED $MTCO_2E$	RETAINED IN BRAZIL $MTCO_2E$	REVENUE BRL MILLION	TOTAL POTENTIAL $MTCO_2E$	YEARLY EXPORTED $MTCO_2E$	RETAINED IN BRAZIL $MTCO_2E$	REVENUE BRL MILLION
Hard-to-abate	100.06	50.03	50.03	**27,016**	133.42	66.71	66.71	**45,027**
ARR	109.18	54.59	54.59	**15,058**	109.18	54.59	54.59	**26,542**
Total	**209.24**	**104.62**	**104.62**	**42,074**	**242.59**	**121.30**	**121.30**	**71,569**

The volume of reductions and removals retained in Brazil — estimated at 105 $MtCO_2e$ in 2030 and 121 $MtCO_2e$ in 2035 — represents a decisive contribution to achieving the NDC, by directly affecting both the marginal cost and the level of ambition of the domestic effort. In particular, by 2035 this volume is of the same order of magnitude as the gap between the upper and lower bounds of Brazil's target range, implying that its domestic retention alone could enable a shift from the upper towards the lower bound of the NDC. If the country is already aligned with the more ambitious trajectory, this additional volume would allow emissions to fall below the lower bound, significantly increasing the level of climate ambition. Alternatively, if the country is off track to achieve its NDC due to the failure to implement even the least-cost mitigation measures available, engagement under Article 6 could still play a corrective role by reducing the mitigation gap. This therefore constitutes a concrete operationalization of Brazil's NDC text, which explicitly recognizes the role of market mechanisms and international cooperation as instruments to enhance ambition and reduce the cost of compliance with climate targets.

An important consideration regarding the environmental outcomes of each proposed pathway is that across the three first pathways, net emissions are projected to reach approximately 1,050 $MtCO_2e$ in 2035, consistent with Brazil's NDC target. In Pathway 4, however, due to the additional mitigation outcomes accounted towards the Brazilian NDC, net emissions reach 1,095.4 $MtCO_2e$ in 2030 and 928.7 $MtCO_2e$ in 2035, beyond the NDC commitment.

Moreover, both activity categories assessed present strong, complementary cases: ARR activities generate catalytic co-benefits, such as rural employment, bioeconomy supply chain development, biodiversity and water security that extend well beyond their direct carbon removals; hard-to-abate sectors are unlikely to decarbonise within the relevant policy timeframe under domestic market signals alone, and early Article 6 engagement can accelerate technology deployment.

In summary, Pathway 4 combines elements of the previous scenarios, simultaneously advancing decarbonization in hard-to-abate sectors and expanding nature-based solutions, under a conservative approach to Article 6 engagement. In this scenario, GDP reaches BRL 13.31 trillion in 2030 and BRL 15.32 trillion in 2035, representing a marginal gain of approximately +0.4% in 2030 and +1.2% in 2035 relative to Pathway 1. The trade balance remains positive, reaching 0.18% of GDP in 2030 and 1.60% in 2035.

In the labour market, results show a positive and consistent effect. Employment levels remain high, with approximately 110.7 million FTE jobs in 2030 and 110.9 million in 2035. Relative to Pathway 1, Pathway 4 generates approximately 190,000 additional FTE jobs in 2035, performing better than Pathway 2 (70,000 additional FTE jobs) and approaching Pathway 3 (440,000 additional FTE jobs), reflecting the combination of capital-intensive activities and more labour-intensive nature-based solutions. ARR activities play a central role, given their labour-intensive nature and broad territorial reach.

From an environmental perspective, Pathway 4 delivers the most ambitious outcomes. Net emissions reach 1,095.4 $MtCO_2e$ in 2030 and decline to 928.7 $MtCO_2e$ in 2035, positioning Brazil not only within its NDC target but significantly below its upper bound. Emissions intensity of GDP improves to 0.08 $kgCO_2e$/BRL in 2030 and 0.06 $kgCO_2e$/BRL in 2035, reinforcing the decoupling between economic growth and emissions.

From a social perspective, the scenario maintains strong gains in income and consumption, with the purchasing power of the poorest population increasing by 1.49 times by 2030 and 1.72 times by 2035 (2015=1 baseline). Inflationary impacts remain moderate (price index of 1.021 in 2030 and 1.054 in 2035), lower than in Pathway 3.

A relevant issue in interpreting the results concerns the risk of authorizing ITMOs while potentially failing to meet the domestic NDC. The analysis of Pathway 4 suggests that this risk is structurally mitigated by design. The combination of a security buffer — restricting export eligibility to measures with marginal costs above those required for domestic compliance — and the retention of 50% of mitigation outcomes ensures that the most cost-effective options remain fully available for Brazil's NDC achievement. In addition, the inflow of external investment directed toward higher-cost measures expands the overall mitigation portfolio without competing with the core domestic strategy.

In sum, Pathway 4 demonstrates that it is possible to combine economic efficiency, climate ambition, and strategic integration into international markets. By preserving lower-cost domestic options through the security buffer while simultaneously leveraging opportunities for mitigation exports, the scenario positions Brazil as a key actor both in achieving its NDC and in contributing to lowering the global cost of the climate transition.

TABLE 3 · ALL PATHWAYS · 2015–2035

Comparative summary of modelling results

TABLE 3 · Comparative Summary of Modelling Results. Source: EOS Consulting based on IMACLIM-BR results. Pathway 4 column highlighted. Pathway 1 = reference (domestic SBCE consolidation). All monetary values in 2023 BRL unless stated. FTE = full-time equivalent jobs. "—" = not applicable for this pathway/period.

INDICATOR	BASELINE			PATHWAY 1		PATHWAY 2		PATHWAY 3		PATHWAY 4		UNIT
	2015	2020	2025	2030	2035	2030	2035	2030	2035	2030	2035	
Population (IBGE)	202	209	213	219	218	219	218	219	218	219	218	Millions
GDP (BRL 2023)	10,002	9,767	11,599	13,254	15,135	13,282	15,297	13,319	15,343	**13,310**	**15,321**	BRL bn
GDP growth (vs. ref)	—	—	—	—	—	0.21%	1.07%	0.49%	1.37%	**0.42%**	**1.20%**	% of GDP
GDP per capita	49.5	46.7	54.5	60.5	69.4	60.6	70.2	60.8	70.4	**60.8**	**70.3**	'000 BRL/hab
Trade balance	0.40	1.60	0.05	-0.10	1.15	0.28	2.09	-0.02	1.24	**0.18**	**1.60**	% of GDP
Unemployment rate	9.5	7.6	8.1	7.58	8.08	7.60	8.09	7.55	7.81	**7.56**	**7.93**	%
Employment positions	102	108	109	110.70	110.71	110.67	110.78	110.84	111.15	**110.72**	**110.90**	Millions FTE
New employment positions (vs. ref)	—	—	—	—	—	-30	70	140	440	**20**	**190**	Thousand FTE
Price index (vs. ref)	—	—	—	—	—	1.026	1.046	1.026	1.090	**1.021**	**1.054**	Index
Net emissions	1,562	1,824	1,824	1,200	1,050	1,200	1,050	1,200	1,050	**1,095.4**	**928.7**	$MtCO_2e$
Carbon price (NDC)	—	—	—	—	—	19	26.5	19	26.5	**19**	**26.5**	$US\$/tCO_2e$
ITMO selling price	—	—	—	—	—	100	125	51	90	**74.5**	**109.3**	$US\$/tCO_2e$
ITMOs exported per year	—	—	—	—	—	99.71	106.1	109.2	109.2	**104.6**	**121.3**	$MtCO_2e/yr$
ITMOs exported — Cumulative 2030–2035	—	—	—	—	—	617.4		655.2		**677.6**		$MtCO_2e$
Foreign investment	—	—	—	—	—	53.8	71.6	30.1	53.1	**42.1**	**71.6**	BRL bn
Foreign investment — Cumulative 2030–2035	—	—	—	—	—	376.3		249.6		**341.1**		BRL bn
Emissions per capita	7.7	8.7	8.6	5.5	4.8	5.5	4.8	5.5	4.8	**5.0**	**4.3**	tCO_2e/hab
Emissions intensity	0.16	0.19	0.16	0.09	0.07	0.09	0.07	0.09	0.07	**0.08**	**0.06**	$kgCO_2e/BRL$
Purchasing power – Class 1	1.00	1.08	1.26	1.48	1.70	1.48	1.70	1.49	1.74	**1.49**	**1.72**	2015=1
Purchasing power – Class 2	1.00	1.04	1.21	1.43	1.61	1.42	1.61	1.43	1.64	**1.43**	**1.62**	2015=1
Purchasing power – Class 3	1.00	1.04	1.21	1.35	1.51	1.35	1.51	1.36	1.54	**1.35**	**1.53**	2015=1
Purchasing power – Class 4	1.00	1.01	1.15	1.28	1.44	1.28	1.44	1.29	1.46	**1.29**	**1.45**	2015=1

04

Final considerations and limitations

Strategic implications for SBCE design, Article 6 engagement, and Brazil's positioning as a global leader in high-integrity carbon market governance.

The results indicate that establishing the institutional foundation of the SBCE and its articulation with the voluntary market highlighted under Pathway 1 remains a necessary condition to ensure the integrity, predictability, and credibility of an integrated Brazilian carbon market. However, the analysis shows that the strategic combination of domestic instruments with international cooperative approaches — as explored in Pathways 2, 3, and Pathway 4 — significantly enhances the country's economic, social, and environmental potential. This approach enables the transformation of cost differentials into tangible opportunities for financing, innovation, and income generation.

In addition, a recurring concern in discussions among host countries on Article 6 relates to the risk of authorizing ITMOs while simultaneously failing to meet the NDC. The results of this study, although not exhaustive, indicate that this risk can be substantially mitigated, particularly Pathway 4 represent an example of that. First, the adoption of a security buffer ensures that only measures with marginal costs above the domestic cost trajectory to achieve the NDC are eligible for export, fully preserving the portfolio of lower-cost options required for NDC compliance. Second, the rule mandating the retention of 50% of mitigation outcomes within the country ensures that a significant share of reductions remains available for domestic efforts, contributing not only to achieving the target but also to lowering its marginal cost. Finally, the logic of attracting external investment toward higher cost, not prioritized domestically measures expands the total volume of available mitigation, reducing the risk of scarcity of options over time. Although uncertainties remain regarding international carbon price dynamics, the proposed design incorporates sufficient economic and regulatory safeguards to ensure that Brazil's participation in Article 6 reinforces, rather than undermines, its trajectory of compliance and increasing climate ambition.

In this context, Pathway 4 stands out as a particularly robust and balanced configuration, coherently combining industrial decarbonization with nature-based solutions, anchored in two core premises: (i) the retention of a significant share of reductions and removals for domestic NDC compliance, and (ii) the adoption of a conservative security buffer, ensuring that only measures with marginal costs above the domestic threshold are eligible for export. This architecture preserves the most cost-effective mitigation options for Brazil while enabling the capture of external revenues and the attraction of investment.

From an environmental perspective, Pathway 4 demonstrates a higher level of ambition, positioning the country not only within its NDC target but significantly below its upper bound by 2035. This outcome stems directly from the domestic retention of substantial additional mitigation volumes — on the order of 121.3 $MtCO_2e$ — which alone would enable a shift from the upper towards the lower bound of its NDC range. This represents a concrete operationalization of the Brazilian NDC, which explicitly recognizes the role of market mechanisms as tools to enhance climate ambition.

From an economic standpoint, Pathway 4 combines efficiency gains with diversification of growth drivers. The scenario delivers solid macroeconomic performance, with GDP expansion above the reference scenario, maintenance of external balance, and significant revenue generation from ITMO commercialization. By channelling to international markets emission reductions achieved at lower costs than those observed in developed economies, Brazil contributes to reducing the global cost of implementing the Paris Agreement, while simultaneously capturing financial and technological flows that reinforce its own decarbonization trajectory.

From a social perspective, the results highlight the potential for a just and inclusive transition, with consistent gains in income and employment. In particular, the strong contribution of nature-based solutions — especially ARR — introduces a labour-intensive component, with direct effects on job creation in rural areas and on the dynamism of regional economies. This feature distinguishes Pathway 4 by combining technological sophistication with territorial inclusion, broadening the distribution of the socio-economic benefits of the transition. Overall, the results indicate that the different pathways should not be interpreted as mutually exclusive alternatives, but as components of a potential integrated and scaled strategy.

Beyond the aspects already discussed, it is essential to recognise a structural feature of developing economies — and particularly of Brazil — that decisively shapes the role of carbon markets: the relative scarcity of capital. While the country has a broad and diversified portfolio of mitigation opportunities — anchored in its extensive territory, high availability of natural resources, relatively clean energy matrix, and strong potential in nature-based solutions — the central limitation to their large-scale implementation lies in the cost and access to financing. Brazil has historically faced some of the highest costs of capital in the world, with real interest rates among the highest globally.

In this context, international market mechanisms play a strategic role by enabling the entry of external capital under potentially more favourable conditions. By allowing the monetisation of mitigation outcomes and their commercialisation in markets with greater willingness to pay, these instruments function as a channel for capital cost and marginal abatement cost arbitrage, unlocking investments that would otherwise not occur at the necessary pace or scale.

Finally, this study reinforces that Brazil has a unique strategic opportunity to position itself as a global leader in carbon market governance. By aligning robust domestic instruments with a well-calibrated international engagement, the country can simultaneously reduce the cost of its own transition, raise its level of climate ambition, and contribute decisively to the global economic efficiency of the mitigation effort. The adoption of an evidence-based approach, combined with continuous dialogue between government, the private sector, and society, will be fundamental to transforming this potential into concrete results, consolidating a coherent, efficient, and high-integrity carbon market capable of sustaining the country's long-term development in a context of increasing climate urgency.

Limitations and Recommendations for Future Studies

The results presented in this study should be interpreted in light of a relevant set of uncertainties inherent to long-term economic modelling and the dynamic nature of carbon markets. In particular, uncertainties associated with future carbon price trajectories, both in Brazil and in international markets, stand out — these depend on regulatory, geopolitical, and global climate ambition factors. When assuming the price trajectories of ARR credits internationally, to estimate the "willingness" to pay of international buyers, a certain degree of uncertainty is embedded in the assumption. In terms of the study's results, a higher-oil-price scenario would tend to amplify the relevance of instruments capable of channelling investment toward clean technologies and reducing transition risks, reinforcing rather than reversing the study's central conclusions. This, however, does not ultimately threaten the consistency and robustness of the estimates dramatically.

Additionally, there are relevant uncertainties related to mitigation costs, the technical and economic potential of different abatement options, and the pace of development and diffusion of new technologies, especially in hard-to-abate sectors. These elements directly influence the relative competitiveness of mitigation options and, consequently, the economic viability of the different pathways analysed.

Another important point concerns the limitations of the reference data used. A significant portion of the cost and mitigation potential estimates derives from earlier studies — such as the "Opções de Mitigação" project — which, while robust, reflect a technological and economic context that has already been evolving rapidly. Furthermore, as in any integrated modelling exercise, a certain degree of market efficiency and economic rationality is assumed, which may not fully materialise in the short term due to institutional barriers, market failures, or financing constraints.

One limitation embedded in the design choices of pathway 4 regards the chosen 50% credit retention rule, which was designed to safeguard domestic NDC compliance, but may constrain the financial viability of certain high-cost mitigation projects. The proportion of mitigation outcomes available for international commercialization directly affects revenue projections and investment returns, and a fixed retention rate may not be equally suited to the diverse business models and cost structures of different project types. Further studies assessing the financial implications of alternative retention ratios across specific sectors and project categories would be valuable.

MARKET'S PERSPECTIVES

Unicarbo · The additionality component in landfill gas related activities

In Brazil, landfills can provide a significant opportunity to cut methane while generating renewable energy, either in the form of electricity, biomethane, or both. But turning biogas into power takes serious upfront capital. Without carbon finance and Article 6 as one of the financing instruments, setting up advanced capture and flaring systems just isn't economically viable for most operators — especially smaller sites outside major urban centers. If these facilities are designed with climate goals in mind from day one, they stop being just waste deposits and start acting as decentralized power plants. It's a shift that cleans up municipal waste, creates local jobs, and draws in private investment. With a clearer regulatory framework, Brazil could easily scale this model, proving that even smaller municipalities can drive real environmental value as well as significantly increase efficiency in existing projects.

A further structural limitation of the modelling framework concerns the treatment of NDC compliance as an assumption rather than a result. Across all four pathways, the model is calibrated to converge towards full NDC achievement by 2035, which constrains the analysis to scenarios of successful domestic implementation. In practice, however, partial compliance is a possible outcome, and its implications for ITMO authorisation might not be trivial: under conditions of incomplete NDC achievement, the justification for authorising mitigation outcomes for international transfer becomes more dependent on the specific characteristics of eligible activities.

Nevertheless, despite eventual limitations, the results of this study consistently indicate the strategic relevance of Brazil engaging proactively and dynamically with Article 6 mechanisms. Given the pace of evolution of international carbon markets, such engagement should be accompanied by continuous reassessment of reference models, market conditions, and the performance of implemented cooperative approaches. Even if initially pursued through pilot initiatives or limited-scale authorizations, Article 6 cooperation may prove to be a critical instrument for financing the country's climate agenda while supporting broader sustainable development objectives.

In light of these limitations, it is recommended that research agendas be deepened to refine and expand the results presented here. First, the updating of marginal abatement cost curves (MACCs) for Brazil is essential. More recent studies could capture technological advances, structural changes in the economy, and new mitigation opportunities that have emerged since the publication of the reference studies, offering a more precise basis for the assessment of climate policies and market strategies. Moreover, future research could explore the temporal dimension of ITMO authorizations. Several mitigation options remain above the SBCE price threshold during their early implementation phases, only becoming cost-effective domestically over time. Time-conditioned authorization, whereby a project's mitigation outcomes are authorized for export during an initial period, could represent a practical mechanism to unlock project viability early on while preserving long-term domestic mitigation value. Identifying which activities and sectors are best suited to this approach represents a relevant leverage for further work.

Beyond ARR, other activities, such as REDD+ project and programs, landfill-related mitigations, among others, may face comparable structural challenges to be implemented, such as high upfront capital requirements, long investment cycles, or transformative socio-environmental externalities, that could justify similar differentiated treatment to be promoted within an Article 6 engagement framework. Identifying and rigorously evaluating such sectors represents a relevant avenue for future research and policy design.

More in-depth sensitivity analyses would be particularly valuable for testing the robustness of the results against different carbon price trajectories, oil prices, exchange rates, technological costs, discount rates, and scenarios for the evolution of international demand for credits. This type of exercise would allow for the identification of risk ranges and opportunities, contributing to the design of more resilient and adaptive policies.

Additionally, further studies focused on the operationalization of the pathways discussed in this report could provide important practical insights. This includes the assessment of institutional arrangements, especially considering the interaction between international agreements under Article 6 and other domestic mitigation policies and leverages and authorization procedures. Advancing the understanding of how these approaches could be implemented in practice would help reduce uncertainty, improve regulatory readiness.

Finally, the development of more detailed sectoral analyses is recommended, particularly for industrial and land-use segments. Studies of this nature could more directly support the decision-making of companies and policymakers, by identifying specific investment opportunities, technological bottlenecks, and positioning strategies in international carbon markets. In this sense, the advancement of these analyses can play a central role in preparing the Brazilian economy to capture the emerging opportunities associated with the climate transition, simultaneously promoting productive modernisation, increased competitiveness, and long-term value creation.

References & Endnotes

1. Centro Clima / COPPE / UFRJ (2023). *Uma Estratégia de Descarbonização para uma Economia Brasileira de Zero Carbono Líquido em 2050: Instrumentos de Política e Planos Setoriais de Mitigação — Projeto DecarBoost*.

2. Agora Energiewende (2024). *Next stop 2040: EU climate policy between economic opportunities and fiscal risks — assessing the macroeconomic impacts of Europe's transition to climate neutrality*. Berlin. agora-energiewende.org

3. Ministério da Fazenda (2024). *Anúncios Iniciais da Secretaria Extraordinária de Mercado de Carbono*. youtube.com/watch?v=mySl94pqsL4

4. Brasil. Ministério da Ciência, Tecnologia, Inovações e Comunicações — MCTIC. *Opções de Mitigação de Emissões de Gases de Efeito Estufa (GEE) em Setores-Chave do Brasil*.

IETA

IETA

Making Net Zero Possible

Since 1999, IETA has been the leading voice of business on ambitious market-based climate-change solutions and driving net zero.

ieta.org