



REPORT . 2025

OPPORTUNITIES FOR BRAZIL IN CARBON MARKETS



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SUMMARY OF PREVIOUS EDITIONS

2021

The first report **Opportunities for Brazil in carbon markets**, besides introducing important concepts about carbon markets, focused on opportunities related to productive sectors in the mechanisms of Article 6 of the Paris Agreement and in the voluntary market. The study reviewed the Forestry, Agriculture, Energy, Transport, and Industry sectors in terms of emission reduction technologies, socio-economic benefits and opportunities for the production chain. It also presented the potential supply of credits generated in Brazil and estimates of demand for these credits. Based on the identified opportunities and barriers, and considering the sectors to be prioritized, recommendations for the Brazilian government and the business sector were presented.

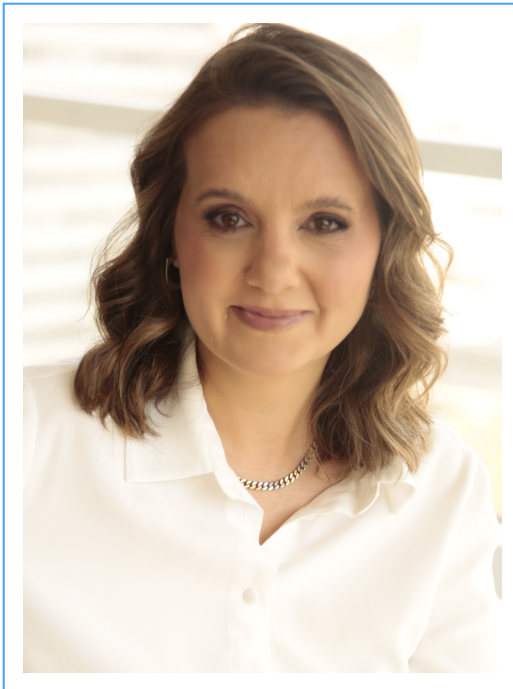
2022

The study **Opportunities for Brazil in carbon markets 2022** presented progress on the definitions of the new carbon market mechanisms under Article 6 post-COP 26 and an updated overview of the regulated markets and the voluntary market. This report also provided an unprecedented mapping of the current national carbon market ecosystem with important definitions of the types of players and their participation in the market and presented a national overview of the projects registered in the country since 2003. Based on interviews with market players, it was possible to identify the main barriers and opportunities for operating in these markets in Brazil. Based on the specific barriers and opportunities for market players, recommendations were made to the different players and to the Brazilian government.

2023

The study **“Opportunities for Brazil in Carbon Markets 2023”** focused on the potential impacts of establishing a regulated market in Brazil. To this end, it observed trends in the implementation of new markets, possible ways of interaction between carbon markets, and identified impacts on the international competitiveness of Brazilian products in the face of exposure to boundary adjustment rates of regulated foreign markets, seeking to understand whether the implementation of a regulated market in Brazil can minimize them. In addition, it analyzed the country’s policy and regulatory updates regarding carbon markets, the costs and opportunities of mitigating emissions in sectors to be regulated, and the socioeconomic impacts of implementing the system in Brazil.

COVER LETTER



Gabriella Dorhiac

Executive Director of
ICC Brazil

The transition to a low-carbon economy is not a distant aspiration — it is a defining imperative of this decade. As we reach 10 years of the Paris Agreement and the world intensifies its efforts to achieve its critical goals, Brazil stands before a unique opportunity. With its large natural assets, large innovation potential and growing policy maturity, the country is uniquely positioned to lead in the development of carbon markets that combine environmental integrity, economic opportunity, and social progress.

Opportunities for Brazil in Carbon Markets, builds upon three previous versions to provide an updated and comprehensive view of Brazil's potential in this evolving and complex landscape. Unlike the previous versions that had the supply of carbon credits as a starting point, this edition focuses on the demand to analyze trends and opportunities for the country. The work is centered on three key pillars: International mechanisms — particularly those under Article 6 of the Paris Agreement —, increasing maturity of the Voluntary Carbon Market, and the establishment of Brazil's own Emissions Trading System (SBCE). Together, these frameworks represent

the foundation for a credible, transparent, and effective carbon pricing architecture capable of driving meaningful climate action.

Our analysis shows that SBCE will become the main driver of domestic demand for carbon credits by 2030, while international cooperation under Article 6 can potentialize even more the role that Brazil can play globally. In parallel, the voluntary market continues to play a pivotal role, evolving toward higher-quality standards and greater alignment with national and global goals. This convergence creates unprecedented opportunities for Brazil — not only to meet its Nationally Determined Contribution (NDC) but to generate sustainable economic value from decarbonization.

ICC Brasil firmly believes that the findings and recommendations presented in this work can inform public policies, guide private-sector strategies, and encourage cross-sector collaboration. They underscore that the success of Brazil's carbon market will depend on robust governance, transparent methodologies, and long-term investment in mitigation projects capable of delivering real, verifiable, and inclusive benefits.

We invite readers — policymakers, businesses, and civil society alike — to engage with this study as both a technical resource and a call to action. Harnessing the full potential of carbon markets is not merely a compliance exercise; it is an opportunity to redefine Brazil's contribution to a resilient, low-carbon global economy.



ICC Brasil, one of the national committees of the International Chamber of Commerce (ICC), was created in 2014 with the mission of bringing the private sector to the center of the international trade agenda and amplifying the voice of the Brazilian business community with governments and international organizations, in the elaboration of projects aimed at economic and social development and improving the business environment.

From a multi-sectoral approach, we produce knowledge through advocacy projects and initiatives, seeking to approach the private sector to government bodies and global debates in multilateral organizations such as the UN, WTO and G20, providing subsidies for the development of public policies that are beneficial to business and society.

We also disseminate locally the content developed by the global ICC in its 12 areas of activity, organize events on topics of relevance to the country's economy, give a voice to companies based in Brazil at the global level and convey to the relevant government authorities the ICC's positions on key issues for a good, healthy and sustainable business environment.

ICC was founded in 1919 with the mission of promoting more open, fair and transparent interna-

tional trade. Today, ICC represents the voice of business at the highest levels of intergovernmental decision-making, whether at the World Trade Organization, the G20 or the United Nations, and is the first private sector organization with observer status at the UN General Assembly. It is this ability to connect the public and private sectors that sets ICC apart as a unique institution, responding to the needs of all stakeholders involved in international trade and the issues surrounding it, such as innovation and sustainability.

To find out more, visit iccbrazil.org



WayCarbon is a global company, a reference in solutions focused on just and resilient climate transition towards a Net-Zero economy. Founded in Brazil in 2006, WayCarbon employs scientific and business knowledge leveraged by technology to support companies and governments in their climate change and sustainable strategies. In 2022, WayCarbon was acquired by Santander Spain, accelerating its ambition to contribute to the adoption of commitments and the implementation of effective solutions to address climate change.

WayCarbon has served over 500 private sector clients, besides having extensive experience in projects for multilateral organizations (Global Compact, UN, BID) in the areas of mitigation, adaptation, and compensation. Its technological solutions are already used by customers in 40 countries.

WayCarbon's specialized consulting services and software are designed to support companies and governments in an integrated manner on their decarbonization journeys.

To find out more, visit waycarbon.com

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Attribution:

Please cite this work as follows: ICC Brasil and WayCarbon. Opportunities for Brazil in Carbon Markets. Report 2025.

Available at: **iccbrazil.org**

MESSAGES FROM SUPPORTERS



Se é Bayer, é bom

“ In recent years, Bayer has been actively working to address the challenges of the carbon ecosystem in Brazilian agriculture. Our participation in this study highlights our journey and reaffirms our conviction that collective actions in the business sector can have a significant impact on the evolution of the regulated carbon market, as well as strengthen Brazil's role as a key player in global climate solutions.”



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“ The opportunities in the carbon market highlight the challenges of a just climate transition in Brazil. Implementing the SBCE will require a higher level of integrity and a highly inclusive model. We understand that the involvement of retail sector is essential for a just transition. Cielo has been a strategic partner to the sector, driving sustainable and inclusive businesses, and with our 30 years of experience, we have delivered technology and security that expand opportunities for all people.”



“ Itaú recognizes Brazil's strategic role in building global climate solutions and sees the carbon market as a lever to accelerate the transition to a low-carbon economy. By supporting the study of the country's opportunities, we reinforce our commitment to sustainable development and believe that a sound and efficient market is essential to drive investment and position Brazil on the climate agenda.”



“ SAP's strategy is to enable companies to operate as intelligent enterprises. A global market leader in enterprise application software, the company supports businesses of all sizes and across every industry to achieve high performance — 77% of the world's transaction revenue passes through an SAP system. With a complete suite of applications and services, SAP enables public-sector and companies in 25 industry sectors worldwide to run profitably, continuously adapt, and make a difference.”



“ At Shell, we support the development of robust and transparent carbon markets that accelerate decarbonization and value high-integrity solutions. This study seeks to offer strategic recommendations to the government, the private sector, and those requesting carbon credits, reinforcing Brazil's leading role in the journey toward a low-carbon economy and driving the energy transition with socio-environmental responsibility and a focus on innovation.”

LIST OF ACRONYMS

A6.4ER	Article 6, paragraph 4, emission reduction	IPCC	Intergovernmental Panel on Climate Change
ACR	American Carbon Registry	IPPU	Industrial Processes and Product Use
ART	Architecture for REDD+ Transactions	ITMO	Internationally Transferred Mitigation Outcomes
BAU	Business as Usual	JCM	Joint Crediting Mechanism
CAR	Climate Action Reserve	MAC	Marginal Abatement Costs
CBE	Brazilian Emissions Allowance	MRV	Monitoring, reporting and verification
CCB	Climate, Community & Biodiversity	NDC	Nationally Determined Contribution
CCPs	Core Carbon Principles	NGFS	Network for Greening the Financial System
CDM	Clean Development Mechanism	SDGs	Sustainable Development Goals
CER	Verified Carbon Credits	OECD	Organization for Economic Co-operation and Development
CIM	Interministerial Committee on Climate Change	PA	Project Activity
CNL	Carbon Neutral LNG	PACM	Paris Agreement Crediting Mechanism
COP	Conference of the Parties	PNA	National Allocation Plan
CORSIA	Carbon Offset and Reduction Scheme for International Aviation	RTK	International Revenue Tonne Kilometre
CPA	Component Project Activity	SBCE	Brazilian Emissions Trading System
CRVE	Verified Emission Reduction or Removal Certificates	SBTi	Science Based Target Initiative
ETS	Emissions Trading System	SINAPSE	National Simulator of Sectoral Policies and Emissions
GCC	Global Carbon Council	tCO₂e	Ton of carbon dioxide equivalent
GCAM	Global Change Assessment Model	TFSVCM	Taskforce on Scaling Voluntary Carbon Markets
GHG	Greenhouse Gases	UNEP-CCC	United Nations Environment Program – Copenhagen Climate Centre
GIIGNL	International Group of Liquefied Natural Gas Importers	UNFCCC	United Nations Framework Convention on Climate Change
LNG	Liquefied Natural Gas	VCS	Verified Carbon Standard
GS	Gold Standard	VER	Verified Emissions Removals
ICC	International Chamber of Commerce		

SUMMARY

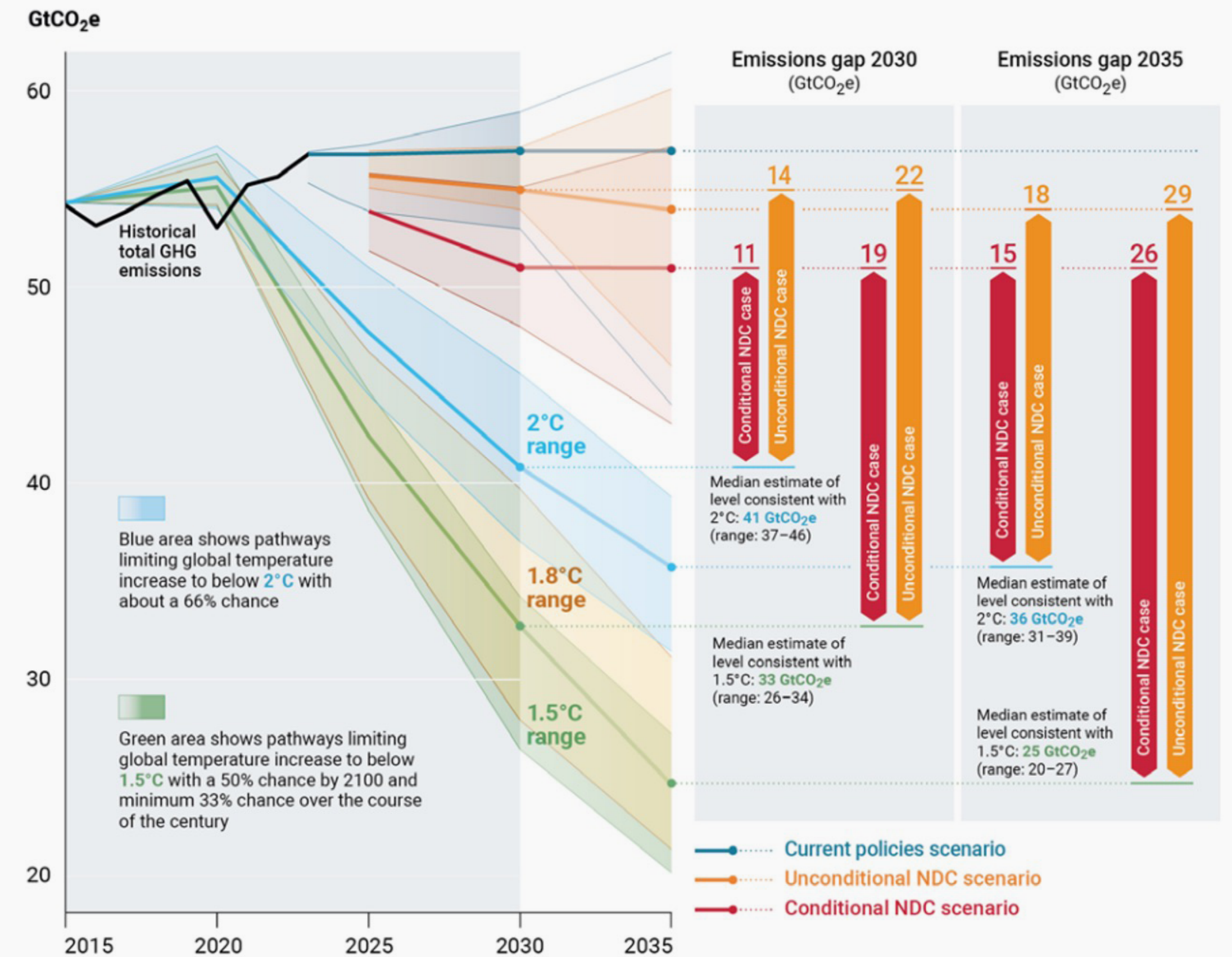
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1. PRESENTATION

2024 recorded an average global temperature 1.55°C above pre-industrial levels, higher than the 1.5°C target established in the Paris Agreement in 2015 (WMO, 2025). Despite progress in global commitments, a significant gap remains between the actions envisaged in current climate policies and the efforts needed to limit global warming. Under the implementation scenario of unconditional Nationally Determined Contributions (NDCs)¹, an additional reduction of 14 GtCO₂e² would be required to limit global warming to 2°C and 22 GtCO₂e to limit warming to 1.5°C above pre-industrial levels in 2030. By 2035, these gaps increase by 4 GtCO₂e for a 2°C limit and 7 GtCO₂e for a 1.5°C warming limit (UNEP, 2024). The gap between announced commitments and the emissions needed to limit global warming indicates that, despite advances in ambition in the NDCs, current commitments still do not reduce emissions to the magnitude necessary to contain global warming, which reinforces the importance of updating the NDCs in pursuit of more ambitious targets. Figure 1 shows the scale of the climate challenge.

In this scenario, carbon markets emerge as central instruments for enabling climate investments, as they reduce the global costs of mitigating greenhouse gas (GHG) emissions. By putting a price on emissions, these mechanisms direct resources toward more cost-effective emissions reduction activities, enabling companies and governments to achieve their climate goals more efficiently.

Figure 1 – Global emissions under different scenarios and emissions gaps in 2030 and 2035



Source: UNEP (2024).

1. NDCs can be classified as conditional and unconditional, according to the degree of dependence on external support for their implementation. Conditional NDCs represent commitments that a country can only achieve through external support such as climate finance, technology transfer or technical assistance. Unconditional NDCs, on the other hand, refer to goals that the country can achieve using only its internal resources, policies and capabilities, that is, it does not depend on international cooperation to achieve its climate goals.

2. GtCO₂e is a measurement that represents 1 billion tons of carbon dioxide equivalent. Just as MtCO₂e is a measurement that represents 1 million tons of carbon dioxide equivalent.

Box 1

CONTEXTUALIZATION ON CARBON MARKET ENVIRONMENTS

There are three main carbon pricing instruments: carbon taxes, emissions trading systems (ETS) and carbon crediting mechanisms. The last two are known as carbon markets and trade units representing 1 ton of carbon dioxide equivalent (tCO₂e).

- Emission Trading System (ETS) are carbon markets regulated at the international, national or regional level in which their regulator allocates or auctions emission allowances, which are rights to emit a certain amount of GHG to companies in regulated sectors considering a cap (maximum emissions limit of the system, which is equal to the sum of allowances allocated to the regulated agents of the system). Companies that emit below their allowances can trade their excess allowances with a company that emits (ICC Brasil; WayCarbon, 2023). Among the ETSs consolidated in the global economy, there is European Union Emissions Trading System (EU ETS), in force since 2005, and the California Cap-and-Trade, which came into operation in 2012.
- Carbon crediting mechanisms are carbon markets in which credits generated in general through voluntary activities that reduce emissions or increase removals are traded. The supply of carbon credits is generated through three main categories of credit mechanisms: (BANCO MUNDIAL, 2025; ICC Brasil; WayCarbon, 2021):

- Government credit mechanisms administered by one or more national or subnational governments, sometimes their credits are used for ETS compliance or carbon taxes³. Examples include the California Compliance Offset Program, which has its own credit generation protocols that will be used in California Cap-and-trade, and the Republic of Korea Offset Credit Mechanism, which accepts Clean Development Mechanism (CDM) credits and converts them into units in its system for compliance with South Korea's ETS (K-ETS)..
- Independent credit mechanisms (Voluntary Carbon Market) in which carbon credits are generated based on methodologies and processes of independent certification standards and verified by third parties.
- International credit mechanisms administered by an international organization established with the authority of national governments, such as United Nations agencies. The main international credit mechanism is the Paris Agreement Crediting Mechanism (PACM), which allows direct transfers of carbon credits generated through methodologies specific to this mechanism (Article 6.4 Emission Reductions - A6.4ERs) between countries and the private sector.

Another relevant mechanism is the Article 6.2 mechanism for international cooperation in which countries party to the Paris Agreement will transact Internationally Transferred Mitigation Outcomes (ITMOs), which are the result of different types of activities, defined as actual, verified and additional, representing emission reductions or removals, and including mitigation co-benefits resulting from adaptation actions

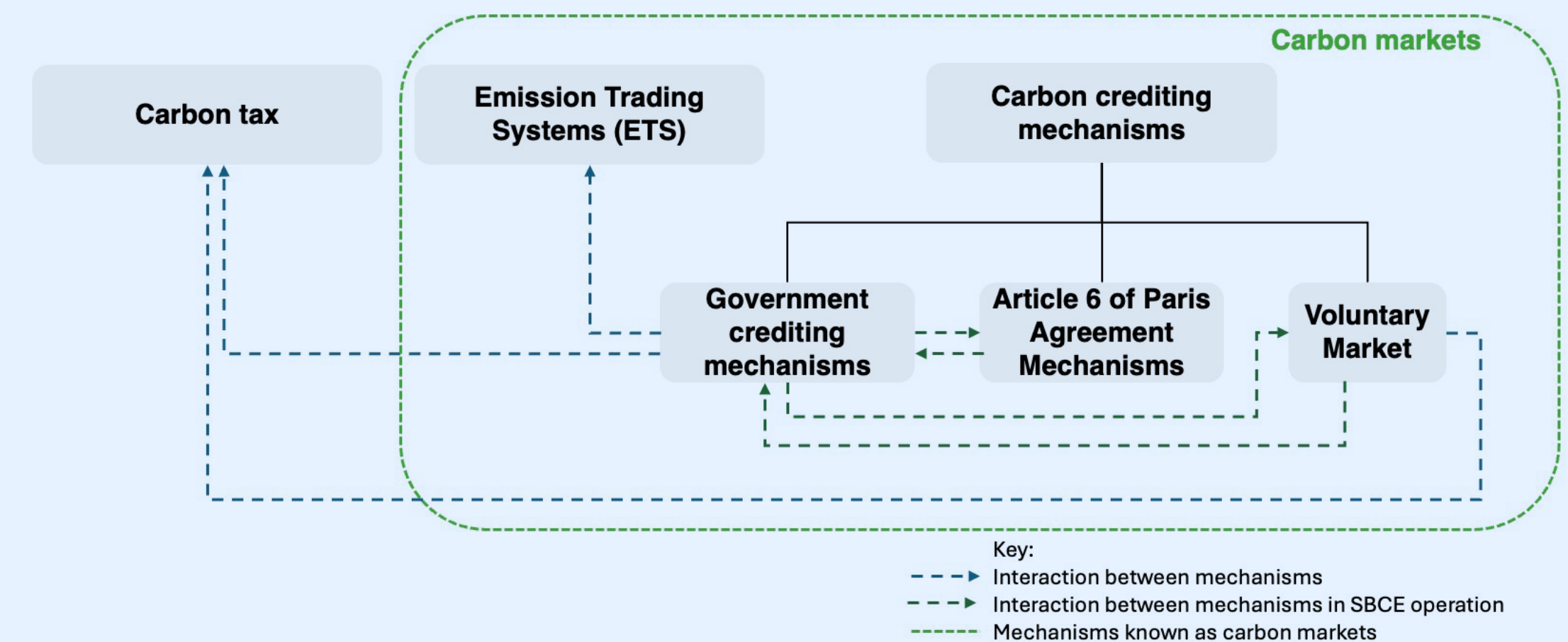
and/or economic diversification plans or the means to achieve them. In this way, PACM credits (A6.4ER) can be packaged and transferred internationally as ITMOs (UNFCCC, 2023).

In the Brazilian context, according to Law 15,042/2024, Brazilian Emissions Trading System (in Portuguese, *Sistema Brasileiro de Comércio de Emissões* - SBCE) will accept credits from accredited methodologies for compliance. Thus, it is understood that SBCE will also act as or be integrated into a government credit mechanism that will manage the Verified Emissions Reductions or Removals Certificates (CRVEs). It is understood that CRVEs will come from carbon credits generated by independent certification standards (which operate in Voluntary Market) using accredited

methodologies and will undergo a conversion process to enter SBCE environment and become CRVEs, as in South Korea, where there is conversion of units generated outside the system. Furthermore, the law provides that CRVEs can leave the system and be sold on Voluntary Market, that units generated in PACM could be accepted as a CRVE - if originating from accredited methodologies - and that CRVEs could be transferred as ITMO, if they are previously authorized by the designated national authority. Thus, several forms of interaction between carbon market environments are identified in the context of SBCE.

Figure 2 below presents the carbon market environments and their possible interaction.

Figure 2 - Carbon market environments and their interaction



Source: WayCarbon

3. International experience does not show direct acceptance of Voluntary Market credits for ETS compliance. There are documentation review processes and specific protocols for converting units into government mechanisms, depending on the jurisdiction, and their subsequent use in ETS (ICC Brasil; WayCarbon, 2025). However, there is use of voluntary credits for carbon tax compliance (Banco Mundial, 2025).

This study considers three carbon market environments in which there are opportunities for Brazil: Article 6 mechanisms, Voluntary Carbon Market and SBCE.

Under Article 6 mechanisms, the NDCs of countries party to the Paris Agreement – which set out their decarbonization ambitions – signal the demand and supply potential for units in these mechanisms. However, with current global climate policies, GHG emissions mitigation instruments remain largely limited and fragmented, reducing visibility into the actual volumes transacted and the prices in this global carbon market. **In this sense, the current round of NDC reviews – which must be submitted by countries by November 2025 – will be essential to understanding the direction in which the world will move and the future of carbon markets in the next decade.**

At the national or subnational level, there are currently 37 ETS, which, together with the 43 carbon taxes, cover approximately 28% of global GHG emissions (World Bank, 2025). In 2024, Brazil established the regulatory framework (Law No. 15,042/2024) for the creation of a national ETS, SBCE.

This law represents a window of opportunity for the country to unlock investments in decarbonization not only in regulated sectors, but also in unregulated sectors, as it will allow the use of offsets with units generated from activities in unregulated

sectors. Furthermore, with the implementation of a regulated carbon market in Brazil, the country demonstrates efforts to reinforce its leading role in the climate agenda and positions itself strategically internationally, enabling the attraction of international investments from countries either through Article 6 mechanisms or from the private sector through Voluntary Market, thus expanding Brazil’s potential in different trading environments.

The **Voluntary Carbon Market**⁴ has shown fluctuations in its supply of credits in recent years. After sharp growth in 2021, the market has been experiencing a decline in transaction volume. A 25% drop was observed in 2024 compared to 2023 (Ecosystem Marketplace, 2025). However, **the volume of retired credits**, i.e., those for which there is a record with the standard that generated them that they were used for offsetting and that they can no longer be traded – **remained stable, which demonstrates a more resilient demand for carbon credits in recent years. Currently, Voluntary Market is moving into a new phase, which seeks to signal greater confidence to market agents, through the adoption of multiple quality and integrity structures, such as the *Core Carbon Principles* (CCPs), seeking to promote an adaptation of the supply side in the face of the growing sophistication of demand for emission reduction certificates, which has been seeking to establish criteria for the classification of so-called high-quality credits.**

Therefore, this report discusses the opportunities for Brazil from these three carbon market environments, given the new perspectives with the updates of the 29th Conference of the Parties on Climate Change (COP 29), the expectations regarding COP 30, the gain in maturity of Voluntary Market and the establishment of SBCE in 2024, and what are the potentials for transaction of units in the different areas of carbon markets. Furthermore, the challenges to the full development of this potential will be addressed, given that despite the many potential opportunities, the development of carbon markets still falls short of their capacity. Finally, recommendations will be drawn up for the development of the national market and the exploitation of international opportunities, aimed at both public and private agents.

4. Voluntary Market refers to an offset mechanism that trades certified GHG emission reductions (Certified or Verified Emission Reduction – CER/VER) known as carbon credits, generated using methodologies accepted by independent certification standards, verified by third parties and used to meet voluntary, corporate or individual targets. (ICC Brazil; WayCarbon, 2022).



2. OVERVIEW OF CARBON MARKETS AND ESTIMATES OF THEIR POTENTIAL

Carbon markets have gained global relevance not only as mitigation instruments, but also for the opportunities they offer in terms of income generation and the development of new business models.

Therefore, since the first edition of this study, analyses have been conducted on the potential of different segments of the carbon market at the global and national levels. In this edition, considering the development of these markets, the premises of previous studies were updated to reflect the greater institutional maturity of the markets, as well as regulatory advances and perspectives on national opportunities in carbon markets.

While previous estimates were based on assumptions about the global market from the Taskforce on Scaling Voluntary Carbon Markets (TFSVCM, 2021) and assumptions about Brazilian credit issuances in Voluntary Market, the current study seeks to update these assumptions, segmenting the market into three environments: 1) the mechanisms of Article 6 of the Paris Agreement; 2) the Voluntary Carbon Market; and 3) SBCE. The Carbon Offset and Reduction Scheme for International Aviation (CORSIA) is also considered part of the Article 6 mechanisms market since the credits traded for use in CORSIA⁵ require authorization by the project host countries to be used for international mitigation objectives other than fulfilling an NDC.

Box 2

SOCIAL COST OF CARBON

The social cost of carbon represents the economic cost caused by an additional ton of carbon or its equivalent in the atmosphere. In an optimal climate policy, the social cost of carbon should equal the price of carbon (Nordhaus, 2019). However, under market conditions, this cost is not observed, so the cost of carbon and its price are significantly different. While the social cost of carbon is often es-

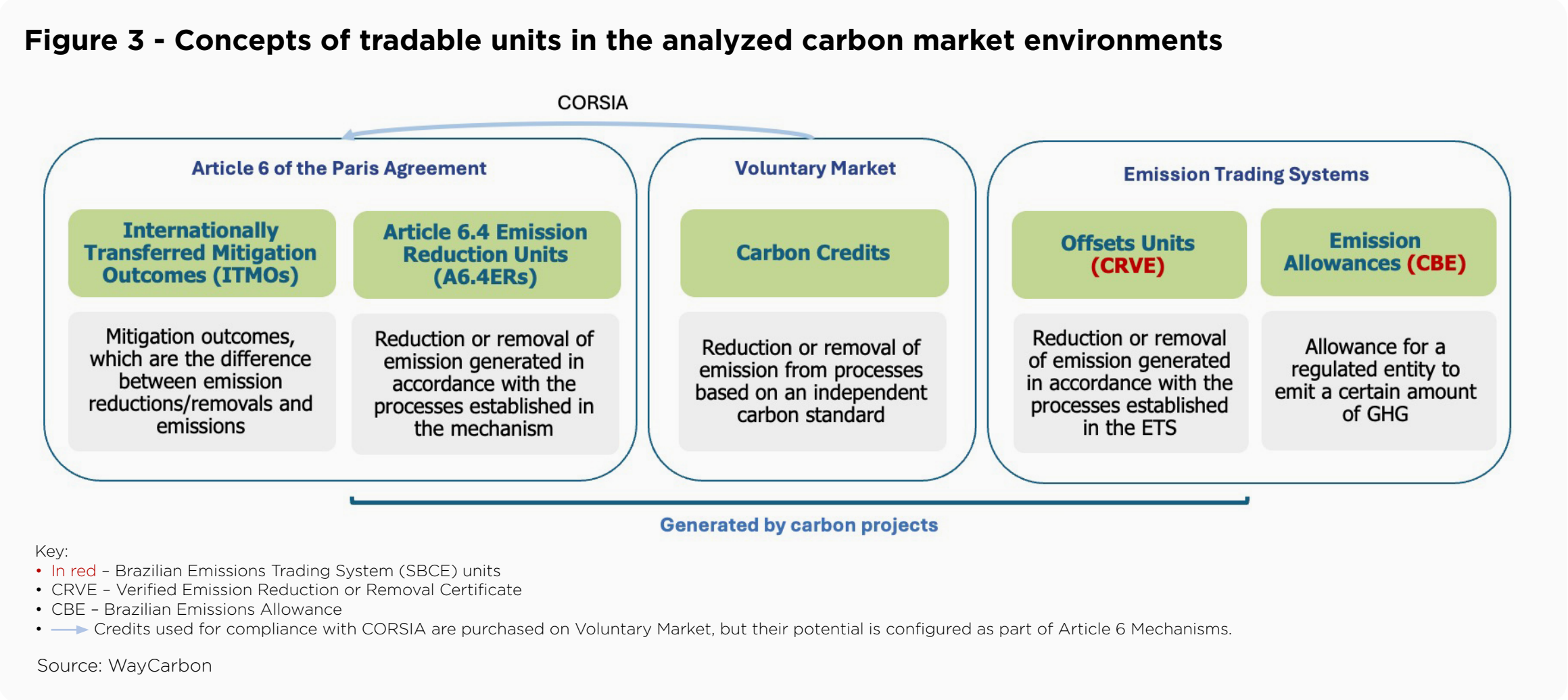
timated at around US\$100, the average price of credits in Voluntary Market last year was US\$6.55. Even in mature regulated markets, such as European Union ETS (EU-ETS), emission allowances still do not reach this value. Additionally, there is no consensus on what the social cost of carbon would be, given that the models are based on very particular assumptions (Pindyck, 2015).

Additionally, while in previous editions the analyses focused on the potential supply of credits from Voluntary Market, this edition gave greater focus to demand elements, considering the situation historically observed in existing markets is one of excess carbon credit emissions in relation to retirements. For this study, retirements were considered as the effective demand for carbon credits due to the impossibility of tracking credit acquisitions that have not been used for this purpose. Finally, unlike previous editions, in this edition the prices of carbon credits, when analyzed, were treated as endogenous – that is, the result of the interaction between supply and demand – and no longer compared to the social cost of carbon.

Note that there may be some overlap between the different markets. For example, a company that will become part of a regulated market may have fewer incentives to demand carbon credits in Voluntary Market, **since part of the emissions may be offset in the regulated market and due to the cost of compliance, which tends to reduce the budget allocated to voluntary emissions offsetting.** Likewise, part of the demand for Voluntary Market credits may depend on whether or not the host country of the decarbonization project accepts corresponding adjustments, as in CORSIA.

5. CORSIA is a carbon pricing system applicable to the international civil aviation sector in which emissions offsets can involve both carbon credits issued via some methodologies used in Voluntary Market and the use of clean fuels. The system was divided into three phases, including the “pilot” phase, which lasted between 2021 and 2023; the first operational phase, effective between 2024 and 2026, participation is voluntary and applies only to international flights between countries that volunteered to participate in the pilot and/or the first phase (including Brazil); and the second operational phase, effective between 2027 and 2035, in which participation will be compulsory for all international flights, with exceptions only for least developed countries, small island developing states, landlocked developing countries; or States with a low ratio of transported kilometers to ton (ICAO, 2025a).

Figure 3, below, clarifies the different concepts and each of the units traded in the three carbon market environments analyzed here. However, the potentials of the different markets are estimated in tons of carbon dioxide equivalent (CO₂e) regardless of the nature and characteristics of the tradable units in each mechanism, for comparability purposes.

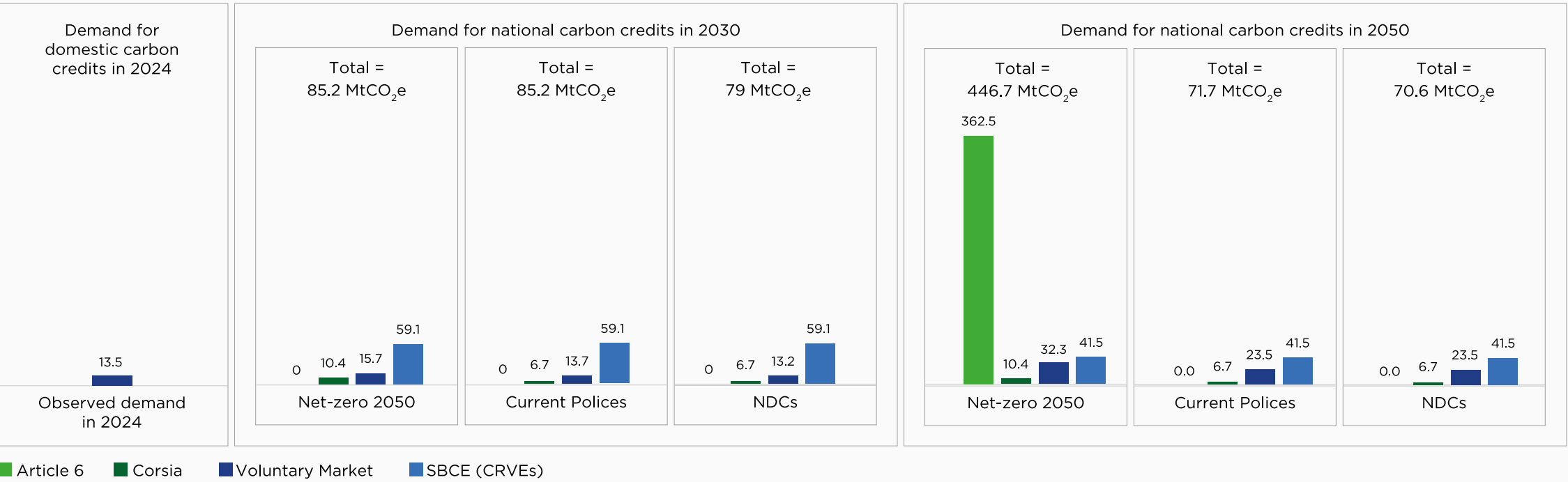


Finally, note that the estimates made are not predictions. **The objective of the analysis is to identify vectors of influence for the demand and supply of carbon markets in the Brazilian context** and not necessarily to make a forecast for the size of the market⁶. Even in mature and more transparent markets, forecasts for 5, 10 or 25 years have a high degree of uncertainty. In carbon markets, given the amount of uncertainty about the future structure of the market and the opacity of information in current markets, any prediction would be even more uncertain. In the

following subsections, the potentials were analyzed with estimates for global and national markets. The following figure summarizes the market potential in the different scenarios analyzed.

As will be detailed in the next sessions, from 2030 onwards SBCE becomes the largest demand driver, considering that SBCE will begin in 2030. From 2050 onwards, achieving global net-zero becomes the most influential factor for demand in carbon markets. Note that the market potential for Article 6 will only be realized if Brazil achieves mitigation re-

Figure 4 - Summary of National Potentials in Carbon Markets (in MtCO₂e, equivalent to millions of tradable units) in the estimated scenarios, 2030 and 2050



sults beyond its NDC commitments. For this reason, in the Current Policies and NDCs scenarios there is no national supply of ITMOs or A6.4ER.

2.1. MARKET MECHANISMS OF ARTICLE 6 OF THE PARIS AGREEMENT

COP 29 marked substantial advances in the consolidation of the international carbon market, based on the consensus on transaction registration rules and the operationalization of Article 6.4. In the context of registries, decisions on Article 6.2 established unified technical standards for authorization, transparency and accounting of mitigation results, including the corresponding adjustment, which can facilitate bilateral transactions between countries and increase

transparency for other stakeholders. Article 6.4, in turn, was transformed into an operational mechanism, PACM, through the establishment of a supervisory body responsible for developing methodologies and integrity criteria for carbon projects that will operate in this market. The first PACM methodology was recently released, which defines how methane emissions from landfills can be managed and qualify for carbon credit generation under Article 6 (UNFCCC, 2025a). For COP 30, in November 2025, the implementation of these mechanisms based on a central international registry and the link between Article 6.2 and 6.4 should be discussed in greater depth. The international registry is expected to allow for the extraction and visualization of data and information on the holdings and action history of authorized Article 6.2 emission reductions and the transfer of these

6. Following the same premises as previous editions, Brazil's potential supply of carbon credits would be updated from 360 MtCO₂e to 1,200 MtCO₂e per year to approximately 194 MtCO₂e to 646 MtCO₂e in 2030. As will be demonstrated below, even with this reduction, these scenarios are still significantly optimistic.

reductions as ITMOs (UNFCCC, 2025b). Additionally, the COP 29 report requested the secretariat to assist country parties, particularly developing countries, to implement a national registry for the generation, certification and generation of ITMOs (UNFCCC, 2025b). **This could be an important support for the structuring of Brazilian Central Registry to be created, after the approval of Law 15,042, which will track both national transactions of SBCE assets and transfers of ITMOs (BRASIL, 2024a). In this way, the Central Registry can be implemented with interoperability with the international registry, which will facilitate the transaction process.**

In general, countries adopt different approaches to using international markets to achieve their NDCs. **Countries such as Sweden and Switzerland allow the use of the Paris Agreement’s market mechanisms**

to achieve their NDC, establishing the maximum percentages in relation to the target to be offset by mitigation activities outside the country, at 15 and 25% of 1990 emissions respectively (Suécia, 2021; Suíça, 2021), **or around 7.5 and 26.6 MtCO₂e. Japan, in turn, commits to offsetting up to 100 MtCO₂e by 2030 and 200 MtCO₂e by 2040 via Article 6.2 or 6.4** (Japão, 2025). In 2025, **European Commission proposed that, from 2036, a contribution of 3% of European Union’s net emissions could be provided by international carbon credits** to achieve the economic block’s 2040 decarbonization target. The proposal still needs to be approved by Parliament and European Council (European Commission, 2025).

However, the lack of clarity on the part of countries regarding how to use the mechanism remains a challenge. In several other cases, the intended use is

not clear enough to determine whether the country intends to act as a demander or supplier in this market (Jeudy-Hugo; Re; Falduto, 2021). The low transparency of this information is noted even among countries that have bilateral cooperation commitments.

International cooperation through Article 6 has advanced in recent years and demonstrates the potential to reduce the global costs of fulfilling NDCs. Under Article 6.2, there are 98 bilateral agreements between 63 different countries. These agreements correspond to a total of 155 pilot projects, of which 130 belong to the Japan Joint Crediting Mechanism (JCM). Besides Japan, most of the other cooperation

agreements are with Singapore and South Korea. Countries in Africa and South and Central America appear as potential project hosts, but none as buyers (UNEP-CCC, 2025).

Figure 5 provides an overview of the bilateral cooperation agreements between the Parties under Article 6.2 of the Paris Agreement. The 98 agreements signed involved 63 party countries, consisting of 52 ITMO transferring countries and 11 purchasing countries. Countries such as Japan, Switzerland, and Sweden stand out as buyers, which, in addition to having declared the amount of acceptance of the Paris Agreement Mechanisms

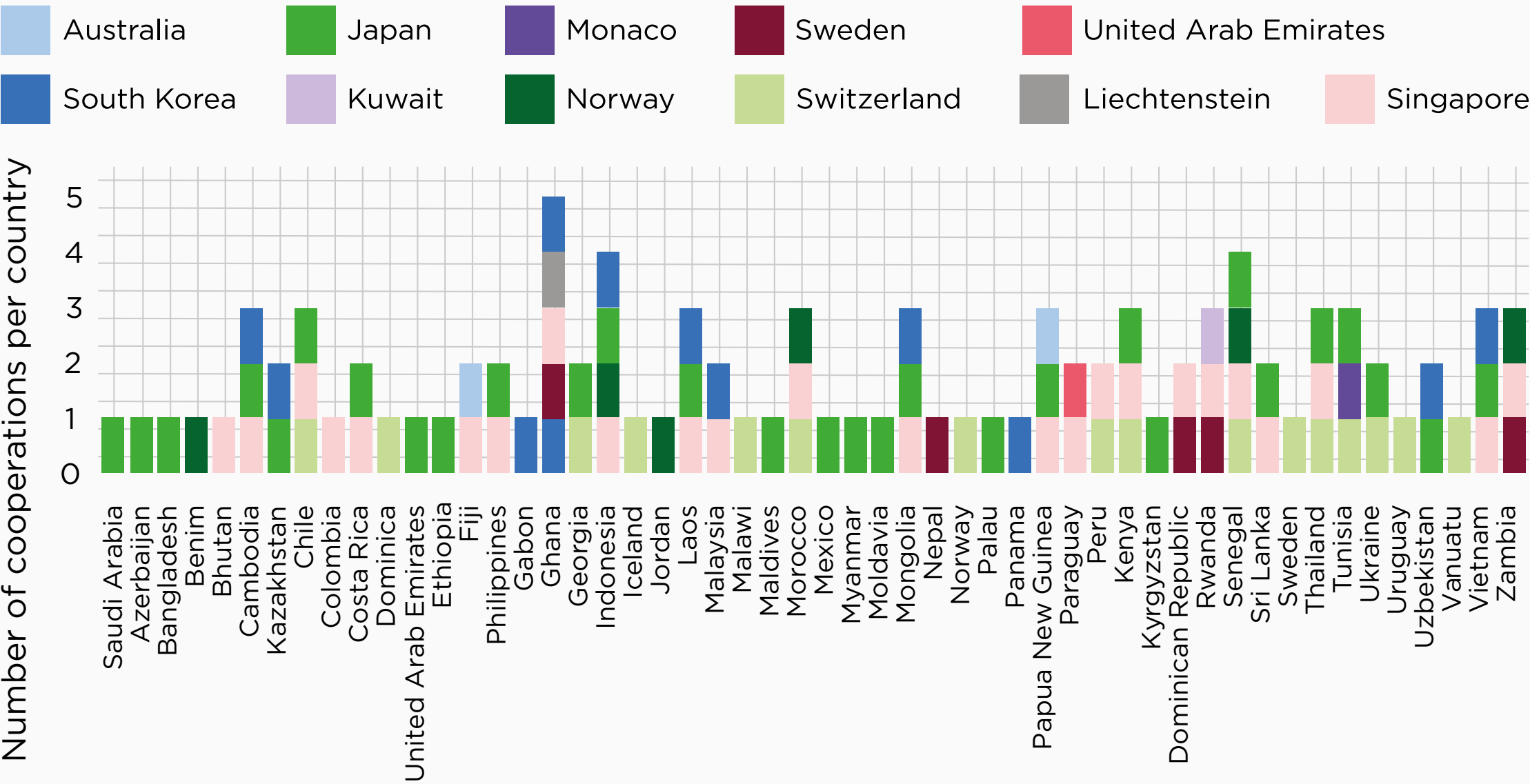
Table 1 - Demand commitments for announced ITMOs or A6.4ER

Demanding Country	Latest NDC Version	NDC Base Year	Emissions in the NDC base year (MtCO ₂ e)	Final Goal of NDC	% acceptance of Paris Agreement mechanisms in NDC	Potential demand for ITMOs or A6.4ER per year
Switzerland	2025	1990	106	Net zero 2050	25%	26.6
Sweden	2023	1990	50	Net zero 2050	15%	7.5
Japan	2025	2013	1,407	Net zero 2050	100 MtCO ₂ e by 2030 200 MtCO ₂ e by 2040	20*
European Union	2023	1990	9,313	Net zero 2050	3%**	279.4
TOTAL	-	-	-	-	-	333.5

* Estimated average of 200 MtCO₂e to be acquired between 2030 and 2040
**Measure not yet approved

Source: WayCarbon, based on UNFCCC (2025c).

Figure 5 - Bilateral cooperation between the parties



Source: WayCarbon based on UNEP-CCC (2025).

for compliance with their NDC, have already signed purchase agreements. In turn, Singapore and South Korea have already established bilateral partnerships, but do not establish a demand quantity in their NDCs. Note that most host countries are located in Africa, Asia, and Latin America, reflecting a financing pattern between developed countries as primary buyers and developing countries as project developers and transferors of mitigation outcomes. Countries such as Ghana, Indonesia, and Senegal maintain simultaneous bilateral relations with several countries, highlighting the participation of developing countries in the international carbon trade. Brazil has not yet authorized the issuance of ITMOs, reserving this decision for a later stage, in accordance with national regulations (UNFCCC, 2025c).

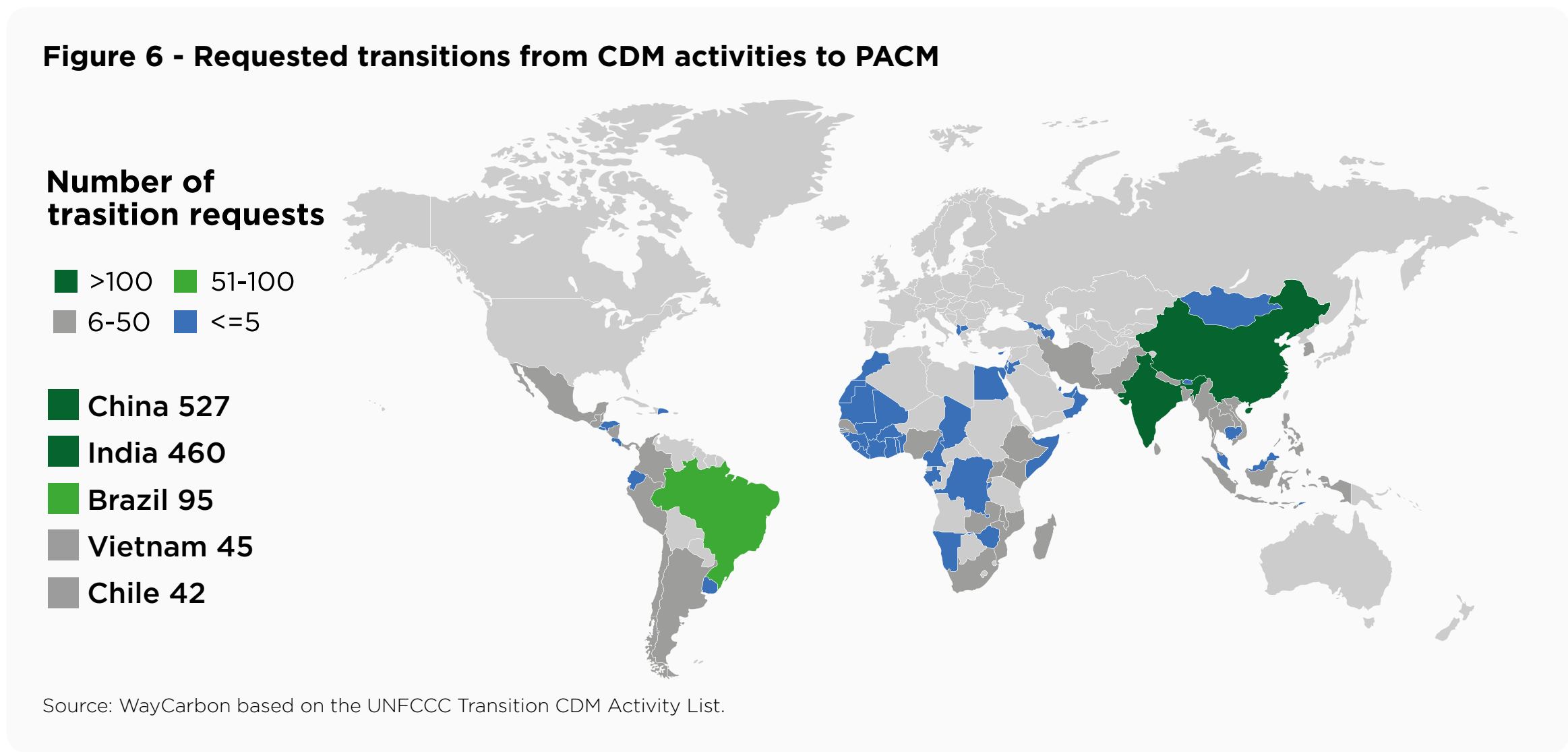
Under Article 6.4, in turn, processes were established for launching the first specific methodologies aimed at generating A6.4ER, or units to be transacted under this mechanism. A fundamental step in the process of generating A6.4ER is the authorization by the host country to apply adjustments corresponding to the reductions or removals of emissions generated in the projects (UNFCCC, 2024).

Participation in Article 6.4 mechanism can occur in two ways. The first refers to projects already registered with the Clean Development Mechanism (CDM), which had the possibility of moving to Article 6.4. These projects may continue to use methodologies previously applied in CDM, provided they meet the

requirements established by Article 6.4. The second form consists of submitting new activities, which must fully comply with the requirements defined by the mechanism in Article 6.4. Deadlines were also established for the transition of reforestation projects from CDM, created under Kyoto Protocol (1997), to PACM, to be requested by project proponents to the country’s Designated National Authority by December 31, 2025 (UNFCCC, 2024). **The transition of these CDM-linked projects to PACM represents an opportunity to ensure the continuity and use of existing projects aimed at global emissions mitigation.**

By July 2025, 1,389 Project Activities (PA), 119 Programs of Activities (PoA) and 954 Component Project Activities (CPA) had been duly submitted⁷. In total, 1508 transitions of CDM activities to PACM were requested. The Figure 6 presents a global map with transition requests. It is worth noting that the five countries – China, India, Brazil, Vietnam and Chile – with the highest number of requests account for 77% of the total sent. Countries such as Bangladesh, Bhutan, Dominican Republic, Ghana, Myanmar, Pakistan, Sri Lanka and Uganda have already approved the transition of these CDM activities, resulting in 22 PAs, 18 PoAs and 218 CPAs (UNEP-CCC, 2025).

The cumulative amount of emissions reductions from all projects applying to migrate from the CDM to the new Paris Agreement mechanism is approximately 1.54 GtCO₂e between 2021 and 2025, with 71% of this



potential concentrated in Asia (UNEP-CCC, 2025). In the *ranking* of mitigation potential by country that requested the migration of CDM projects to PACM, India leads with 208 MtCO₂e of reduction potential, followed by China (189 MtCO₂e), Bangladesh (117 MtCO₂e) and Brazil (98 MtCO₂e) (UNEP-CCC, 2025). **Brazil has a high level of eligibility, with 77% of its submitted projects eligible for migration, which reinforces the country’s strategic role in global mitigation objectives.** While countries like Bangladesh and Myanmar have almost 100% of submitted projects in an eligible situation, others still demonstrate underutilization, such as China (42%) and South Africa (49%), highlighting disparities in the implementa-

tion of transition requests. Regarding the first activities submitted to PACM, UNEP-CCC (2025) reports that 1041 notifications of prior consideration for new projects were submitted and published⁸, covering 824 projects and 217 programs. Most of these project notifications submitted are from the Asian continent, which accounts for 806 notifications. Among countries, India stands out with 626 notifications, representing a potential impact of more than 393 MtCO₂e per year in emissions reductions. **Brazil has already registered 58 notifications of new activities⁹, with an estimated reduction of more than 13 MtCO₂e per year, which could also consolidate it in the development of new projects within the scope**

7. PoA represents a voluntary coordinated action carried out by a public or private entity that aims to pursue an objective that leads to the reduction of GHG emissions or the net removal of GHG. CPA consists of a single measure or a set of interrelated measures under a PoA. In other words, it is an operational subunit within a PoA (UNFCCC, 2022).

8. Notification of prior consideration refers to a mandatory step in PACM activity cycle. This is a form submitted by a project proponent to UNFCCC secretariat, notifying its intention to register a project before the start of activities, and that it has assessed and recognized the potential benefits of registering the project under the Article 6.4 mechanism. This prior notification is essential, as it brings transparency and integrity to projects, and seeks to guarantee the principle of additionality of marketed emissions reductions.

9. The data used are continuously updated on Article 6 Pipeline - UNEP-CCC platform and correspond to the period from August 2025.

of Article 6.4. Brazil is preparing to participate in this mechanism and has stated that when it authorizes the implementation of activities under 6.4, transfers will not be immediately granted, reserving this transfer decision for a later time in accordance with national regulations to be established (UNFCCC, 2025d).

The sectoral scopes and mitigation capacity – and, consequently, the generation of carbon credits – vary significantly between the proposed projects. Based on the IPCC categorization, the renewable energy sector concentrates the largest number of submitted activities, exceeding 350 notified projects (UNEP-CCC, 2025). These projects have different emission mitigation capabilities. Examples range from smaller-scale projects, such as a solar plant project in Zambia, with an annual mitigation capacity of 190 tons of CO₂ equivalent, that is, the capacity to generate 190 credits, to large-scale projects, such as the leak detection and repair system in fossil gas infrastructure in Uzbekistan, with an estimated capacity to generate more than 7 million credits per year.

In Brazil, the project with the greatest mitigation capacity in the energy sector is in the state of Piauí, referring to a wind complex with the potential to generate approximately 780 thousand annual credits. Taking all sectors into account, Ecoparque Paulínia landfill gas project, in the waste sector, is the project with the greatest mitigation capacity, reaching 1.7 million credits per year.

2.1.1. MARKET POTENTIAL

Article 6 of the Paris Agreement allows for greater ambition in its mitigation activities and promotes sustainable development and environmental integrity

through voluntary cooperation in the implementation of the NDCs of the countries participating in the mechanism (UNFCCC, 2025e). However, a fundamental issue stands out for the potential supply of ITMOs or A6.4ER: there must be a greater emission reduction compared to the targets established in the selling country’s NDC. Furthermore, there must be a willingness on the part of other countries to use the market mechanisms of Article 6 to meet their nationally determined commitments.

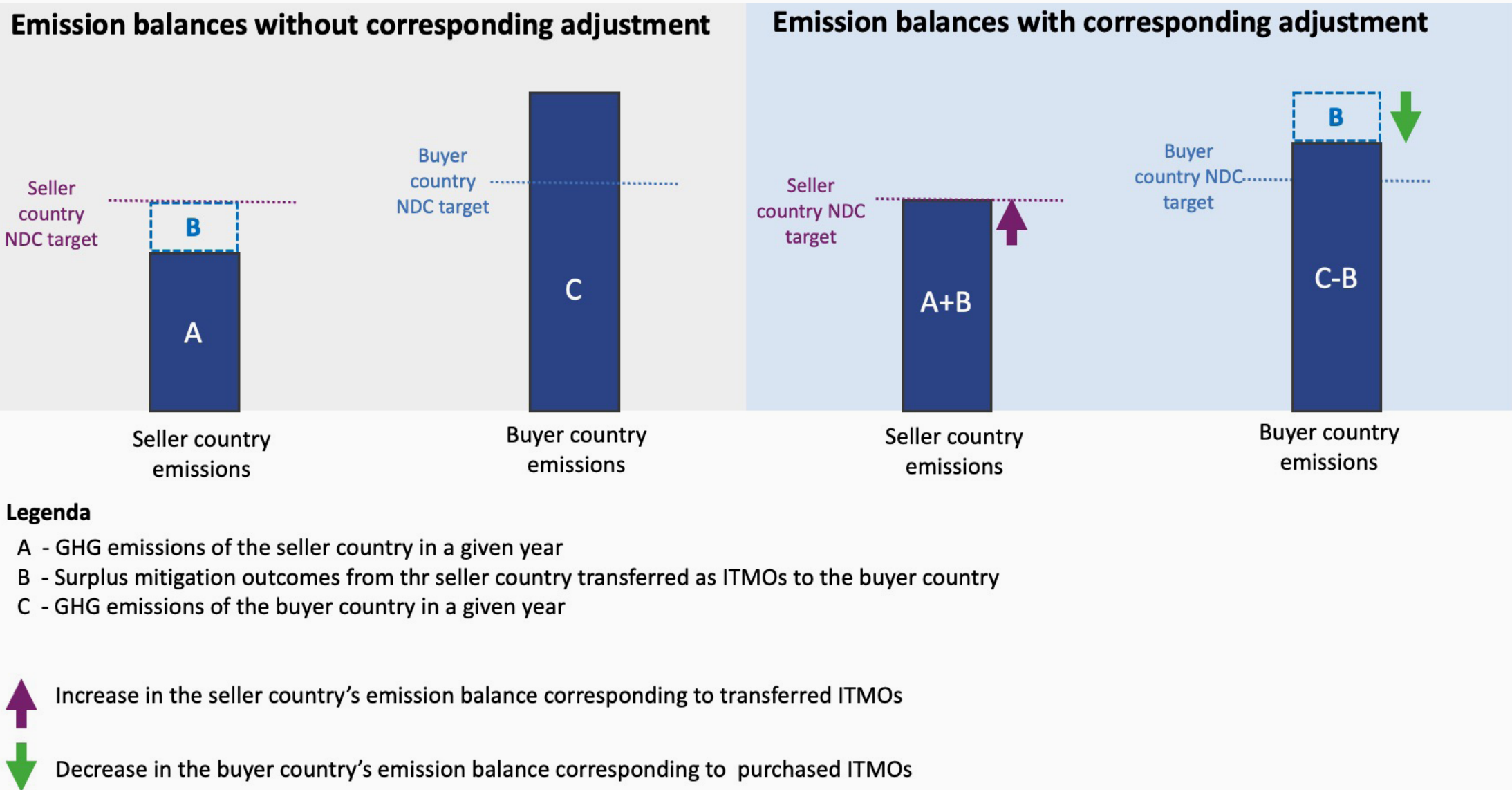
In the short to medium term, for a country to consider selling ITMOs or A6.4ER, it is necessary to break down the NDC’s emissions reduction target into a trajectory, so that it has an annual target that can be compared with the country’s annual carbon balance (UNFCCC, 2025e). This way, it will be possible to identify whether there will be a surplus of emissions in relation to the NDC.

Countries may even commit to selling ITMOs for years in which there are still no mitigation results according to their emissions inventory. To this end, the sale of ITMOs may be made based on estimates that indicate that there will be a national surplus of mitigation results. It should be noted, however, that it is important that sales based on estimates are conservative and that there is effective planning and monitoring in relation to compliance with the NDC to ensure a reduction in excess emissions. If the sale of these units demonstrates a lack of alignment with compliance with the NDC, the country’s credibility in the international market will be compromised.

Thus, **Brazil will be able to transact its mitigation results year after year based on estimates of surplus mitigation results. In fact, it is expected that the resources obtained through the market mechanisms of Article 6, with corresponding adjustments, will enable new projects, whether from direct financial resources or the development of capacities for the implementation of new technologies.** In the long term, as Brazil’s NDC aims to achieve net zero emissions by 2050, the potential supply of ITMOs will be equal to the country’s potential net removals.

The Figure 7 shows the **process of the impact of the corresponding adjustment on national emissions balances is illustrated: when selling the GHG emissions mitigation result, the GHG emissions balance of a given year of the selling country remains equivalent to the non-generation of this transferred mitigation result, so that the emissions reduction established in the NDC can only be achieved through other projects or activities that result in further GHG emissions mitigation, if the NDC of the transferring country has not yet been achieved.**

Figure 7 - Corresponding Adjustment Process resulting from ITMO transaction



Source: Adapted from UNDP (2022).

Likewise, the international sale of A6.4ER with corresponding adjustments – which occurs when this asset is authorized to be traded as ITMO – provides an increase in the country’s decarbonization commitment, so that these emission reductions or removals would need to be mitigated in other projects to maintain the country’s carbon balance, ensuring the achievement of the NDC. Additionally, it is understood that the potential for international transactions of units generated in Brazil’s PACM may not be significant, as the Brazilian NDC is ambitious. It is worth noting that, within the scope of PACM, it will be possible to generate A6.4ER in the mechanism even if they do not have authorization for international transfer. A6.4ERs that are not transferred internationally may be used nationally within the scope of SBCE or for voluntary compensation.

Therefore, as the potential of ITMOs and A6.4ER overlaps in representing GHG emission reductions or removals beyond the NDC, to avoid repetition of terms, ITMOs and A6.4ER will be treated below as ITMOs for ease of reading.

Based on the premise that the long-term supply of national ITMOs is equal to the potential for net removals, it is possible to have an idea of this supply potential using National Simulator of Sectoral Policies and Emissions (SINAPSE), the Brazilian government’s official tool for projecting scenarios for the implementation of sectoral public policies and the potential for reducing GHG emissions. **In the scenario in which all mitigation policies available in SINAPSE are applied,**

the country would have a surplus of emissions mitigation results of 128 MtCO₂e in 2050, considering compliance with the NDC. Since there is no way to simulate NDC compliance scenarios or global net zero scenarios in the tool, this approach was considered to estimate the maximum potential for net removals under an optimistic scenario for national climate policy.

According to Global Change Assessment Model (GCAM) scenarios from Network of Central Banks and Supervisors for Greening the Financial System (NGFS), **Brazil would have surplus mitigation results to transact only in a scenario in which global emissions jointly reach *net zero* by 2050, which reinforces the need for international cooperation to achieve climate goals before that deadline.** In the current policy scenario (Current Polices) or in the scenario that incorporates the ambitions and policies of the current NDCs (GCAM-NDCs), the country’s emissions would still be positive, with no surplus of mitigation results, so that the Brazilian supply of ITMOs tends to be limited. There is no information available about the public policies considered for Brazil in these scenarios. Table 1 presents a summary of the premises adopted in each scenario.

Table 1 – Assumptions adopted to estimate the demand for national ITMOs

Variable	Scenario	Scenario Description	Premise adopted
Global demand for ITMOs	Net zero 2050 (GCAM)	The Net Zero 2050 scenario limits global warming to 1.5°C through stringent climate policies and innovation. This scenario presupposes the immediate implementation of ambitious climate policies and global cooperation to achieve the climate objective.	The premise adopted in this scenario is that countries’ negative net emissions would be rewarded through the market mechanisms of the Paris Agreement.
	NDC (GCAM)	NDCs include all promised policies, even if they are not yet backed by actual implemented policies.	In both the NDC (GCAM) and Current Polices (GCAM) scenarios, global and national emissions increase, so that demand and supply for ITMOs are assumed to be zero.
	Current Polices (GCAM)	Current Policies assume that only currently implemented policies are preserved. Global emissions increase by 2080, leading to warming of about 3°C.	
	SINAPSE	The National Simulator of Sectoral Policies and Emissions SINAPSE MCTI is the Brazilian government’s official tool for projecting scenarios for the implementation of sectoral public policies and the potential for reducing GHG emissions, aiming to achieve the goals of the Brazilian NDC.	Scenario used to estimate the technical potential for net removals of GHG emissions, considering assumptions more suited to the national reality.

Source: WayCarbon, based on NGFS (2025) e MCTI (2025).

While Current Policies scenario assumes that only currently implemented policies are preserved, resulting in warming of about 3°C, the GCAM-NDCs scenario assumes that the moderate and heterogeneous climate ambition reflected in the conditional NDCs in early 2024 continues throughout the 21st century, so that emissions decline but still lead to warming of 2.3°C. In both scenarios, Brazil would not achieve net-zero emissions, which reinforces the need for better climate policies to increase GHG emissions mitigation.

The **Net Zero 2050 scenario** limits global warming to 1.5°C through strict climate policies and innovation. This scenario presupposes the immediate implementation of ambitious climate policies, such as technological innovations in carbon capture. **In this scenario, Brazil would reach negative net emissions from 2045, with removals of around 21 MtCO₂e per year, until reaching 362.5 MtCO₂e per year, based on the premise that the total market traded volume is composed of the countries' negative net emissions. Thus, Brazil's potential for ITMO transactions would repre-**

sent approximately 33% of the Paris Agreement's market mechanisms. The Figure 8 presents the potential for offering ITMOs according to this scenario

The scenario estimates reinforce Brazil's technical potential to generate a surplus of mitigation results in 2050 and sell them internationally. However, for this technical potential to become practical and be achieved, there must be political and market conditions to do so.

Brazil's ITMO supply potential in the *GCAM - Net Zero 2050* scenario of 362.5 MtCO₂e, for example, is higher than the currently announced demand commitments, which total 333.5 MtCO₂e, considering the commitments of Japan, Sweden, Switzerland and European Union (not yet approved by European Parliament), which expresses the need for increased international cooperation to limit global warming. In this sense, international cooperation through the mechanisms of the Paris Agreement may play a relevant role in reducing national emissions, but it may not be sufficient for Brazil to comply with its NDC.

A significant part of the effort to achieve the NDC depends on internal initiatives, several of which have already been mapped by public policy monitoring bodies, such as: i) measures to improve the governance, monitoring, and effectiveness of Policy to Prevent and Combat Illegal Deforestation (PPCD)(CMAP; Ministério do Planejamento, 2023a); ii) institutionalization and methodological improvement of the system necessary for monitoring, reporting, and verification of RenovAgro (formerly the ABC Plan) (TCU, 2023);

iii) adopting measures to end the tax subsidy for thermoelectricity (CMAP; Ministério do Planejamento, 2023b).

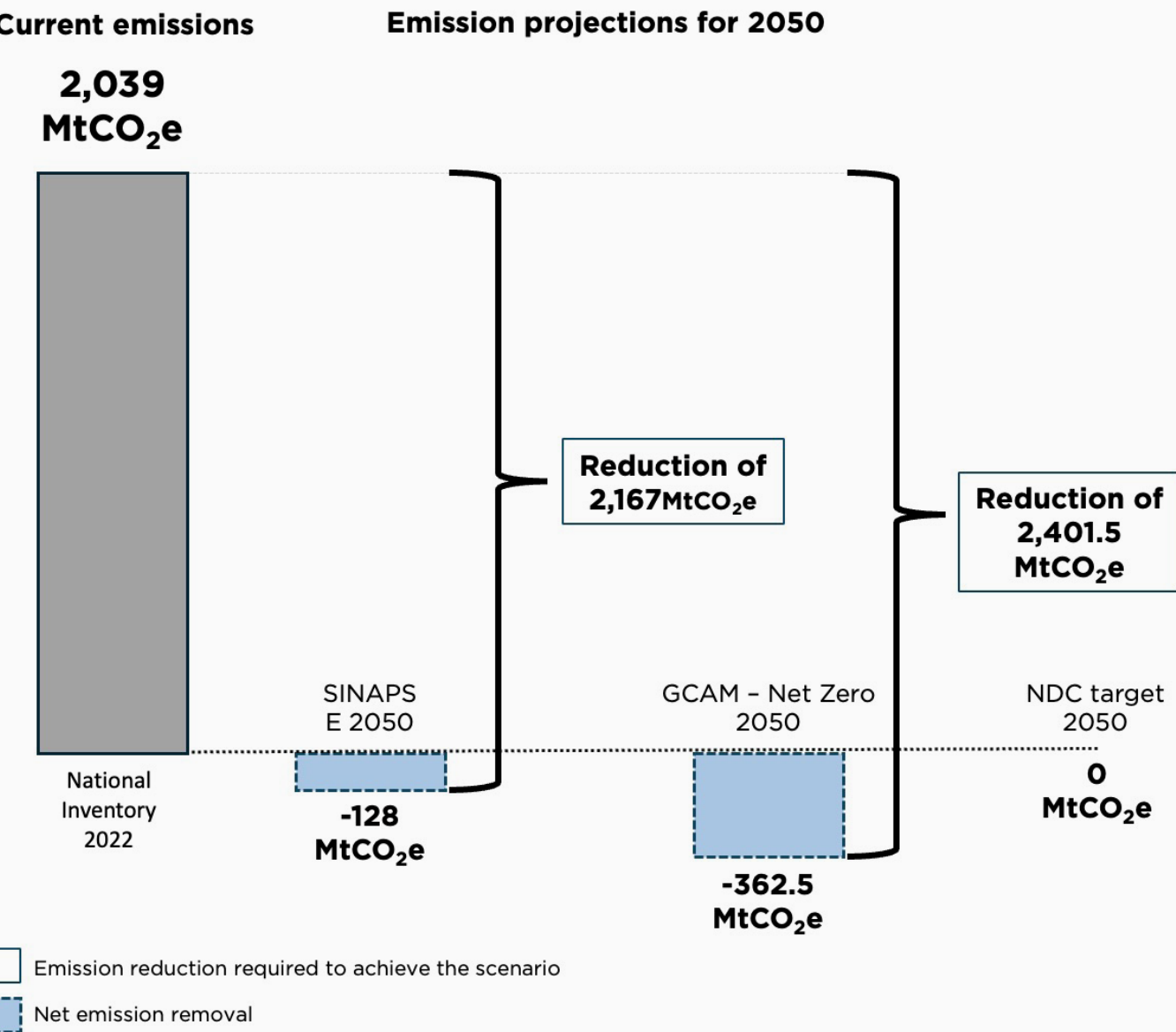
Thus, **National Mitigation Strategy, currently under development, plays a fundamental role in not only establishing new mitigation actions, policies and instruments, but also in improving existing policies, taking advantage of lessons learned from successful and unsuccessful experiences.** It is also necessary for the various current climate policies to have monitoring and reporting systems that are consistent with National Inventory so that their impact can be reflected in compliance (or not) with the NDC.

2.1.1.1 CORSIA

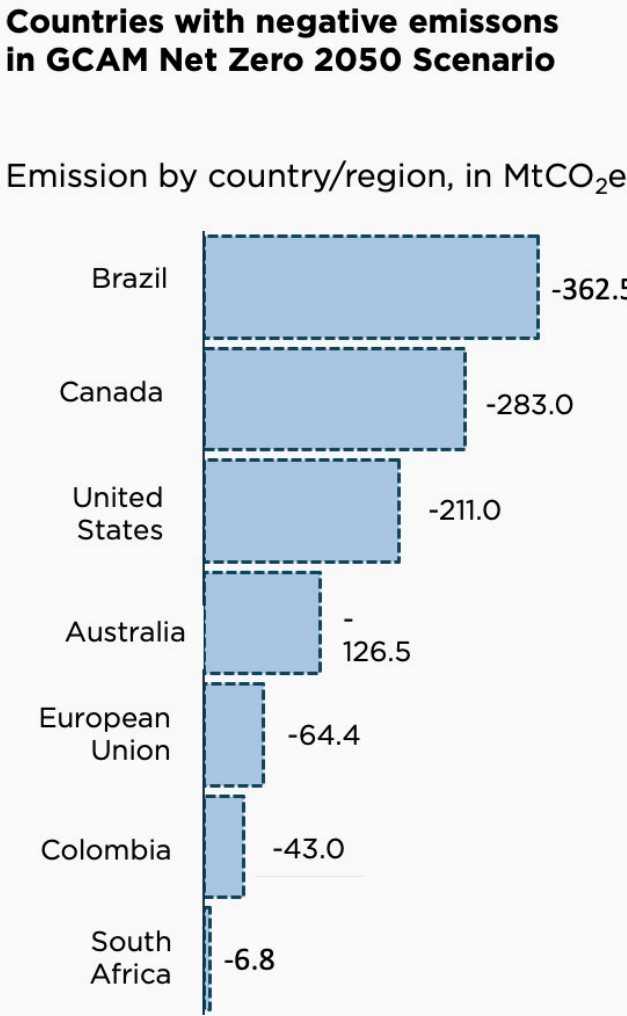
In addition to the targets established by countries' NDCs, CORSIA is a market segment that can generate demand for credits from national projects. There is an interaction between the market mechanisms of the Paris Agreement and the Voluntary Carbon Market, given that, although originating from Voluntary Market, **the credits traded for use in CORSIA are equivalent to ITMOs, as they are mitigation results authorized by host countries for use in international mitigation purposes other than the achievement of an NDC and require corresponding adjustments** (IATA *et al.*, 2024). Thus, a potential for Article 6 mechanisms within CORSIA is estimated based on parameters seen in Voluntary Market experience.

The independent certification standards accepted in the first operational phase of CORSIA are: Ameri-

Figure 8 - Net Removals Potential for Brazil in 2050 - ITMOs Supply - according to SINAPSE and NGFS projections (GCAM - Net Zero 2050)



Source: WayCarbon, based on MCTI (2023, 2025) Richters *et al.* (2024)



can Carbon Registry (ACR); Architecture for REDD+ Transactions (ART); Climate Action Reserve (CAR); Global Carbon Council (GCC); Gold Standard (GS) and Verified Carbon Standard (VCS). All projects must have their first credit generation period starting in 2016 and emissions reductions (or removals) must have occurred between 2021 and 2026.

The estimated global demand for CORSIA is **102 to 148 MtCO₂e for the first operational phase considering the countries volunteering in this phase, between 2024 and 2026, which would result in an average increase of 34 to 49.3 MtCO₂e in the annual demand for carbon credits. For the second operational phase, between 2027 and 2035, in which participation is mandatory, the accumulated demand in the period would be between 878 and 1,362 MtCO₂e, which would be equivalent to an average increase of between 109.75 and 170.25 MtCO₂e in the annual demand for credits in that period, an increase of between 62.43% and 96.8% in relation to the credits retired in 2024 in Voluntary Market. Considering these scenarios, the price of CORSIA-eligible credits could range from US\$6.8 to US\$20.8/tCO₂ by 2026.**

However, in recent years, most transactions for emissions compensation are carried out through bilateral contracts in Voluntary Market, making price information largely opaque (ICAO, 2025b). The price forecast and the assumptions applied should be subsequently supported by more robust data if these are available.

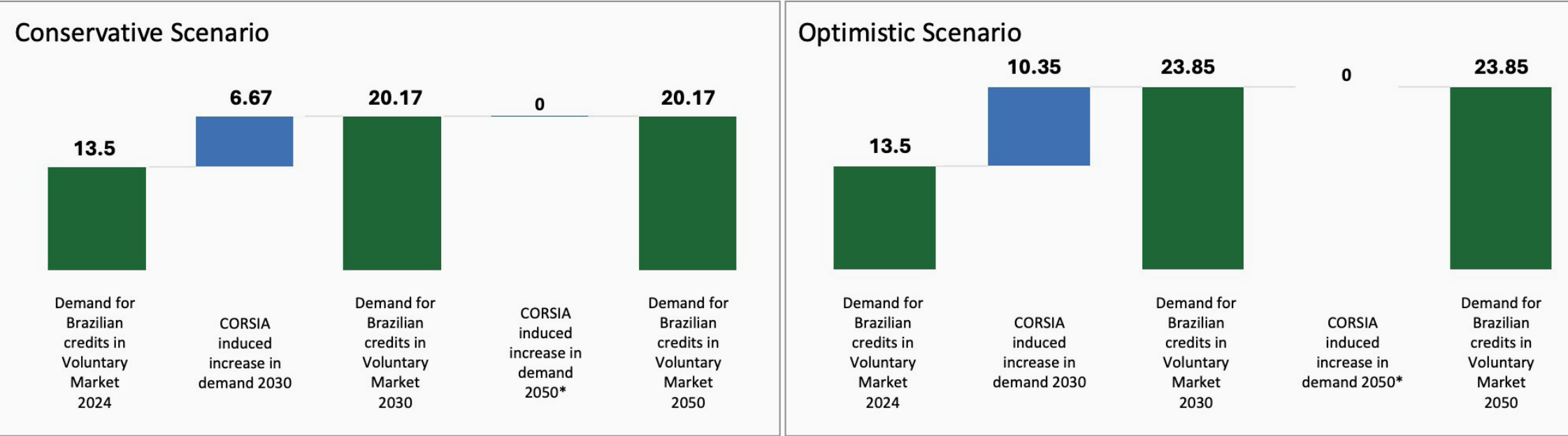
Given that there is no ICAO (2025b) estimate available for 2050 and that the evolution of demand for

carbon credits would depend on technological advances for the civil aviation sector, it was considered that annual demand between 2035 and 2050 would remain constant.

Considering a potential demand for Brazilian project credits eligible for CORSIA in the same magnitude as the demand for credits in Voluntary Market, at 6.08% of global retirements (historical average), the potential for CORSIA-eligible domestic credits would be around 6.67 to 10.35 MtCO₂e in carbon credits per year, which would represent an increase of up to 76.6% of the credits demanded in 2024. However, the realization of this potential, as in the market mechanisms of Article 6, depends on the acceptance of corresponding adjustments to this amount to be transacted. The Figure 9 presents the potential for demand for carbon credits in Voluntary Market and CORSIA.

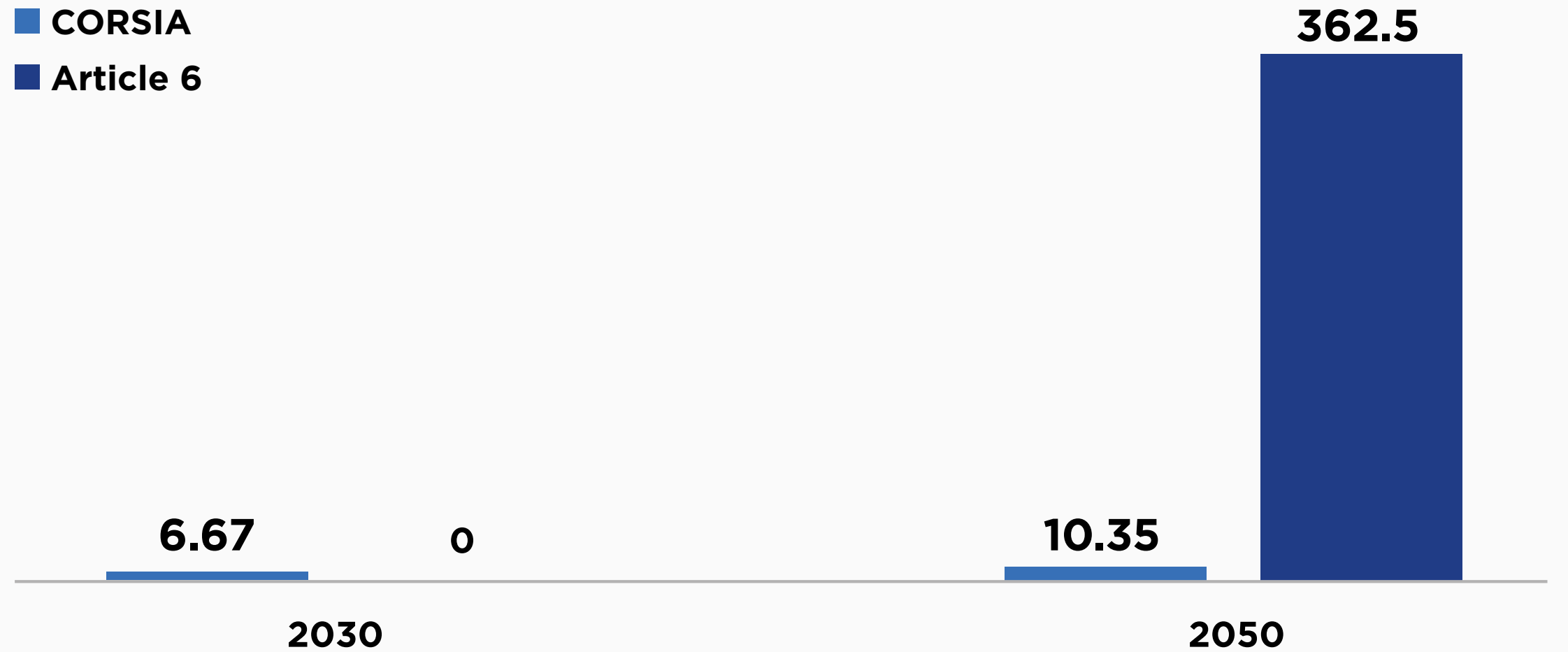
Therefore, demand arising from CORSIA could be an important driver of demand for national credits until 2030. From 2050 onwards, as analyzed in the previous subsection, the mitigation results offered under the Paris Agreement tend to be the largest driver of demand for national credits. It is worth noting that both cases are considered ITMOs, within the scope of this report, due to the need to accept corresponding adjustments for the market units to be tradable. Figure 10 summarize the potentials for Brazilian ITMOs.

Figure 9 – Potential growth in demand for Brazilian carbon credits, in MtCO₂e.



*Demand for 2050 considered equal to demand for the second phase in 2030.
Source: Waycarbon, based on ICAO (2025b).

Figure 10 – Market potential for Brazilian ITMOS (in MtCO₂e)



Source: Waycarbon.

2.1.2. KEY MESSAGES

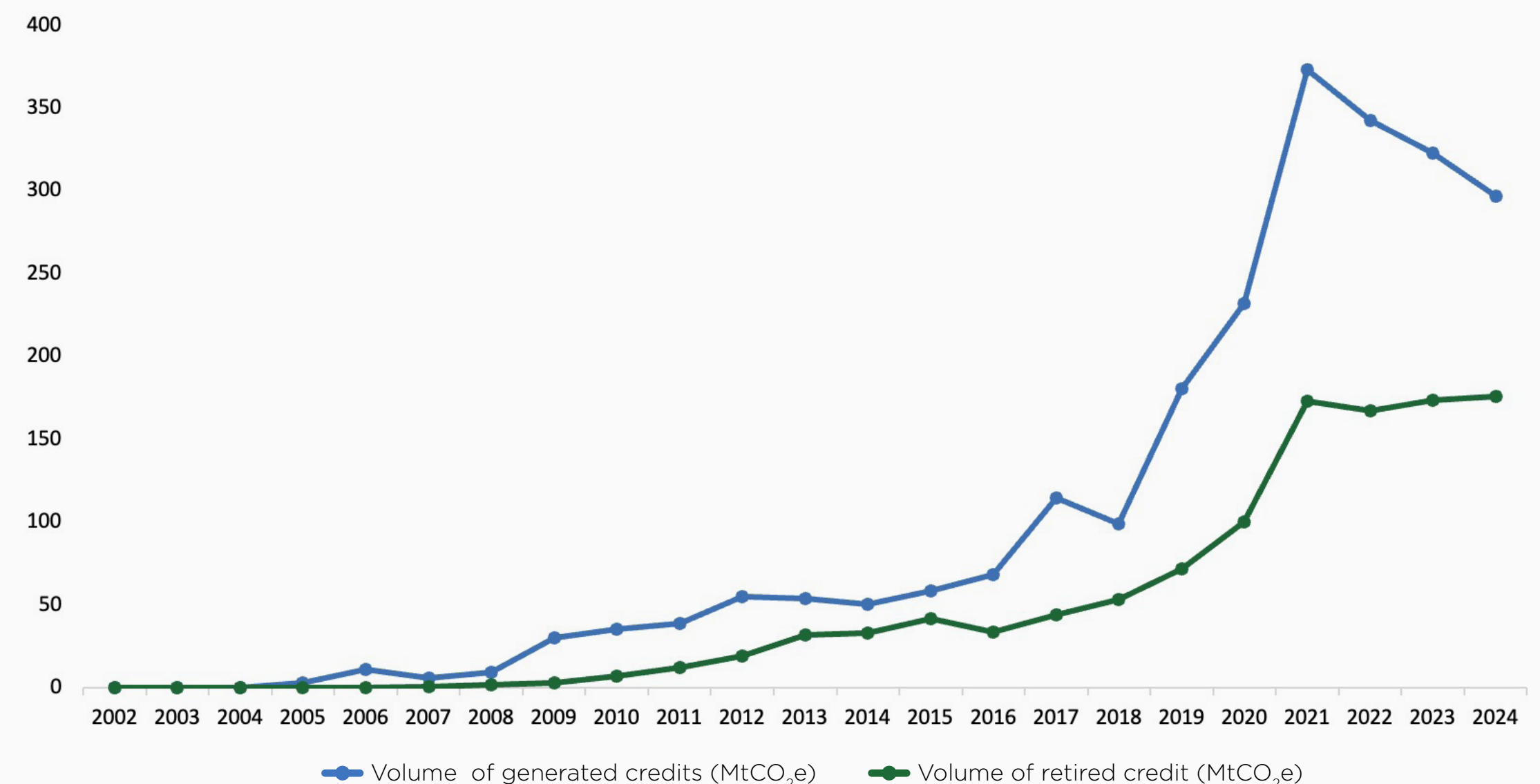
- ▶ Demand for ITMOs and A6.4ER is still in its infancy, as is the signaling of intent to use the Paris Agreement market mechanisms in NDCs, given the gaps in how the mechanisms will operate.
- ▶ The sale of ITMOs is possible given a consistent reduction in emissions that exceeds the targets set in the NDC. Therefore, the proceeds from this sale cannot be the basis of the NDC compliance strategy. Compliance with Brazil's NDC therefore still depends more on the consistency and effectiveness of domestic policies than on the international carbon market, which reinforces the need for a solid and predictable regulatory framework.
- ▶ Considering Brazil's ITMO offering, the country will be able to trade its excess mitigation results in relation to the country's emissions reduction target year after year.
- ▶ In the long term, with Brazil's NDC for 2050 targeting net-zero emissions, the potential for ITMO transactions will represent the country's net removals.
- ▶ In a scenario of international cooperation to reduce global warming, Brazil would be a leader in the sale of ITMOs, offering around 33% of ITMOs traded.
- ▶ The National Mitigation Strategy plays a key role not only in establishing new mitigation instruments and policies, but also in consolidating existing policies, drawing on lessons learned from successful and unsuccessful.
- ▶ CORSIA steps 1 and 2 may increase global demand for Voluntary Market carbon credits that are subject to corresponding adjustments.
- ▶ For Brazil, CORSIA could represent a potential increase of up to 76.6% in demand for carbon credits compared to 2024, provided that corresponding adjustment mechanisms are accepted.

2.2. VOLUNTARY MARKET

The survey of carbon credit generation in the 2022 version of this study (ICC Brasil; WayCarbon, 2022) took into account projects registered with VCS, Gold Standard, ACR and CAR. This version expands this analysis, also considering the independent carbon certification standards Cercabono, Architecture for REDD+ Transactions (ART), PlanVivo, Global Carbon Council (GCC) and Climate Forward¹⁰.

The Figure 11 presents the history of carbon credits generated and retired in the world. After a peak in credit generation observed in 2021 – a movement that can be interpreted as a reflection of market speculation given the acceleration of corporate climate goals (Carbon Direct, 2023) – subsequent years saw a lower volume of credits being generated, but still in a quantity greater than retirements.

Figure 11 – History of carbon credits generated and retired in the world



Source: WayCarbon based on the independent certification standards analyzed.

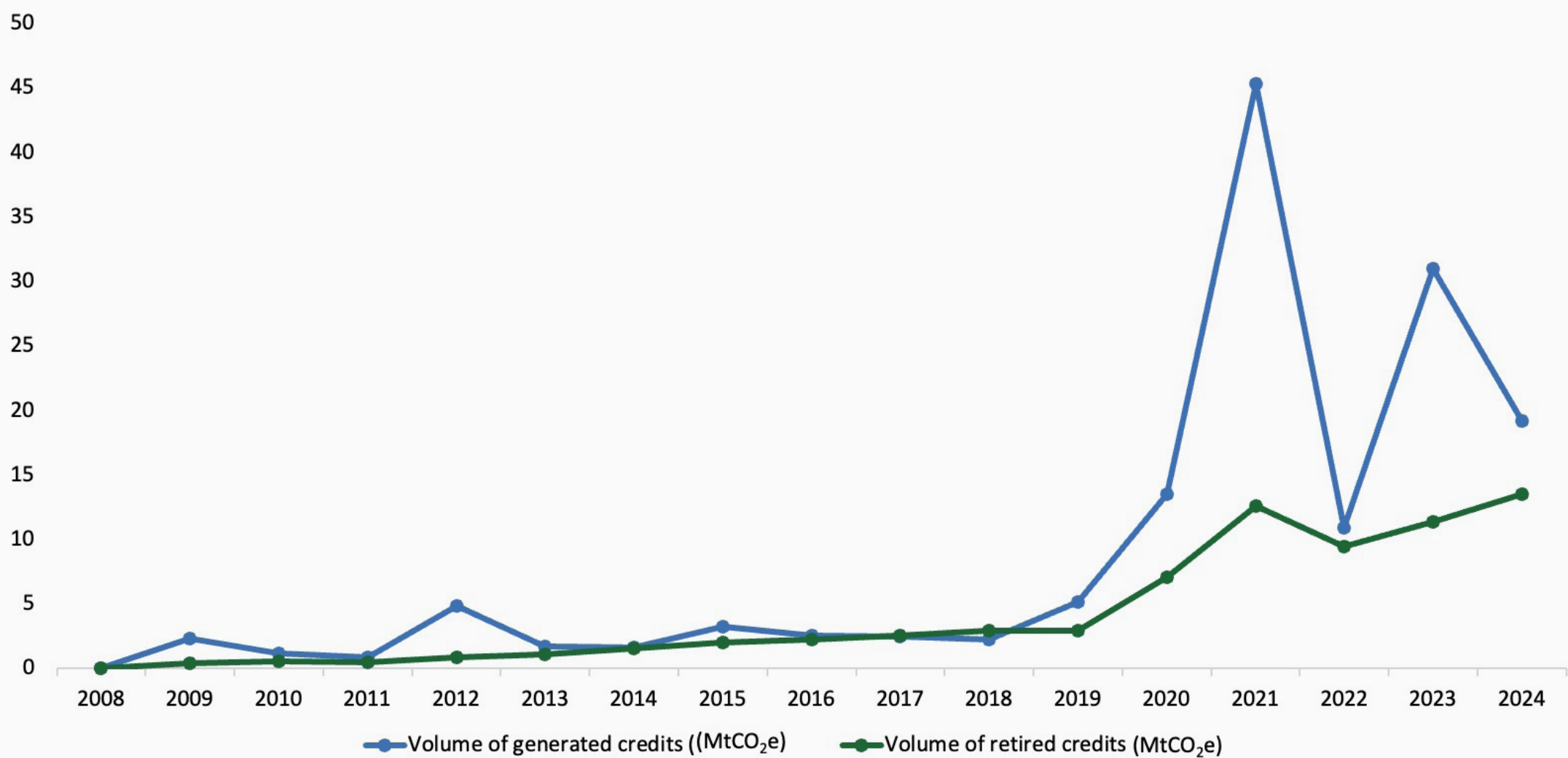
10. The information from the independent certification standards analyzed in this study was obtained from their project platforms between May 5 and 30, 2025: VCS (Verra, [s. d.]), (Gold Standard, [s. d.]), (ACR, [s. d.]), (CAR, [s. d.]), (Cercabono, [s. d.]), Architecture for REDD+ Transactions (ART, [s. d.]), (Plan Vivo, [s. d.]), Global Carbon Council (GCC, [s. d.]) and Climate Forward, [s. d.].

There is a total of 2,138 million credits generated and 1,143 million retired, resulting in a surplus of 1,238 million credits in the entire historical series. Even if there are credits that have been consumed but not retired and agents of demand for credits that reserve credits for years to be consumed later (banking), such a surplus can be identified as a scenario of significant excess supply of carbon credits in Voluntary Market. On the other hand, **despite recent questions about the integrity of the credits, retirements remained constant over the same period, which may indicate a certain resilience in effective demand.** This trend can be explained by

the increased interaction between Voluntary Market and national compliance instruments, such as carbon tax offsetting via the retirement of Voluntary Market carbon credits (Banco Mundial, 2025).

The historical volume of carbon credits generated and retired in Brazil can be seen in Figure 12. The market has accumulated a total volume of 148 million generated credits and 71 million retired credits in the historical series, with a total of 77 million Brazilian credits generated and not yet retired. The first Brazilian credit record in the independent carbon certification

Figure 12 - History of carbon credits generated and retired in Brazil



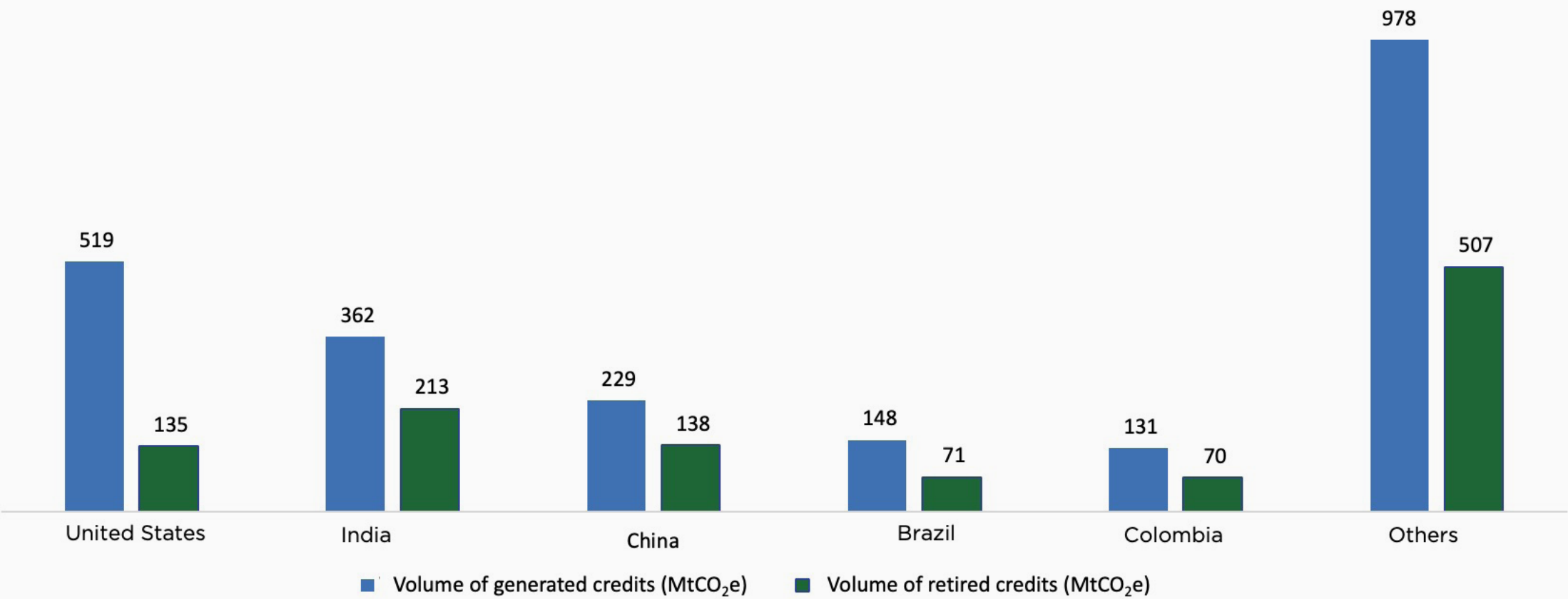
Source: WayCarbon based on the independent certification standards analyzed.

standards analyzed dates to 2009. After the peak of credits in 2021, a trend also identified in other countries, there is a considerable decline in the generation of carbon credits in 2022. Furthermore, following the global trend, the number of retirements between 2021 and 2022 remained relatively stable.

Historically, the top five credit-generating countries account for approximately 59% of generated credits and 55% of retired credits. Namely: United States, China, India, Brazil and Colombia. While the first four were already in this group of main carbon credit generators, Colombia has recently stood out, reaching a cumulative 98.3 million credits generated in the last

5 years, a value more than three times higher than in the five-year period between 2015-2019. Much of this growth is due to the generation of credits in Cercarbono, which has already accounted for 76% of Colombian credits since 2019. Total retirements of Colombian credits have already reached 70 million credits, almost reaching the retirements of Brazilian credits, at 71 million credits. A significant part of the purpose of these pensions is to offset the national carbon tax, which accounts for approximately 45.4% of credit pensions in the country. The Figure 13 presents the generation and retirement of credits from these countries and the accumulation of other countries.

Figure 13 - Main countries generating carbon credits in Voluntary Market (in MtCO₂e) - accumulated generation and retirement from 2002 to 2024



Source: WayCarbon based on the independent certification standards analyzed.

In other credit-generating countries, the predominance of VCS is observed both on the supply side (credit generation) and on the demand side (retirements), with 54 and 69% of the credits generated and retired globally, respectively. In Brazil, until 2022, VCS dominated credit generation. However, in 2023, in its first year in Brazil, Cercarbono was responsible for almost 80% of the credits generated that year. In 2024, Brazilian credit generation was evenly distributed among four independent certification standards: Cercarbono accounted for 34%; Gold Standard for 27%; VCS generated 25%; and finally, GCC generated 14% of the credits that year. It is worth highlighting the significant growth in the participation of the Gold Standard, which generated, in total, 2.7 million credits in Brazilian projects between 2012 and 2023 and 5.1 million carbon credits in 2024 alone.

Retirements in Brazil, however, are dominated by VCS, responsible for more than 90% of historical retirements. Despite the gradual reduction in credit generation, the volume of credits retired in VCS remains relatively constant over time (69% of the total retired). As one of the oldest certification standards and with processes already known and recognized, VCS maintains a preferred position among agents in the demand for carbon credits.

It is also important to highlight the role of co-benefits generated by carbon credit projects, that is, additional positive impacts, including social and/or environmental improvements, especially regarding alignment with Sustainable Development Goals (SDGs), in the supply and demand for carbon credits. Only four

of the independent certification standards analyzed – VCS, Cercarbono, ACR and GCC – systematically report the association, or lack thereof, of registered projects with any SDG. Together, these standards represent 72% of the total volume of credits generated.

Based on the historical series, 22% of the volume of credits generated by these standards is linked to at least one SDG. This link may occur retroactively, as in the case of projects registered before the formalization of the SDGs, such as initiatives dating back to 2009. Over the last ten years, the average percentage of credit volume generated associated with some SDG reached 24%. However, **in 2023 and 2024, this percentage rose to 33%, suggesting a positive trend in the supply of credits for aligning registered projects with the SDGs.** On the other hand, this trend is not yet reflected in credit retirements. The average over the last ten years indicates that only 10% of the volume of retired credits was linked to at least one SDG – in 2023 and 2024 the percentage is equal to the average.

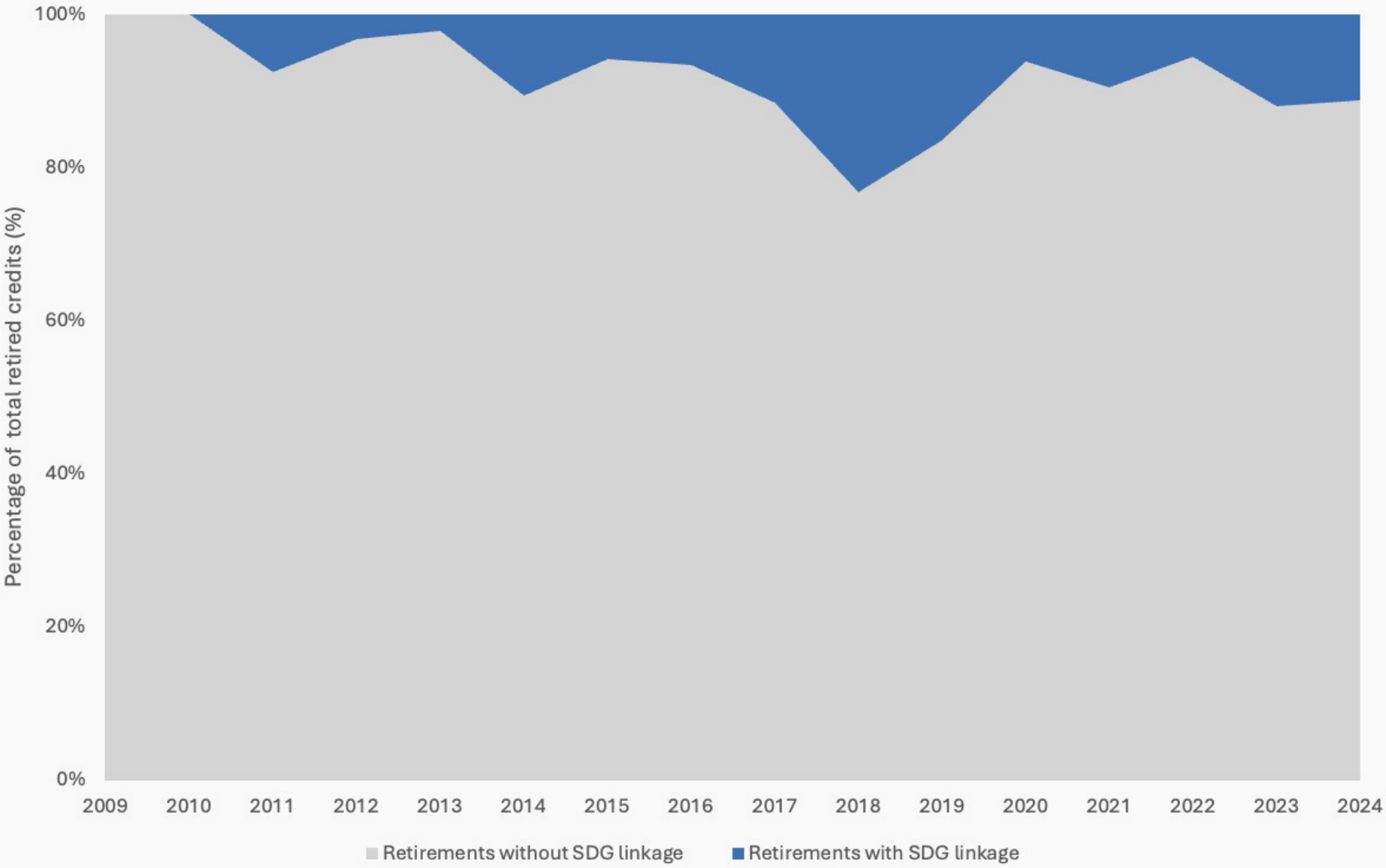
Although co-benefits have already been mentioned as valued elements in corporate sustainability strategies, the survey of the volume of credit retirements with some additional certification, which proves positive social and/or environmental impacts, does not yet show a consistent trend of preference, on the part of buyers, for these types of credit. The total volume of retired credits associated with some SDGs shows slight growth and annual fluctuations without a defined pattern, which suggests that the choice of buyers may be more related to specific project factors – such as price, type,

location or confidence in the methodology – than to the presence of co-benefits, as shown in Figure 14.

Another approach used to evaluate the co-benefits generated by projects is the adoption of labels, such as CCB (*Climate, Community & Biodiversity*), which seek to ensure the application of good practices aimed at generating positive benefits in three dimensions: mitigating climate change, developing local communities, and conserving biodiversity. The CCB is managed by Verra, which also manages VCS, making it the only standard among those analyzed those features

projects certified with the label. Furthermore, CCB is restricted to projects in AFOLU (Agriculture, Forestry and Other Land Use) sector. Therefore, considering only the credits from AFOLU projects issued by VCS in the historical series, 70% of the volume of credits already have CCB. In the last five years (2020 – 2024), this percentage increases to 74%, indicating a slight intensification in the adoption of the label among recent projects. **Regarding retirements, credits with CCB represent 66% of the total number of retirees since 2009 – the year in which the first credits with this label were recorded. In the last five years, this rate**

Figure 14 - Relationship between retirement credits with contribution to some SDG and credits without contribution



Source: WayCarbon based on the independent certification standards analyzed.

has risen to 76%, suggesting a growing preference for credits with certified co-benefits at the time of retirement. The Figure 15 shows an increase in retirements with this standard is evident, demonstrating an increase in interest in credits for projects that contribute to biodiversity and local communities.

Regarding credit-generating projects, the Energy, Industry and AFOLU sectors stand out worldwide in terms of the volume of credit generated and retirements. The industry played a leading role between 2002 and 2010, a period in which it was responsible for generating 53% of registered credits. From 2011

onwards, however, its representation was significantly reduced – not so much due to a significant drop in the volume of credits generated, but, above all, due to the accelerated growth of projects in Energy and AFOLU sectors. In 2022, Industry regained relevance, accounting for 13% of the credits generated, reaching a historic record of 43 million credits generated.

The AFOLU sector, traditionally with a strong market share – especially since 2011 –, saw a significant decline in credit supply in 2024, possibly because of recent criticism regarding the integrity of forest conservation projects. For the first time in a decade, its share fell

to less than 30% of total credit generated. In absolute terms, the volume fell from 135 million credits in 2023 to 76 million in 2024, representing a reduction of approximately 44% of its issuances in one year.

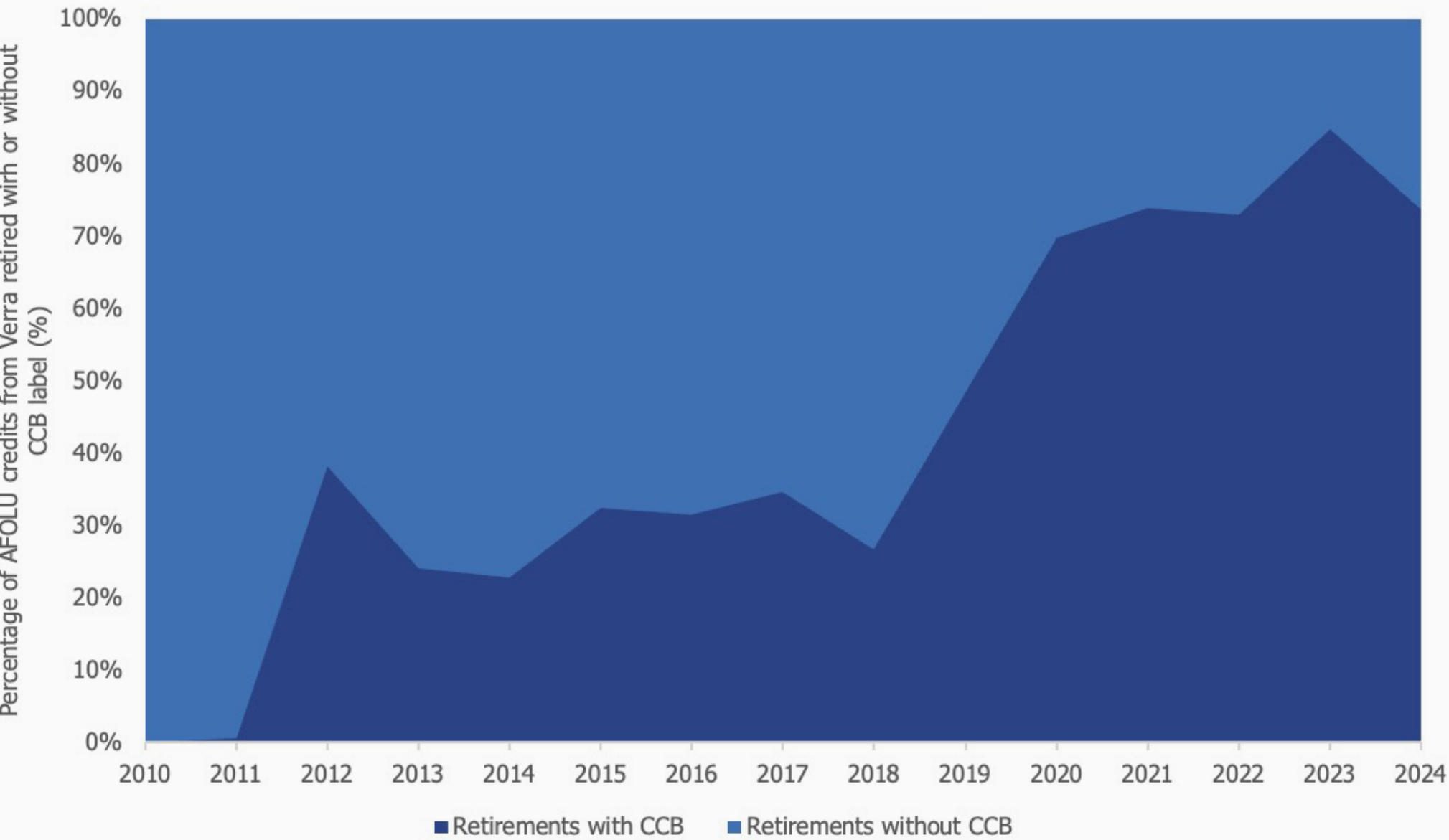
The energy sector has maintained a significant share in credit generation since 2009. Starting in 2020, the sector began generating more than 100 million credits annually, reaching its peak in 2021, reaching the milestone of 150 million credits. Over the last five years, its contribution has fluctuated around 40% of total credit generation.

Regarding the demand for carbon credits, it is observed that the sectors with the highest volume of retirements

are, naturally, also the largest generators of credits. The Energy sector leads in this regard, with 71 million credits retired in 2023 and 78 million in 2024. The AFOLU sector follows closely, with 69 million credits retired in 2023 and 70 million in 2024. The Industrial sector, after peak generation in 2022, presented 16 million retired credits in 2023 and 10 million in 2024. The Figure 16 presents the generation of credits and retirements accumulated by these sectors in the world.

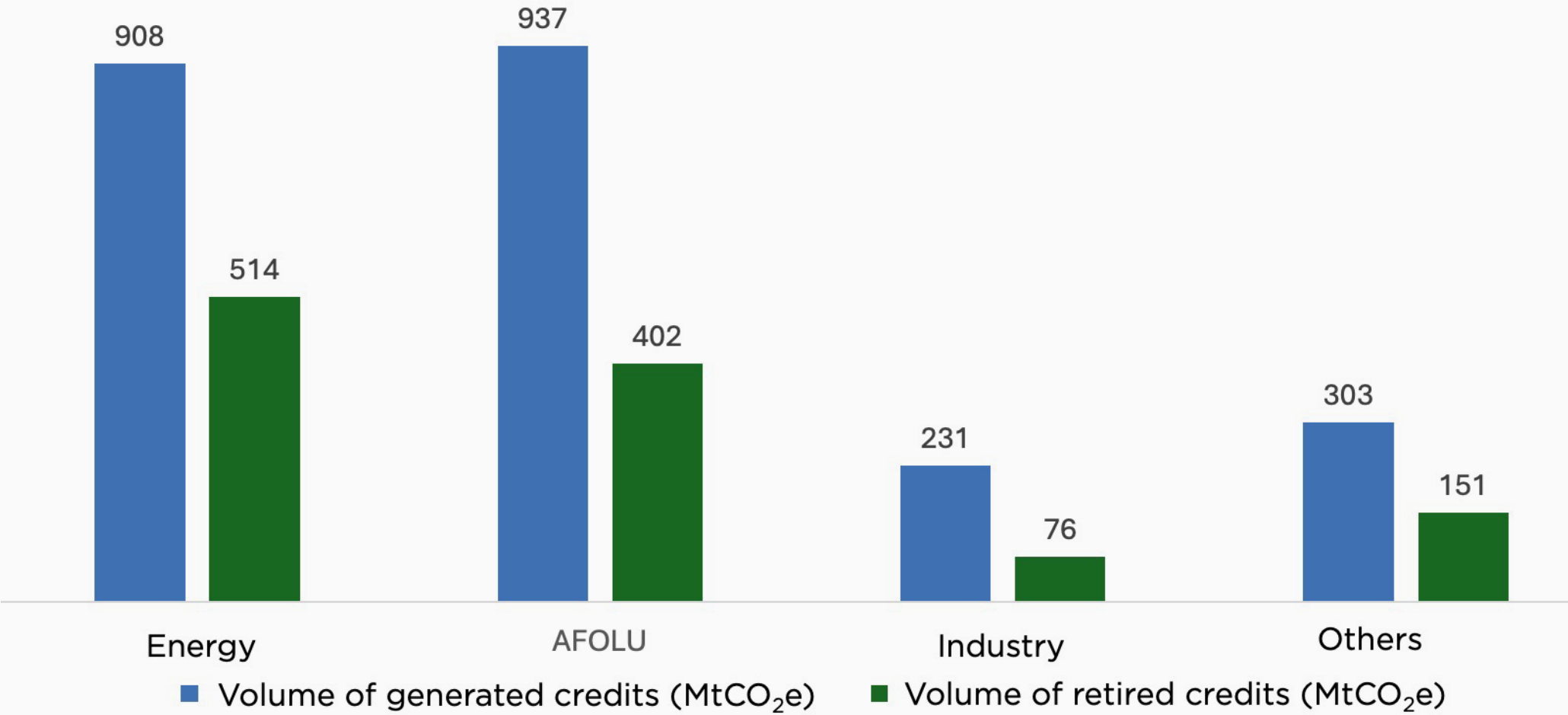
In the Brazilian context, no registered projects in the industrial sector were identified in the analyzed standards. Furthermore, in Brazil, the AFOLU sector has greater relevance in generating credits and retirements, in relation to other sectors, than is observed

Figure 15 - Percentage of the volume of VCS AFOLU credits retired with or without CCB



Source: WayCarbon based on the independent certification standards analyzed.

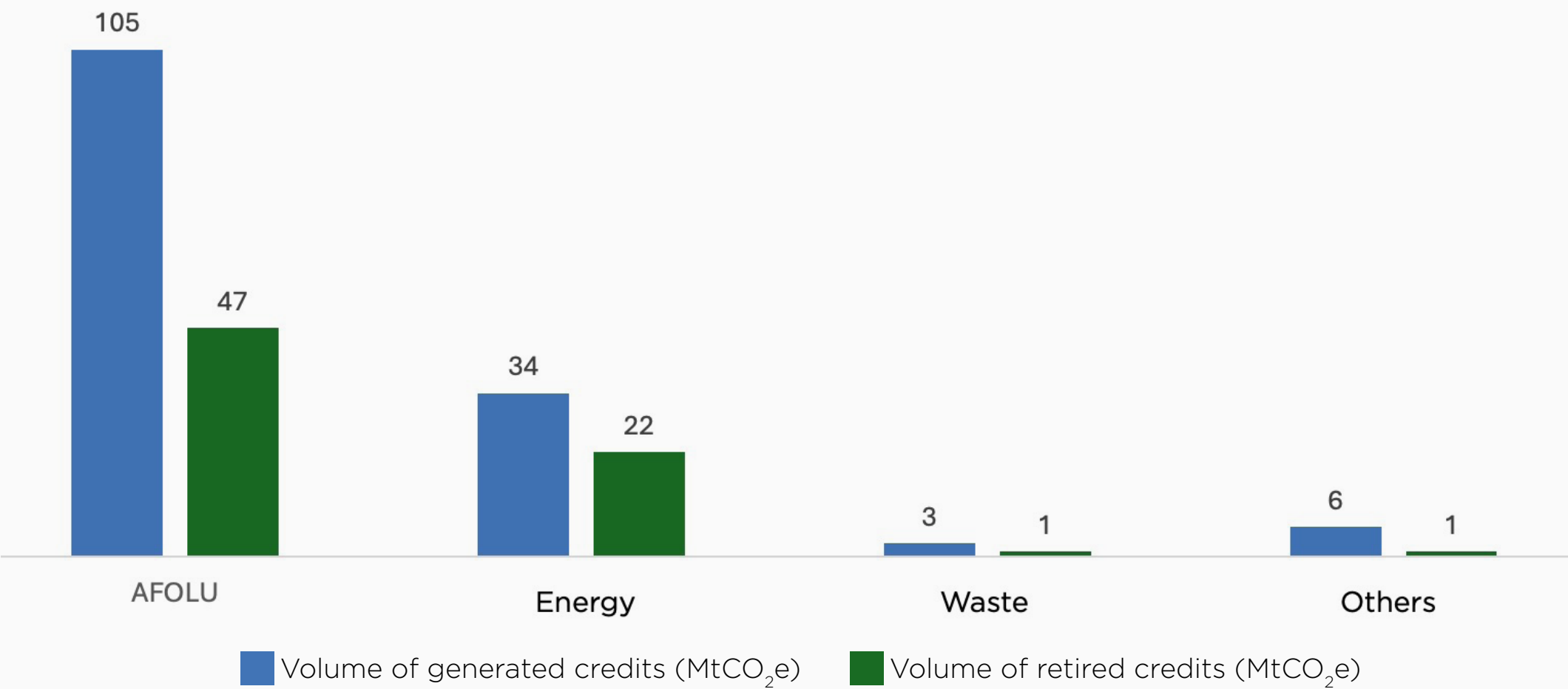
Figure 16 - History of carbon credits generated and retired worldwide (2002–2024) by carbon credit supplier sector (in MtCO₂e)



Source: WayCarbon based on the independent certification standards analyzed

worldwide. This trend can be justified by the generation of socio-environmental co-benefits in forest conservation and restoration projects in addition to the reduction and/or removal of GHG emissions and the loss of additionality of renewable energy projects in the country. The main carbon credit-generating activities in the country throughout the historical series (between 2002 and 2024) are, in order of relevance: the AFOLU sector, with approximately 105 million credits generated and 47 million retired; the energy sector, with 34 million credits generated and 22 million retired; and thirdly, the waste sector, with 3 million credits generated and 1 million retired. The Figure 17 summarizes the generation and retirement of carbon credits in Brazil by supplying sector.

Figure 17 - History of carbon credits generated and retired in Brazil (2002 – 2024) by sector offering carbon credits (in MtCO₂e)

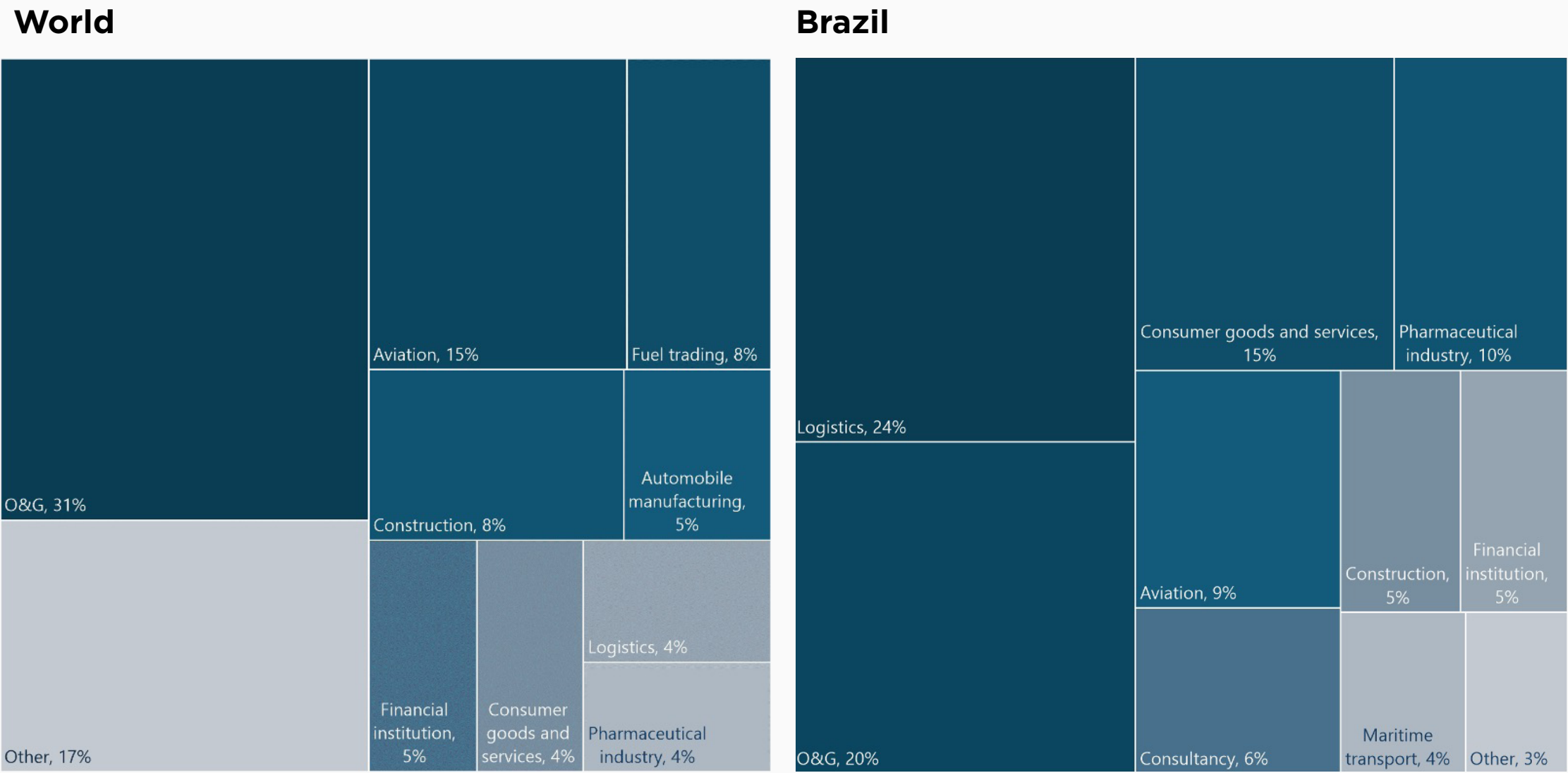


Source: WayCarbon based on the independent certification standards analyzed.

Regarding consumers of carbon credits, agents of demand for carbon credits that retire credits, there is a greater participation of certain sectors of the economy, as per Figure 18. Globally, the Oil & Gas and Aviation sectors have historically stood out as the largest consumers of carbon credit. In 2023 and 2024 alone, companies in the Oil and Gas sector were responsible for the retirement of more than 40 million credits. The Aviation sector has demonstrated consistency in this process, with an average of approximately 5 million credits retired annually, between 2020 and 2024.

In Brazil, this trend is also confirmed. The Oil and Gas and Aviation sectors are among the main consumers

Figure 18 - Sectors of the main beneficiaries of carbon credits in the world and in Brazil



Source: WayCarbon based on the independent certification standards analyzed.

of carbon credit in the country. Furthermore, consulting firms have gained relevance on the national scene in recent years, positioning themselves as one of the segments that retire the most credits. Other sectors, such as Logistics, Consumer Goods and Services and the Pharmaceutical Industry, also stand out. However, in these cases, the significant volume of retirements is driven mainly by the operations of a single company in each sector.

Despite the relative stability of retirements between 2023 and 2024 globally, credit prices fell by around

6%, as did the volume traded, which fell by 25% in this same period (Ecosystem Marketplace, 2025). Renewable energy credit prices were the most affected during the period, with a 32% reduction compared to 2023, while agricultural project credits grew 18% in the same period, despite an 87% contraction in transaction volume. The agriculture sector was the only sector that recorded an increase in average price, driven by the price of the Livestock Methane, Sustainable Farmland Management and Soil Carbon subgroups. Table 2, next page, presents prices and volume traded in each sector.

Table 2 - Volume traded and prices practiced in the global Voluntary Carbon Market in 2023 and 2024

	2023		2024		Variation	
	Volume (MtCO ₂ e)	Price (USD)	Volume (MtCO ₂ e)	Price (USD)	Volume (MtCO ₂ e)	Price (USD)
Forest and Land Use	37.1	\$ 10.04	37.0	\$ 9.27	0%	-8%
Renewable Energy	29.0	\$ 3.92	22.3	\$ 2.67	-23%	-32%
Industry	12.2	\$ 4.10	5.7	\$ 3.66	-53%	-11%
Domestic/Community Devices	10.2	\$ 7.71	5.1	\$ 7.30	-50%	-5%
Waste	1.5	\$ 7.46	4.8	\$ 6.72	226%	-10%
Agriculture	4.7	\$ 6.51	0.6	\$ 7.66	-87%	18%
Energy Efficiency and Fuel Replacement	9.4	\$ 3.65	0.6	\$ 3.05	-93%	-16%
Transportation	-	-	0.2	\$ 3.24	-	-

Source: (Ecosystem Marketplace, 2025).

Note that the volume transacted may not coincide with the generation or retirement of credits, given that this volume refers to negotiations. Once generated, a credit can be transacted countless times until it is, in fact, retired. Credits are retired only once and may be the result of a transaction that occurred in the same year as retirement or in previous years. Thus, although the volume traded is an important thermometer, measuring liquidity and market price signaling, this indicator can incorporate negotiations that do not result in emissions offsets, the main purpose of the Voluntary Carbon Market demand. For these reasons, this study considers retirement as the effective demand for carbon credits, given that a credit can only be retired, that is, “consumed”, once.

2.2.1. MARKET POTENTIAL

The demand for credits in Voluntary Market is significantly fragmented, so identifying the main drivers of potential future demand tends to be an analysis permeated by uncertainty. Therefore, the following estimates seek to outline a rationale for the vectors that may influence future demand for credit in Voluntary Market and, consequently, the potential for this market. As mentioned previously, the following analyses are not forecasts, but rather scenario analyses, given the available information.

It is expected that much of the future demand for these credits will come from companies that have

climate commitments. Among the climate commitments, Science Based Target Initiative (SBTi) stands out as it is probably the main initiative used to establish targets. Currently, more than 10,000 companies have already declared some commitment to establishing climate targets in accordance with the SBTi, and more than 7,900 have already had their targets effectively approved by the initiative, covering around 5,000 MtCO₂ in annual emissions covered by climate commitments in 2023 (SBTi, 2024, 2025). In general, companies with long-term targets approved by the initiative must reduce approximately 90% of their emissions by 2050, neutralizing residual emissions, which would imply a **global demand of 500 MtCO₂e per year in 2050, considering the current scope of the initiative and that companies meet the current commitments**, assumed in 2023.

Historically, the volume of credits in which those retiring the credits (consumers) are companies that have some commitment to SBTi was around 60.3 million credits, which represents around 5.3% of the credits retired globally in Voluntary Market. In 2023, retirements from companies with some commitment to SBTi totaled approximately 17.25 million credits, which represents only 0.35% of the GHG emissions covered by the initiative.

The percentage below 10% is expected, given that the initial focus of the initiative is to reduce emissions and not to offset or neutralize emissions. Given that companies face budget constraints when choosing

to decarbonize internally, fewer resources remain for purchasing carbon credits. Since offsetting non-residual emissions is not permitted to meet reduction targets, the purchase of carbon credit is intended for companies with more ambitious commitments than those stipulated by the SBTi. Additionally, most of the targets are short-term, not indicating a commitment to decarbonization by 2050 with the neutralization of residual emissions. Still, for potential demand in 2050, it is possible that emissions mitigation options will become scarce, so that neutralizations reach 10% of currently covered emissions. It is worth noting that only emission removal credits are currently permitted for the neutralization of residual emissions.

Furthermore, the number of companies with established targets has been growing significantly year after year, which could increase the emissions covered by the initiative. Between 2020 and 2024, the number of companies with established goals grew by an average of 228% per year, going from 546 companies with approved goals in 2020 to 6,781 companies in 2024, a trend that may continue in the coming years. Given the uncertainty regarding new climate commitments, however, this potential growth was not considered when estimating demand for the horizons analyzed.

Another portion of the effective demand for carbon credit comes from companies with other climate commitments unrelated to SBTi, such as Shell, the largest identified demander, with more than 36.8 million credits retired by 2024. In addition to Shell, it is noteworthy

thy that other companies in the fossil fuel production chain represent a significant portion of the effective demand for carbon credit, such as companies participating in International Group of Liquefied Natural Gas Importers (GIIGNL). Historically, companies participating in this group have retired 60 million credits, of which approximately 6.8 million were expressly retired for the purpose of offsetting Liquefied Natural Gas (LNG) emissions. Between 2020 and 2024, companies that are part of GIIGNL offset, on average, 0.9% of emissions related to imported LNG, considering LNG life cycle emissions (GIIGNL, 2020).

In addition to GIIGNL, Tokyo Gas and 14 other Japanese companies from different sectors created Carbon Neutral LNG (CNL) Buyers Alliance, aiming to offset emissions from natural gas used in Japan (Tokio Gas, 2021). The supply of carbon-neutral liquefied natural gas may be attractive for decarbonizing Asian countries, given that while many Asian countries consider natural gas essential to replace coal in the energy sector, most have insufficient domestic production, few economically viable options for expanding domestic production, and limited alternative sources for pipeline imports (BLANTON; MOSIS, 2021). Therefore, importing LNG may be more attractive than importing fuel, given the possibility of being transported by ships (BLANTON; MOSIS, 2021).

Considering these main groups of influence on the demand for credits in Voluntary Market, the global demand potential for the years 2030 and 2050 was estimated separately for each group. The other retirements, which are not from companies with SBTi or

GIIGNL commitments or which were not identified, were treated as “others”. It was considered that this portion of the retirement of credits will vary according to the decarbonization scenarios produced by the NGFS GCAM model, already used in the calculation of the potential of the Article 6 mechanisms in a previous section of this study. Table 3 presents a summary of the premises of the scenarios analyzed.

Net Zero 2050 scenario limits global warming to 1.5°C through stringent climate policies and innovation, achieving global net zero CO₂ emissions by around 2050. This scenario presupposes the immediate implementation of ambitious climate policies, such as technological innovations in carbon capture and storage. The less ambitious NDCs scenario assumes that the moderate and heterogeneous climate ambition reflected in the conditional NDCs in early 2024 continues throughout the 21st century, so that emissions decline

but still lead to 2.3°C of warming. Finally, Current Policies scenario assumes that only currently implemented policies are preserved. In this scenario, emissions increase until 2080, resulting in warming of about 3°C and severe physical risks. As global emissions increase in these last two scenarios, it was considered that the demand for carbon credits from companies that do not have SBTi targets in Voluntary Market would also increase as a measure to offset corporate emissions.

Table 3 - Assumptions for estimating demand for carbon credits in Voluntary Market

Variable	Scenario	Premise adopted
Global demand for credit from SBTi companies	Net zero 2050	Linear growth of retirements between 2024 and 2050, until reaching 10% of the emissions currently covered by the initiative, that is, only residual emissions (500 MtCO ₂ e in 2050). This demand would be exclusively for removal credits, due to the restriction established by SBTi.
	Current Polices and NDC (GCAM)	Linear growth of SBTi company retirements equal to the historical average (57.73% in relation to 2024 emissions).
Global demand for credits related to GIIGNL companies	All scenarios (GCAM)	Demand variation equal to the growth rate of natural gas use in the respective scenarios.
Global demands from other diverse initiatives	All scenarios (GCAM)	Demand variation at the same rate of decarbonization as the global economy.
Demand for Brazilian credits	All scenarios	Average of National Credit Retirements in Relation to Total Retirements in Voluntary Market

Source: WayCarbon.

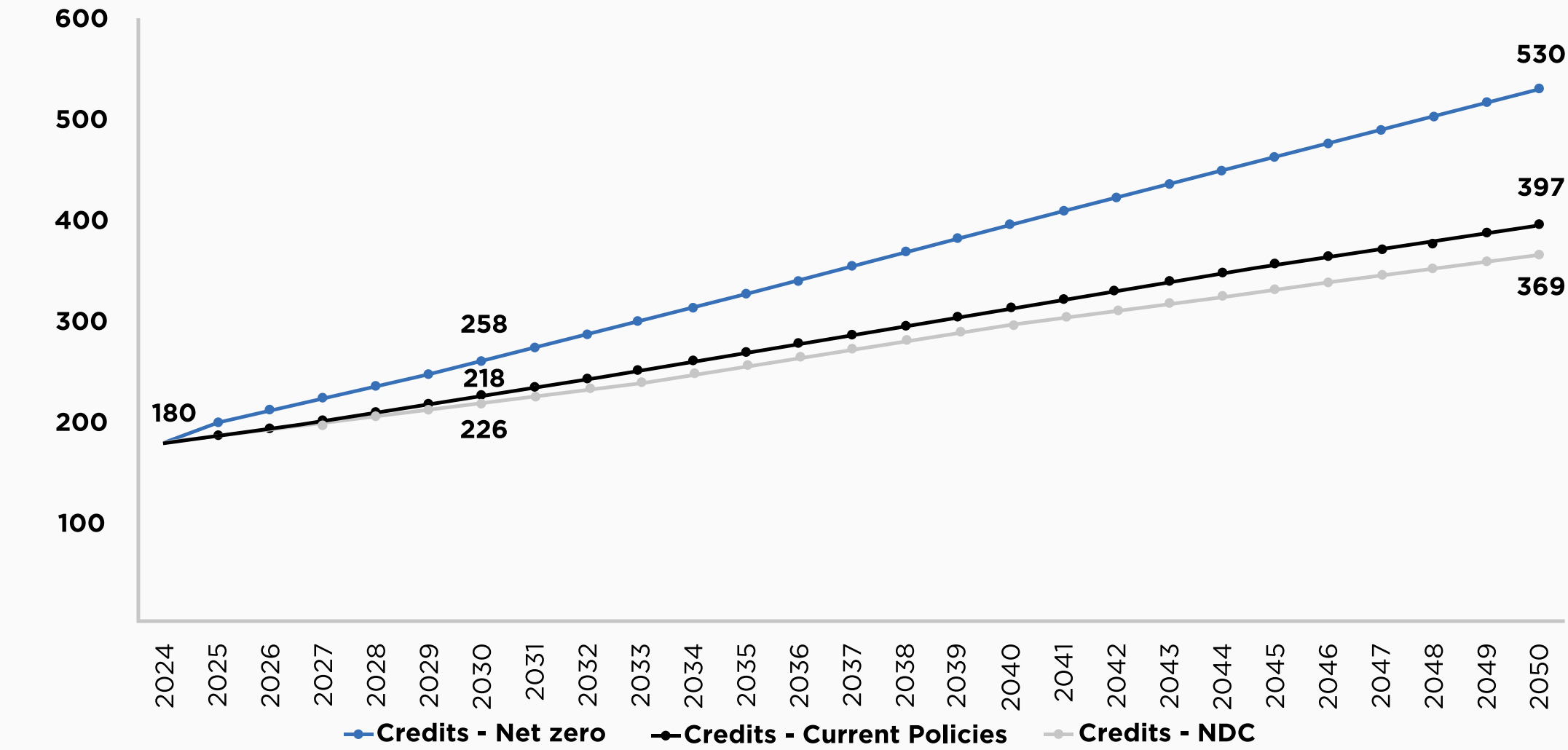
In Figure 19, Current Policies scenario would present a greater demand for credits in relation to the NDC compliance scenario, given that in this scenario GHG emissions are higher. With the fulfillment of NDCs and consequently the reduction of countries' emissions,

there would be fewer emissions to be offset. In the Net Zero scenario, in turn, the reduction in national GHG emissions is offset by voluntary commitments, which makes the demand for credits greater in this scenario. For the demand for Brazilian credits, as most credit

Following the same trend as the global scenario, the demand for Brazilian credits would vary between 13.2 and 15.7 million credits in 2030 and 22.4 to 32.2 million in 2050. National retirements observed in 2024 were approximately 13.5 million credits, so that, considering the adopted assumptions, significant growth in demand for national credits in Voluntary Market is not expected until 2030. The low

growth in relation to retirements observed in 2024 is due to the proportion of historically retired credits. As it is not possible to observe any upward trend in retirements of Brazilian credits in the historical series, this increase in market-share was not projected. The Figure 20 presents the demand for carbon credits in the NDC scenarios and in the net-zero 2050 scenario.

Figure 19 - Global Demand Scenarios for Carbon Credits in Voluntary Market (in MtCO₂e)

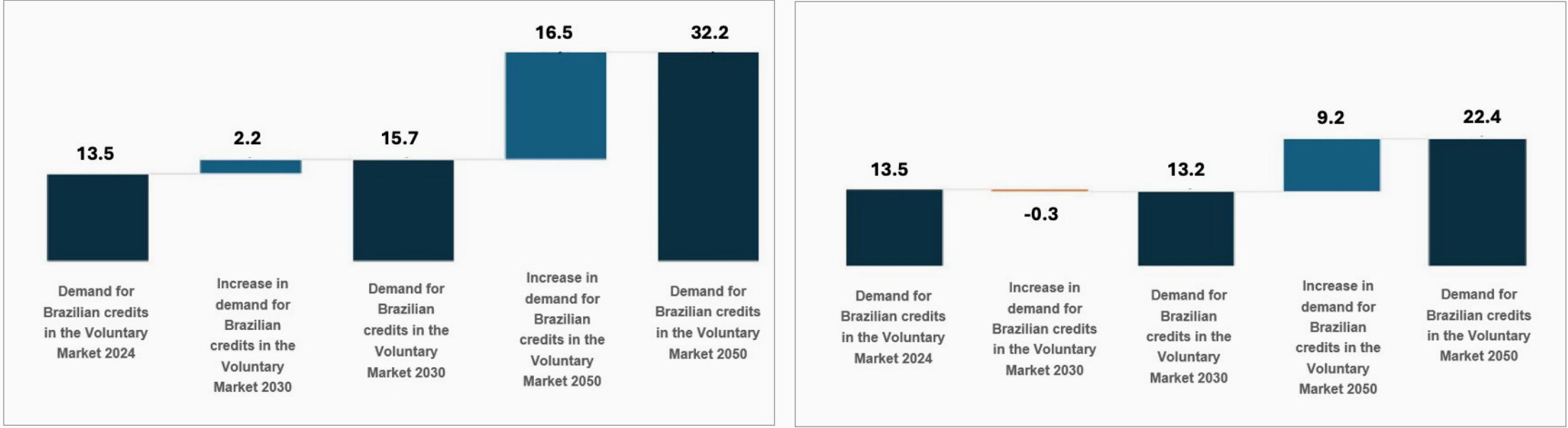


Source: WayCarbon

retirements come from international demand, it was considered that the market share of Brazilian credit retirements will remain constant at the average of the last 10 years, equal to 6.08% of global retirements. Furthermore, this exercise did not consider the possible impact of SBCE on Voluntary Market, an impact that will be analyzed separately in the next section,

given that it is not known whether the Brazilian regulated market will accept the same methodologies currently used in Voluntary Market. Additionally, by being part of a regulated market, this demand would have a compliance nature, no longer voluntary.

Figure 20 - Increase in demand for Brazilian Carbon Credits in Voluntary Market (in millions)



Source: WayCarbon

The fundamental difference compared to previous editions of this study is that, while previous versions focused on the potential supply of carbon credits, considering the proportion of supply observed in 2019 and 2021 constant (2020 was not considered as a baseline year due to the COVID-19 pandemic), this current edition focuses on the potential demand for the analysis of market potential, given that there must be agents willing to buy the credits for the economic opportunity to materialize.

Naturally, other initiatives may emerge and reinforce this trend of demand for national credits. For example, Petrobras, which historically retired around 150,000 carbon credits, considering retirements with identification of the final beneficiary in the databases of the analyzed standards¹¹, launched in 2025 an initiative to promote the restoration of 50,000 hectares of degraded areas in the Brazilian Amazon, ProFloresta+, with an expected contracting of 5 million credits in the initial phase of the initiative (PETROBRAS, 2025).

11. All analyses in the document are based on retirements in which it was possible to identify the end user of the credit. Petrobras' sustainability report mentions the purchase of 175,000 credits in 2023 (PETROBRAS, 2024). This purchase may not have been adequately mapped in this survey due to the formatting of the data in the analyzed patterns or because it did not actually convert into retirement. The company's emissions inventory, published in the Public Emissions Registry with a gold seal, reports the offsetting of approximately 96,000 tCO₂e, which would be equivalent to 96,000 carbon credits. (Registro Público de Emissões, 2024). Additionally, the subsidiary Petrobras Combustíveis Colombia retired approximately 831,000 carbon credits, all from Colombian projects, with the purpose of offsetting Colombia's carbon tax, so this offsetting purpose does not generate demand for Brazilian credits.

It was not disclosed whether this contract would be the total accumulated or the company’s annual demand for carbon credits or what the expected demand would be in the remaining phases. From the relationship between 5 million credits in 50 thousand hectares, it is possible to infer that this will not be an annual demand, given that a carbon absorption rate equal to 100 tCO₂e/hectare/year is unlikely. It was therefore considered that this and other sporadic offsetting initiatives are included in the variable “Global demands for other diverse initiatives” that makes up the demand for carbon credits.

Petrobras’ initiative, however, contributes to the dissemination of long-term carbon credit purchasing models in Brazil. These advance purchase models are essential to provide financial predictability to supply agents, such as project developers, by reducing the risk of price fluctuations and uncertainty related to demand for credits (IEG; Banco Mundial, 2018). By signing these contracts, demand agents could influence the design of the project, including contributing to the verification of socio-environmental safeguards and the integrity of the project.

On the other hand, initiatives such as the operation of SBCE may discourage companies that will be regulated from voluntarily offsetting their emissions, since they will already have the regulatory cost associated with purchasing units in the regulated market. This possibility was also not considered, especially since most of the demand for national credit comes from international companies.

2.2.2. KEY MESSAGES

- ▶ Voluntary Market is experiencing an over-supply of credits in relation to the amount of retired credits.
- ▶ Despite recent questions about the quality of carbon credits, demand for credits has remained relatively stable in recent years.
- ▶ Signals from demand regarding co-benefits are still ambiguous: although credits with more co-benefits are more expensive, the volume of retirements of these credits is not higher than the volume of retirements of credits without co-benefit specifications. On the other hand, there has been an upward trend in the retirement of VCS AFO-LU credits with CCB (Climate, Community & Biodiversity).
- ▶ Demand for Voluntary Market credit remains significantly dispersed.
- ▶ The growth of Voluntary Market depends significantly on the private sector fulfilling its climate commitments, especially companies with SBTi targets.
- ▶ The potential of the Brazilian market tends to grow at the same rate as the international market, given that most of the demand for Brazilian credits comes from foreign companies.

2.3. NATIONAL REGULATED MARKET (SBCE)

At the national level, the main foundations for establishing the Brazilian regulated carbon market were established through Law 15,042 and, from then on, the implementation of the market will go through some stages that must be regulated in an infra-legal manner.Law 15,042 established SBCE governance structure, composed of three different bodies: **Inter-ministerial Committee on Climate Change (CIM)**, a deliberative body of SBCE, which will establish market guidelines; **Management Body**, the executing body of SBCE, with normative, regulatory, executive, sanctioning and appeals powers; **Permanent Technical Advisory Committee**, an advisory body of SBCE, which is responsible for presenting subsidies and recommendations for improving SBCE (BRASIL, 2024a).

Regulatory thresholds were also established in SBCE, of 10 thousand tCO₂e for reporting emissions and 25 thousand tCO₂e for the periodic reconciliation of emissions from regulated entities. This emissions reconciliation may involve the use of Brazilian Emissions Allowance (CBE) - the emissions allowances in SBCE - or CRVEs - SBCE compensation units. This is possible since SBCE provides for the possibility of acceptance, by the managing body, of carbon credit generated in unregulated¹² sectors for the purpose of offsetting emissions from regulated entities. After

these credits are entered into SBCE, they will be converted into CRVEs.

This guideline follows the experience of some ETSs, such as those of European Union, California, China, for example, which allow – or allowed in the initial phases of the system – the use of external credits, from unregulated sectors, for compensation considering specific procedures of each system (ICC Brasil; WayCarbon, 2025). The Figura 21, next page, presents the main characteristics of these ETSs, highlighting the regulated sectors, emission limits, and rules for the use of offsets and credits in the regulated market.

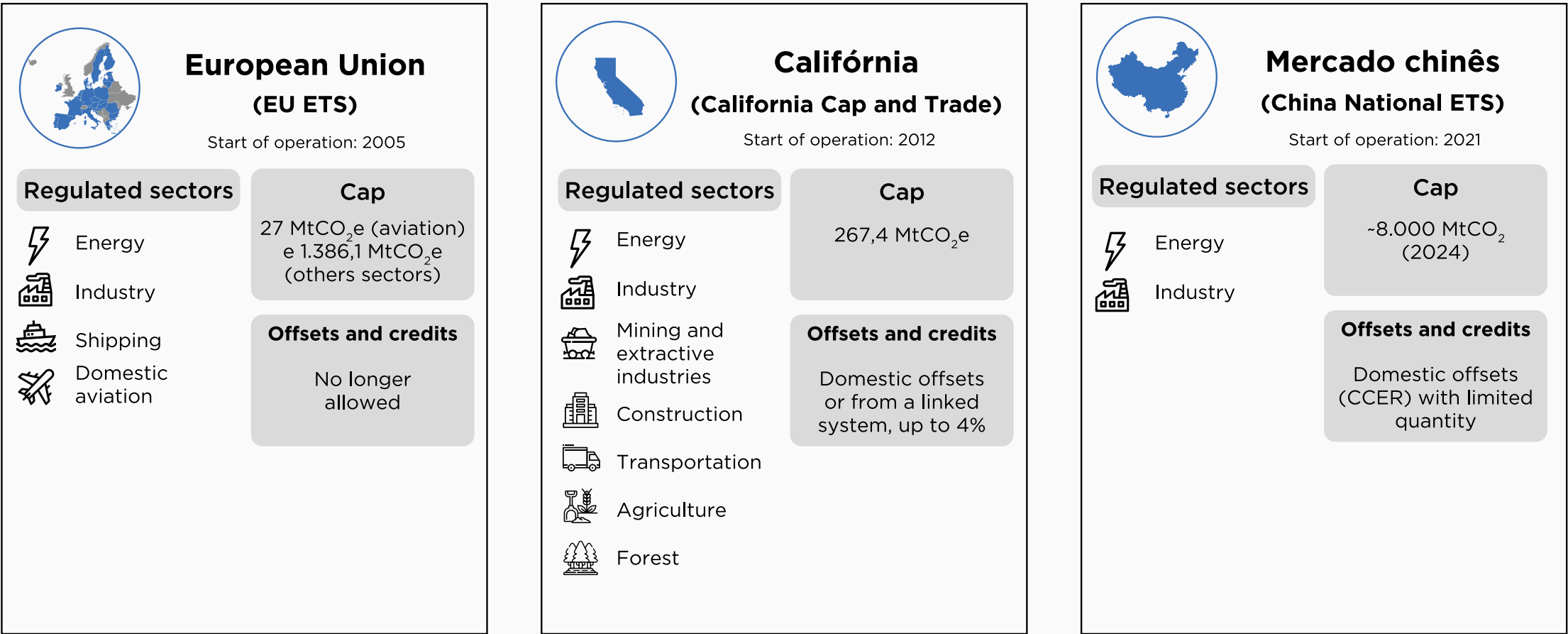
In the Brazilian context, the process for carbon credits from unregulated sectors to become CRVEs will be fundamental to reducing the regulatory cost of SBCE, given that sectors potentially affected by regulation tend to have higher emissions abatement costs. Ensuring the quality of credits is strategic for Brazil, given its role as one of the main generators of carbon credits in the global Voluntary Market. **For the use of CRVEs, the managing body will evaluate which methodologies will be accepted, as well as the maximum acceptable limit of these units for compliance purposes in SBCE.**

To date, beyond the emission thresholds of regulated agents, there are no further definitions regarding the market microstructure¹³, such as regulated sectors,

12. The terminology “unregulated sectors” was deliberately used to avoid the term “Voluntary Market”. In this case, given that it has not yet been defined whether CRVEs will come from Voluntary Market or whether they will have some level of ambiguity, this study will treat the markets as distinct, even though there is some possibility of interaction between them.

13. The concept of Microstructure used in this context concerns definitions that will dictate the relationship between regulated agents in the market. Other elements, such as the governance of SBCE, are already reasonably well defined and, when addressed, will be treated as elements of the general structure or macrostructure.

Figure 21 - Benchmark of other Emissions Trading Systems



Source: ICC Brasil; WayCarbon (2025).

the “cap”, percentages of free allocations, etc. Therefore, the estimate of transaction potential was made based on the following assumptions: 1) on elements of the market microstructure; 2) on emissions from regulated sectors; 3) and on abatement potentials based on marginal abatement curves available for Brazil.

2.3.1. MARKET POTENTIAL

Considering the hypothesis that the emissions regulated by SBCE are mainly emissions from industry, power generation and the use of fuels in transportation¹⁴, as analyzed by Banco Mundial (2020), and that regulation reaches approximately 40% of these emissions, considering the representativeness of scope 1 emissions reported in the 2022 Public Emissions Registry

in relation to national emissions, it is expected that the emissions covered by SBCE will total approximately 295.3 MtCO₂e in 2030, in SINAPSE Business as Usual (BAU) scenario (MCTI, 2025b).

CRVEs, in turn, will likely have a limited acceptance rate, in line with international experiences (ICC Brasil; WayCarbon, 2025) and according to Banco Mundial (2020) , which recommends an initial acceptance rate of 20% of compensation units per regulated agent, which would result in a maximum total demand of approximately 59.1 MtCO₂e in CRVEs in the initial period of SBCE. Effective demand, however, will depend on the market microstructure, the volume of free allocations, the marginal abatement costs of the regulated and non-regulated sectors, among

other elements. In subsequent periods, even if the acceptance percentage remains constant, a reduction in the number of CRVEs is expected over time, given that emissions from regulated companies should reduce after SBCE comes into operation.

Even in the initial periods, the price of CRVEs for new projects will depend on whether or not the remaining CDM credits are accepted. As CDM credits are abundant and currently traded at low prices, between 1 and 3 dollars on the UNFCCC (UNFCCC, 2025f) platform and an average of 1.35 dollars according to the Ecosystem Marketplace (2025) estimate, it is possible that this supply will be predominant in the first years of the Brazilian market. **Given that several Brazilian projects have already requested the transition to PACM, it was considered that these credits will also be accepted internally. The credits issued and not cancelled from these projects amount to 98 MtCO₂e** (UNEP-CCC, 2025).

It is worth noting, however, that there is no official position from the Brazilian government on the matter. However, if the country wants other nations to accept these credits, there would be no reason not to accept them nationally.

Additionally, just like the price of CRVEs, the system's cap and its reduction speed are also crucial for determining the prices of assets traded on SBCE. To achieve the target stipulated by the NDC in 2035, emissions from regulated sectors must fall by approximately 30.6% compared to 2030 emissions under the BAU scenario, considering that deforestation emissions

would be zeroed for Brazil's emissions to reach the NDC target. Reducing deforestation would reduce pressure for decarbonization in regulated sectors, given that the main contribution to NDC compliance would come from this source of emissions. In this scenario, the annual reduction in the cap would be approximately 6.12% per year, a higher value than the reduction factors applied in California and European Union, of 4 and 4.3% respectively (CARB, 2018; European Commission, 2023). The difference can be explained by the start of SBCE's operationalization, which, according to the description of its establishment processes, should begin in 2030. Thus, SBCE would have less time to contribute to achieving the target in 2035.

Finally, the premise was adopted that the cost of compliance cannot be greater than the fine established in case of non-compliance, since this situation could lead to it being more advantageous to fail to comply with regulatory requirements than to comply. In other words, the price of CBEs cannot be so high that it is more advantageous for the regulated entity to break the law and pay the fine. In this case, Law 15,042 establishes the maximum value of up to 4% of the legal entity's gross revenue as the applicable fine, already considering the possibility of recurrence (BRASIL, 2024a). The Table 4 show the example of a fictitious company that faces a high cost of compliance. It is also worth noting that Law 15,042 establishes other sanctions in case of non-compliance, including, among other sanctions, the embargo of activity, source or installation, partial or total suspension of activity, installation and source.

14. In regulating the transportation sector, the point of regulation can be terminals and large refineries, as in the California ETS, or fuel distributors or end-user suppliers, as in the German ETS (ICAP; Banco Mundial, 2021a)

Table 4 - Fictional example for cost of compliance versus cost of non-compliance (fine) in SBCE

Company Gross Revenue (A)	US\$ 1,000,000,000
Company’s Regulated Emissions (B)	50,000 tCO ₂ e
Free Allocations (C)	85%
CBE Price* (D)	US\$ 6,000
Regulatory Cost (B x (1-C) x D)	US\$ 45,000,000
Cost of Fine (A x 4%)	US\$ 40,000,000

*It is worth remembering that CBE price was determined based on marginal abatement costs from Mitigation Options study (MCTI, 2018).
Source: WayCarbon, based on MCTI (2018) e Brasil (2024b).

As the revenue of regulated companies is not yet known, the industry’s Gross Revenue and its average historical real growth projected until 2050 (IBGE, 2023) were considered as a reference for the revenue value of regulated companies. The maximum value of CBEs would be given by the ratio between Gross Revenue and annual GHG emissions. Table 5 presents a summary of the assumptions used to estimate demand for CRVEs.

Considering these assumptions established in Table 3, the price of CBEs tends to rise considerably in the adopted scenario, since the marginal abatement costs of regulated sectors are much higher and the GHG emissions abatement required in these sectors would also be higher due to the assumption of limiting the use of CVREs for compliance. Initially, due to the higher cap and greater number of free allowances in the first phase, allowances would cost approximately US\$5 in 2030, given that the abatement required to achieve regulatory compliance would be relatively

small and have low marginal costs. As the cap and the number of free allocations decrease, this value would reach US\$ 276 in 2050, considering the mitigation technologies available in Mitigation Options (MCTI, 2018). Until 2044, however, CBE prices are expected to remain around US\$ 149, but they would increase significantly from that year onward due to the scarcity of available abatement technologies.

Some points of attention are necessary regarding these prices. Firstly, the simulation did not consider price stabilization mechanisms or other market design elements that could mitigate this sharp rise in allowance prices. Additionally, the further away the projection is in time, the more uncertain the marginal abatement costs are, given that technological innovations over time may reduce the cost of technologies (economies of scale) or new technologies may emerge during the period. Furthermore, the scenario

Table 5 - Assumptions for estimating demand for CRVE in SBCE

Variable	Premise adopted
Total Regulated Emissions	Industry (IPPU); Energy; Transport (upstream). They total approximately 468.2 MtCO ₂ e in 2022 and in SINAPSE BAU scenario they total 741.4 MtCO ₂ e in 2030.
% of emissions covered by regulation	39.83% of Total Regulated Emissions. The ratio between Scope 1 emissions reported in the Public Emissions Registry (except agriculture) and emissions from regulated sectors in 2022.
Annual cap reduction	6.12% per year. Average rate required for national emissions to increase from 1,513 MtCO ₂ e in 2030 (SINAPSE BAU scenario, with zero emissions related to Land Use) to 1,050 MtCO ₂ e in 2035 (NDC target).
Free Allocations	First 5 years = 100% of emissions covered by regulation, with 5% reduction every 5 years.
Marginal Abatement Costs (MAC) of regulated and non-regulated sectors	Equal to the costs of the Mitigation Options study
Abatement potential	Same proportion of emissions covered by regulation
Restriction on the issuance of CRVEs	Financial additionality. If the MAC is less than zero, CRVE would not be additional. Projects with MAC below zero would therefore not issue credits.
Restriction on demand for CRVEs	Limited to 20% of emissions covered by regulation.
Maximum CBE price	Limited, according to the maximum fine of 4% of the companies’ revenue. Considers industry revenue for 2022, applying historical real growth up to 2050. The maximum price of emissions is given by the ratio between annual revenue and annual emissions.

Source: WayCarbon

considers that emissions reductions relative to BAU scenario would result solely from the SCBE, as highlighted in Figure 22.

Despite its limitations, the simulation shows the rele-

vance of accepting offsets to reduce regulatory costs in SBCE. Even though the values used are not up to date and do not incorporate some mitigation options or possibilities for gains related to technological innovations, the difference between the marginal

Market, currently averaging US\$ 6.55.

As noted in Figure 22, in the early years of SBCE, **the acceptance of offsets tends to reduce CBE prices in the initial years of SBCE**, while the cap is still relatively higher and free allocations remain at a high percentage, thus reducing the need for emissions reductions. With the reduction of the cap and free allocations, CRVEs cease to influence CBE prices from 2037 onwards, as the marginal abatement costs become significantly higher. **For regulated entities, however, the use of CRVEs becomes even more relevant for compliance cost reduction, since their price is much lower than the expected CBE price.** For example, while the expected price of CRVEs was considered constant at USD 6.55, the price of CBEs in 2037 would reach USD 77.23, making the option to offset emissions through CRVEs significantly cheaper.

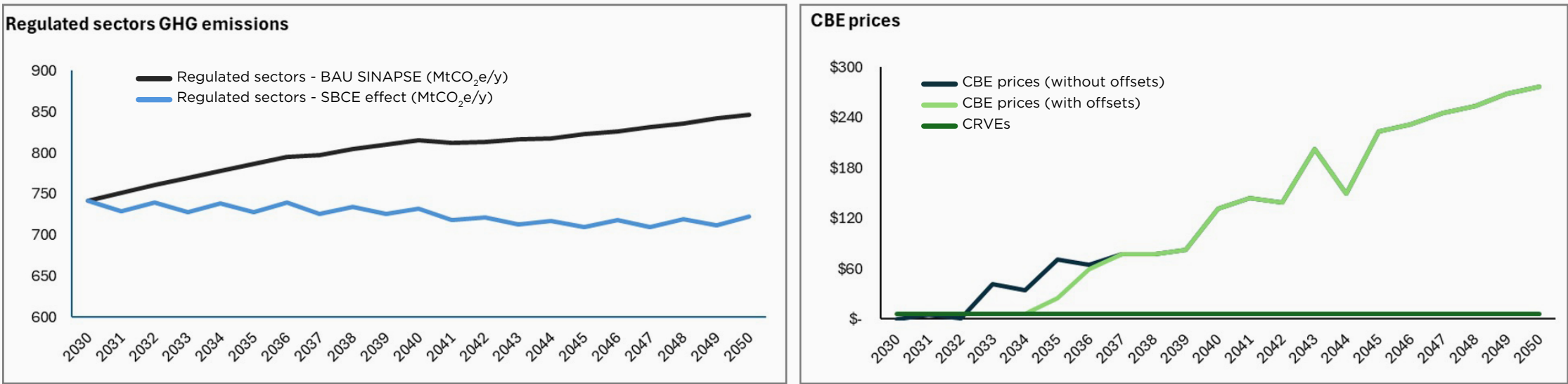
Despite the potential growth in demand for carbon credits from non-regulated sectors, no increase in the price of these credits was considered for Voluntary Market or SBCE, as the potential emission reductions available at marginal costs between USD 0.22 and USD 0.45 are sufficient to meet both Voluntary Market demand and potential SBCE demand. This is due to the potential abatement volume, which exceeds the demand generated by SBCE. Accordingly, it was assumed that CRVE prices would remain constant at USD 6.55 until 2050.

This assumption is based on the premise that CRVE market would exhibit perfect competition and, therefore, the price of the credits would approximate the marginal abatement costs of non-regulated sectors¹⁵. Current Voluntary Market prices incorporate certification and verification costs for emissions reductions. If there were no restrictions on CRVE usage, CRVE and CBE prices would tend to converge, as both assets would be perfect substitutes (Murray 2012; Gronwald; Hintermann, 2016). With the 20% usage restriction, CBEs and CRVEs are not perfect substitutes. Since CRVE demand would be limited to a quantity that can be supplied at low costs, a price difference between CBEs and CRVEs would remain. This imperfect substitution relationship between emission allowances and offset instruments is well documented for the EU ETS(Nazifi, 2013; Dormady; Englander, 2016; Gronwald; Hintermann, 2016; Yu; Mallory, 2020).

Nonetheless, SBCE can significantly increase demand for carbon credits, considering that Brazilian credit retirements in Voluntary Market totaled approximately 13.5 million units in 2024. However, it is not yet possible to assert full interoperability between the national regulated market and Voluntary Market. The methodologies and independent verification standards to be accepted under SBCE will be defined later through secondary regulations.

Even without full interoperability, establishing transition rules for existing Voluntary Market projects to generate CRVEs can help ensure continuity and leverage pioneering initiatives, recognizing the early investments of Voluntary Market project proponents.

Figure 22 - GHG emissions from regulated sectors in the BAU scenario *versus* SBCE scenario



Source: WayCarbon.

abatement costs between regulated and unregulated sectors is quite significant, and CRVEs can reduce the compliance costs of regulated agents, especially when cheaper mitigation options are becoming scarcer.

Still considering Table 4 assumptions, the maximum annual demand for CRVEs would be 59.07 million credits in 2030 and 41.5 million in 2050. Due to the limited percentage of offsets, the price of CRVEs tends to remain low throughout the period analyzed, since the marginal abatement costs of decarbonization options in unregulated sectors are around US\$ 0.22 and US\$ 0.45 for this amount required. In this case, **the prices charged on Voluntary Market**

would represent the opportunity cost for CRVE supply agents, so that the price in both market environments tends to equalize. In the early years, cheaper credits, such as CDM credits, would be traded more, given that the price of CBEs will also be low, around US\$ 5.00, so that the regulated entity would have no incentive to purchase CRVEs at a price above that amount. Note that there would be a stock of 98 MtCO₂e of CDM credits to meet the demand for CRVEs (UNEP-CCC, 2025). With the end of credits from the CDM, CRVEs from new projects tend to be in greater demand and the price of these certificates tends to match the prices practiced in Voluntary

15. In competitive markets, the price of a good equals its marginal production cost.(VARIAN, 2010) In Emissions Trading Systems (ETS), the same principle is applied by Yu e Mallory (2020) to explain the price differences between emission offset instruments and emission allowances.

Box 3

Demand for Credits from insurance companies, open private pension entities, capitalization companies, and local reinsurers

In addition to installations regulated under SBCE, which must acquire CBEs or CRVEs to reconcile periodic obligations, Article 56 of Law 15,042 requires that insurance companies, open private pension entities, capitalization companies, and local reinsurers acquire at least 0.5% of their technical reserves and provisions in SBCE assets.

Based on the 2024 consolidated technical provisions (SUSEP, 2025), this would amount to approximately BRL 8.9 billion allocated to SBCE asset purchases. Considering the 2024 average Voluntary Market credit price of USD 6.55 and the 2024 average exchange rate of BRL 5.39 (BACEN, 2025)/USD, this would represent roughly 253 million credits (253 MtCO₂e).

This demand would exceed the total volume of Brazilian credits issued in Voluntary Market from the first issuance through 2024. Between 2009

and 2024, Brazilian credit issuances totaled approximately 148 million credits (148 MtCO₂e). Accordingly, to comply with the regulation, insurers would need to purchase CBEs, as there would likely be insufficient CRVEs in the initial years of the market. This could even hinder regulatory compliance by regulated entities, since allowance supply in an ETS is, by definition, inflexible in each regulatory period¹⁶.

Anticipating the effect of Article 56 of Law 15,042 on SBCE and other detrimental effects on the insurance and pension sectors, National Confederation of Insurers (CNSEG) filed a Direct Action of Unconstitutionality (ADIN) in the Supreme Federal Court to amend Article (STF, 2025).

Due to the alleged unconstitutionality, this potential demand for SBCE assets under Article 56 was not considered in this study.

Naturally, the carbon market is one of several decarbonization policies that should be considered to reduce GHG emissions. Since SBCE will represent a cost for regulated companies, either through the purchase of CBEs or investments in projects with low economic viability (positive marginal cost), implementing other decarbonization incentive policies can reduce SBCE's regulatory cost by lowering the abatement required to meet the cap (ICAP; Banco Mundial, 2021b). Accordingly, national alignment of other (dis)incentive measu-

res for decarbonization should be reviewed to mitigate compliance costs for regulated entities.

In this context, **directing SBCE funds to National Climate Change Fund, as stipulated by Law 15042, can reduce marginal abatement costs by allowing part of regulated entities' expenditures to be invested in new mitigation projects, lowering their capital costs.** However, capital cost is only one of several variables determining project economic viability, and providing subsidized credits alone may not be sufficient to enable

investment, particularly in higher marginal cost projects.

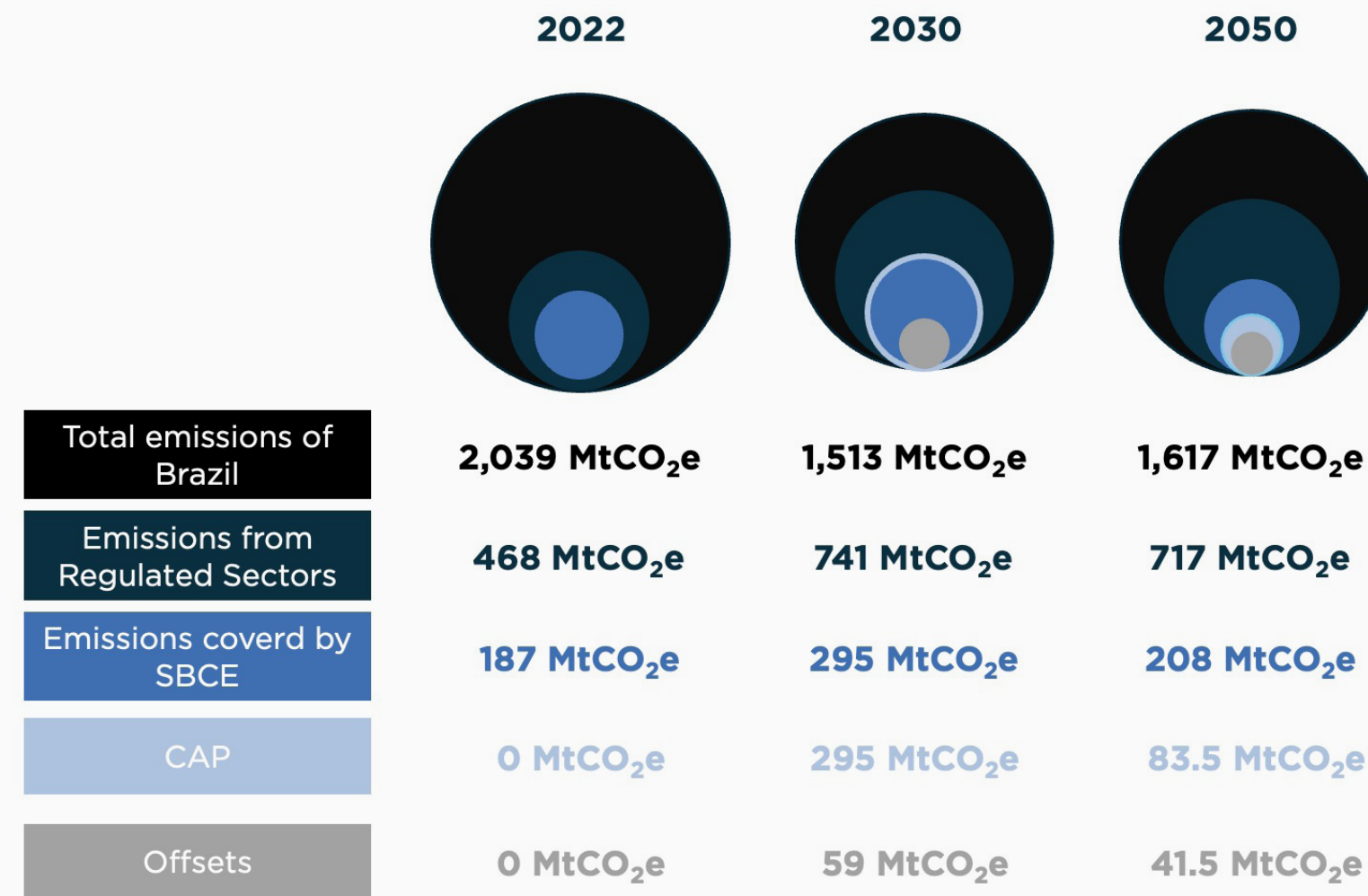
National carbon market regulation must be accompanied by other cost-reduction measures, especially the Brazil Cost Reduction Agenda (ARCB) (MDIC, 2025), to prevent further loss of competitiveness in international markets.

Innovation policies must also be strengthened to enable the development of low-carbon technologies. In some sectors, emission reductions may depend on technologies that are still prohibitively expensive or technically unfeasible (CNI, 2023), requiring innovation investments for large-scale deployment. Although carbon pricing can incentivize innovation, international experience shows that without a conducive environ-

ment, this instrument alone does not lead to significant innovation. Additionally, **beyond specific technology incentives, the technological development process should encourage free creation and self-discovery (Hausmann; Rodrik, 2003), ensuring a favorable environment for unforeseen innovations, as important as targeted support for strategic technologies.**

Finally, it should be considered that SBCE alone may be insufficient to achieve NDC targets, especially if market implementation is not accompanied by other public policies. Figure 23 below illustrates the size of SBCE, based on adopted assumptions, relative to 2022 (MCTI, 2023) observed national emissions and BAU scenario projections from SINAPSE (MCTI, 2025) for 2030 and 2050, excluding land-use-related emissions.

Figure 23 - SBCE scale relative to national emissions

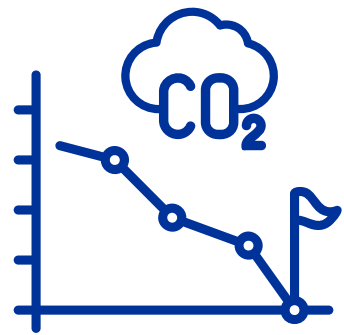


Source: WayCarbon.

16. In regulated markets, allowance supply is fixed or highly inelastic due to the cap. In short, the government sets allowance supply so that prices equal the marginal abatement cost.

2.3.2. KEY MESSAGES

- ▶ The establishment of SBCE represents a milestone in Brazil's national climate policy, creating economic incentives for both regulated and non-regulated sectors.
- ▶ Given that the operational launch of SBCE coincides with the timeline of Brazil's intermediate NDC target, the required emission cap reduction tends to be steeper than in other ETS, so that regulated sectors can achieve their share of the NDC commitment.
- ▶ Due to the high abatement costs of the regulated sectors, CRVEs play a key role in reducing the compliance costs for regulated entities.
- ▶ The potential market for CRVEs in 2030 is estimated at 59 million credits, representing an increase of approximately 337% compared to the demand for credits in Voluntary Carbon Market in 2024. As emissions from regulated sectors decrease, the demand for CRVEs is expected to decline over time, reaching 41 million credits by 2050.
- ▶ Due to the expected increase in compliance costs for regulated entities, it is essential that the regulation of the national carbon market be accompanied by other cost-reduction measures for regulated sectors — particularly through Brazil Cost Reduction Agenda (ARCB) (MDIC, 2025) — to prevent loss of competitiveness for domestic industry.
- ▶ Innovation policies must also be strengthened to enable the development of low-carbon technologies.
- ▶ It should be noted that the establishment of SBCE alone may not be sufficient to meet Brazil's NDC targets, particularly if the implementation of the trading system is not accompanied by complementary public policies.



3. CHALLENGES FOR CARBON MARKETS

Assessing the main barriers associated with the different spheres of carbon market operation—the mechanisms of Article 6 of the Paris Agreement, Voluntary Market, and the national regulated market (SBCE)—is essential to find the best ways to consolidate Brazil's potential in the carbon market. Some challenges are common across markets, such as credit quality, price visibility, and the need for engagement from the agents involved. Understanding these barriers is the basis for mapping and leveraging opportunities so that the country has a carbon market that is not only economically attractive but also effective in promoting significant reductions in GHG emissions. The identification of these barriers aims to map the main elements of complexity affecting the functioning and infrastructure of the carbon market, thereby contributing to a better understanding of the challenges faced by both the business sector and the Brazilian government.

Within the framework of the Paris Agreement, although COP 29 achieved significant progress in operationalizing Article 6.2 and Article 6.4, outstanding issues—such as the establishment of the international centralized registry for Article 6.2 and technical details regarding the operation of Article 6.4—remain and may be addressed at COP 30. These limits related to the implementation of Article 6 require robust market infrastructures to ensure the efficient functioning of the mechanism.

As it is a global mechanism, there is a high level of institutional complexity due to the lack of consolidated national structures, which hinders cohesion for the

development of a global climate policy. In scenarios of geopolitical instability, such as the current one, uncertainty in countries' regulatory frameworks and perceived risk increase, affecting the long-term forecasts of the agents involved and hampering private sector investment. **The current regulatory uncertainty affects countries' ability to comply with NDCs, highlighting the importance of building clear and robust institutional arrangements that can consolidate a strategy defining the role of carbon credits in meeting NDC targets** (World Bank, 2024).

Regarding the infrastructure of the Article 6 market – and, similarly to other segments of the carbon market – the lack of standardization of credits and inconsistent quality represent a challenge to confidence and expansion of market demand. The lack of harmonized criteria for measurement, reporting, and verification compromises the traceability and interoperability of credits between international systems. This challenge opens the door to fraud, double counting, and difficulties in assessing the additionality of credits, compromising the environmental integrity of the entire emissions trading system. **Building an efficient international cooperation mechanism requires state capacity to implement policies and agreements between parties.** Political risk is seen as one of the main factors discouraging investment, so overcoming this challenge is central to building confidence for market players to execute their long-term projects (Stern, 2022).

Another challenge for the advancement of Article 6 is the process of accepting credit sales with correspon-

ding adjustments, which in Brazil's case has not yet been established. **The implementation of corresponding adjustments by Brazil will be important for the country's reputation in the international market, as it is an indication of the additionality and environmental integrity of the credits generated.** This process influences the potential supply of Brazilian credits, as without a clear definition of corresponding adjustments, proof that the credits issued effectively result in a net reduction in emissions is compromised, leading to uncertainty for potential international buyers and limiting the scale of the bilateral cooperation mechanism.

Voluntary Carbon Market, in turn, due to characteristics inherent to its structure, faces challenges that affect the supply and demand for credits. Among them is uncertainty regarding future demand, which makes it difficult to estimate the potential of this market. Voluntary Market is based on promises of future purchases of carbon credit at a price that is not clearly defined and fluctuates over time, so that the voluntary nature of the market makes demand uncertain and volatile, which makes long-term projections difficult. Furthermore, market demand is highly fragmented, creating an unstable and fragmented environment, thus making consistent pricing difficult to achieve. As a result, projects face difficulties in adapting their supply and estimating diffuse and volatile demand, discouraging long-term investments and leading to high implementation costs.

The process of independent certification standards with complex methodologies stands out, which, on

the one hand, considerably increases compliance and observance costs, but aims to protect supply actors regarding the quality of the credits issued¹⁷. For these assets to effectively generate value and reflect real emissions reductions, it is essential that they meet robust quality standards capable of proving their effectiveness in a transparent and verifiable manner. Voluntary Market is often criticized for the additional¹⁸ and traceability of its projects. For demand-side players for credits, purchasing poor-quality credits can pose a reputational risk. In Brazil, for example, there are cases of carbon projects associated with the illegal appropriation of public lands and the trading of credits without additional emissions reductions, which highlights the market's difficulty in ensuring the environmental integrity of the credits offered (Globo, 2023). **High-quality credits ensure environmental integrity, i.e. a credit that effectively contributes to climate change mitigation.** For demand-side players, the absence of this guarantee increases the risk of acquiring “false” credits or credits that do not generate real impact, making it difficult for buyers in general to assess whether a credit is environmentally effective, impacting market demand. As a result, the market has seen a **significant increase in transaction costs due to the requirement for due diligence and compliance processes.**

As it is a fragmented market with various actors in different contexts and with different interests, information asymmetry and lack of transparency are significant structural barriers to the implementation of Voluntary Market infrastructure (World Bank, 2024). The inherent heterogeneity of Voluntary Market makes scalability complex (TSVCM, 2021). These

challenges lead to inaccurate risk assessments, which affect environmental integrity and the transacted value of the market, hindering the traceability of the impact of carbon projects and causing resistance in the demand for Voluntary Market. Within the scope of SBCE, the approval of its regulatory framework at the end of 2024 represented a significant step forward in the consolidation of the regulated carbon market in Brazil. SBCE reduces uncertainty and increases market stability, encouraging long-term investments in climate change. However, **to function fully, SBCE will need to be established with a robust infrastructure of transparency and technical supervision, consolidating efficient governance with monitoring and verification capabilities.**

Technical challenges such as the development of the monitoring, reporting, and verification (MRV) system for emissions and National Allocation Plan need to be operationalized within the timeframe estimated in the law. Any delays could compromise the entire market implementation schedule and cause uncertainty among regulated sectors and market stakeholders, besides implying greater cap reductions to achieve the intended emission reduction percentages. Thus, **through robust implementation, SBCE can emerge as a system with high environmental integrity, transparency, and solid governance, as well as interoperability with international markets.**

SBCE, whose implementation is delayed in relation to several other countries that already have an ETS, will likely become fully operational in 2030, following the phases established by law. This poses a challenge for the Brazilian regulated market's

contribution to meeting the current Brazilian NDC, which aims to reduce GHG emissions by between 59% and 67% by 2035, compared to 2005 levels. This deadline requires greater institutional capacity and assertiveness in creating regulatory instruments and definitions regarding the market microstructure to boost the potential of SBCE. In the private sphere, deadlocks over the design of national market governance may cause delays in pricing, which could increase the regulatory cost of SBCE if the expected reduction in emissions is ambitious.

In general, international regulated markets begin by setting targets for specific sectors. However, for the Brazilian market to ensure integrity and have the capacity to reduce decarbonization costs, it is important to discuss integration between regulated and unregulated sectors. In Brazil's case, the primary agricultural production sector is not subject to the obligations imposed under SBCE. However, the agricultural sector is one of Brazil's major competitive advantages, so the discussion of how this unregulated sector will participate in association with SBCE's PNA will be very relevant for Brazil to meet the targets set out in its NDC.

One of the key points for the efficient operation of SBCE will be its interoperability with Voluntary Carbon Market, especially regarding how voluntary credits can be converted into CRVEs for use in SBCE, if they are generated using methodologies that will be accredited by SBCE. One of the challenges is the risk of oversupply in SBCE due to the widespread acceptance of credits from Voluntary Market. The acceptance of these credits may affect the pricing of SBCE assets, as an oversupply of carbon credit could flood

the market and reduce the price of emission allowances (CBEs). Therefore, **the interaction between the two markets needs to be designed with well-defined limits and robust governance, so as not to compromise the credibility and effectiveness necessary for the regulated market in Brazil to function.**

Thus, defining the applicable criteria for independent carbon certification standards for Voluntary Market as soon as possible is essential to determine which methodologies will be able to generate credits that can be converted into CRVEs within SBCE. The adoption of methodologies with stricter requirements tends to restrict supply, while the incorporation of more flexible standards and the use of international standards established in the market may allow the inclusion of existing projects in Voluntary Market. In this sense, **the selection not only of methodologies but also of certification standards with robust processes already consolidated in Brazil becomes important**, since negative experiences, such as that of China's National ETS—which initially allowed the acceptance of a large number of methodologies—resulted in a significant increase in the system's operating costs (ICC Brasil; WayCarbon, 2025).

In the legal field, **a clear definition of the legal nature of carbon credits and other assets regulated by SBCE is essential to strengthen the confidence of economic agents and enable market scalability.** To date, the only concept whose legal nature has been defined is reforestation carbon credits, which are considered civil assets. For CBEs, CRVEs, and credits generated by other methodologies, the regulatory text does not yet establish a specific legal framework (FGV, 2025).

17. According to ICC Brasil and WayCarbon (2022), the main criteria evaluated to ensure credit quality are: additionality, reliability in calculating reduced or avoided emissions, impact on the community, and information about projects and their impacts.

18. The principle of additionality is a key factor for the environmental integrity of carbon credits because it proves that GHG emission reductions are additional to those that would occur in the absence of human activity (Munhoz; Vargas, 2022). In other words, a project is additional when it promotes emission reductions that would not have occurred without the additional incentive created by the project.

Although the law authorizes the trading of SBCE assets on the capital market, there is still a regulatory vacuum regarding the processes that will be adopted to operationalize these transactions. In this context, the main challenges are: (i) regulating the trading of CBEs and mitigating speculative movements on these assets; and (ii) defining a mechanism for price stabilization, which in the regulatory text mentions direct price control, but international experiences such as the EU ETS use stabilization via quota generation control, i.e., supply control (FGV, 2025). The absence of these guidelines compromises

the clarity of the regulatory, tax, and accounting regimes, hindering the effective operation of SBCE.

Figure 24 below summarizes the main challenges identified in the three carbon market environments analyzed: Article 6 mechanisms, Voluntary Market, and SBCE. The objective is to provide a strategic overview of the specific obstacles in each market sphere. Noted that, due to its recent nature and the fact that it is still in the regulation and implementation phase, SBCE faces the greatest number of challenges and barriers to its effectiveness.

Figure 24 - Challenges for carbon market environments

ARTICLE 6	VOLUNTARY MARKET	SBCE
• Fragmented infrastructure. • Lack of consolidated national frameworks. • Inconsistent credit standardization and quality. • Political risk. • Acceptance process for credit sales with corresponding adjustments.	• Complex methodologies. • Quality of issued credits. • Credit additionality and traceability. • Fragmented market. • Information asymmetry and lack of transparency. • Complex scalability. • Uncertainty regarding future demand. • Fragmented market demand.	• Need for a robust infrastructure for transparency and technical oversight. • Efficient governance mechanisms. • Potential planning delays leading to uncertainty among stakeholders. • Interoperability with the voluntary market. • Selection of certification standards with robust procedures for the acceptance of credits as CRVEs. • Integration between regulated and non-regulated sectors. • Delayed legislation. • Clear legal definition of the nature of credits regulated under SBCE. • Mitigation of speculative movements over CBEs.

Source: WayCarbon.



4. OPPORTUNITIES

Despite the challenges, there are significant opportunities to attract resources for decarbonization, especially from regulated international and domestic markets, mainly represented by the estimates of carbon market potential calculated in this study. Naturally, growth opportunities for the market until 2030 are more predictable than opportunities for 2050, when the growth of carbon market potential tends to depend more on the market mechanisms of the Paris Agreement. In addition, several challenges to market performance may already have been overcome in the early stages of SBCE's operation in Brazil. Therefore, **using short-term opportunities to scale up decarbonization technologies may be key to building a long-term sustainable decarbonization strategy that strengthens Brazil's technical potential for emissions mitigation.**

Under the Paris Agreement, **Brazil's ability to attract resources depends mainly on compliance with the NDC, acceptance of the corresponding adjustments, and the willingness of other countries to purchase Article 6 market units to comply with their NDCs.** In this sense, the NDC update expected for 2025 may provide more promising data for estimating the potential of this market. As previously noted, the signaling of demand for ITMOs by countries remains unclear and still fragmented among a few countries. **Updating and increasing the transparency of NDCs, including intentions to use Article 6, is important to inform long-term expectations.**

In Voluntary Market, on the other hand, demand for domestic credits comes mainly from foreign companies and represents a relatively low percentage of total credits retired globally, averaging around 6% historically. However, **Brazil tends to be a country of interest for the purchase of carbon credits in Voluntary Market, due to its high capacity to generate high-quality, low-cost credits.**

Recent investments supported by the BNDES in the area known as the "Arc of Deforestation" exemplify this great potential. With the goal of transforming the region into an "Arc of Restoration," the project aims to rebuild 24 million hectares by 2050, resulting in a cumulative removal of approximately 1.65 GtCO₂e from the atmosphere. The project, which will enable the generation of high-integrity CO₂ removal credits, also has several co-benefits, such as reversing biodiversity loss, improving water quality, and generating direct and indirect jobs for local communities (BNDES, 2024).

Emissions removal credits are in high demand and are increasing in value on the carbon market, which is currently undergoing a phase of requalification, as mentioned earlier in the study, in which demand is becoming more sophisticated. In 2024, due to the low availability of these types of credits, their prices were, on average, 381% higher than emissions reduction credits (Ecosystem Marketplace, 2025).

In addition, regions in South America and South and East Asia are identified by the private sector as areas

of high interest for Sustainable Agriculture, Afforestation/Reforestation/Revegetation (ARR), Carbon Dioxide Removals (CDR), and Household Devices projects (IETA; A6IP, 2024). On VCS platform alone, there are already 39 ARR projects in Brazil among the registered and pipeline projects, which together achieve an estimated annual emissions reduction of more than 6 million tons of CO₂e (Verra, [s. d.]).

In this way, **Brazil can consolidate its position as an important player in a growing market.** To do so, however, it must address certain regulatory issues that still prevent it from having a robust presence in this market.

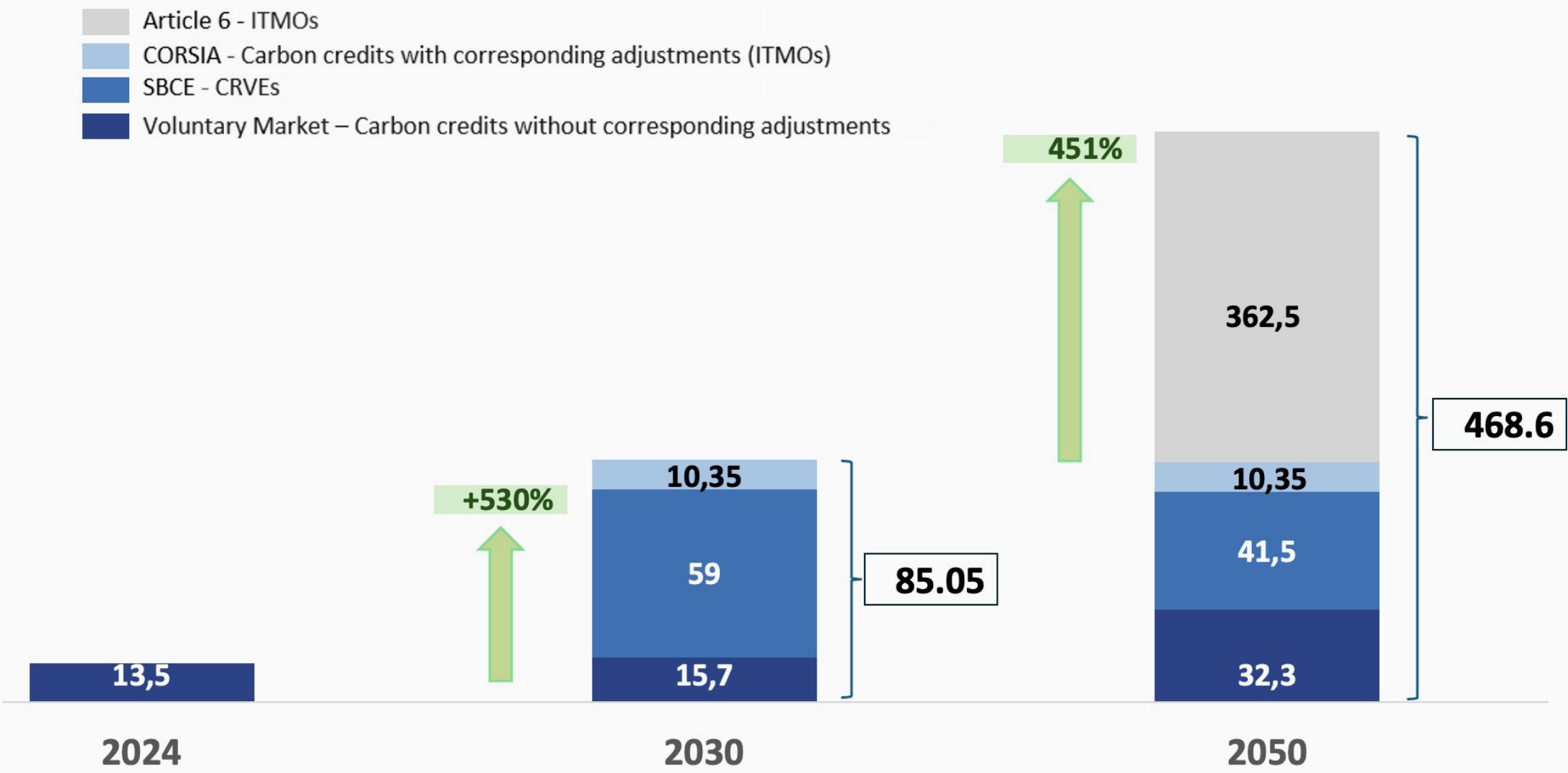
The challenges related to fragmented demand and low incentives for voluntary offsetting remain, but interaction with regulated markets or carbon taxation systems can boost demand for Voluntary Market credits, leveraging opportunities for carbon credit suppliers. In this way, Brazil can consolidate its position as an important player in a growing market. **The implementation of projects using methodologies that will be accredited by SBCE is considered an opportunity for supply players of credits on Voluntary Market, allowing them to leverage their experience and generate credits that can be converted into CRVEs and sold to new audiences, the agents regulated by the system.**

SBCE, on the other hand, has the potential to contribute to the achievement of Brazil's NDC and to attract resources to sectors with lower costs and

greater abatement potential through the acceptance of CRVEs. From 2030 onwards, this is likely to be the main driver of demand for decarbonization project credits at the national level. The magnitude of this influence will depend, however, on decisions regarding the acceptance (or not) of CDM credits in SBCE and the interoperability between Voluntary Market and the national regulated market.

Compared to Voluntary Market, the only market effectively operational in Brazil to date, demand for credits from mitigation projects could grow by up to 530% from 2030 onwards, with SBCE being the main driver of this increase in demand. Credits to be used in CORSIA would represent the second largest driver of increased demand for domestic carbon credits, but realizing this potential will depend entirely on the acceptance of corresponding adjustments.

Figure 25 - Potential Opportunities for the Brazilian Carbon Market, in MtCO₂e (combinations of optimistic scenarios)



Source: WayCarbon.

Figure 25 summarizes the estimated maximum potential for Brazilian participation in each market, considering a combination of the most optimistic scenarios. **In the long term, Brazil's primary opportunity lies in the full implementation of the Paris Agreement. In this context, increasing the ambition of NDCs is essential to create demand for national ITMOs, while the fulfillment of Brazil's NDC is crucial to enable the supply of these ITMOs.**

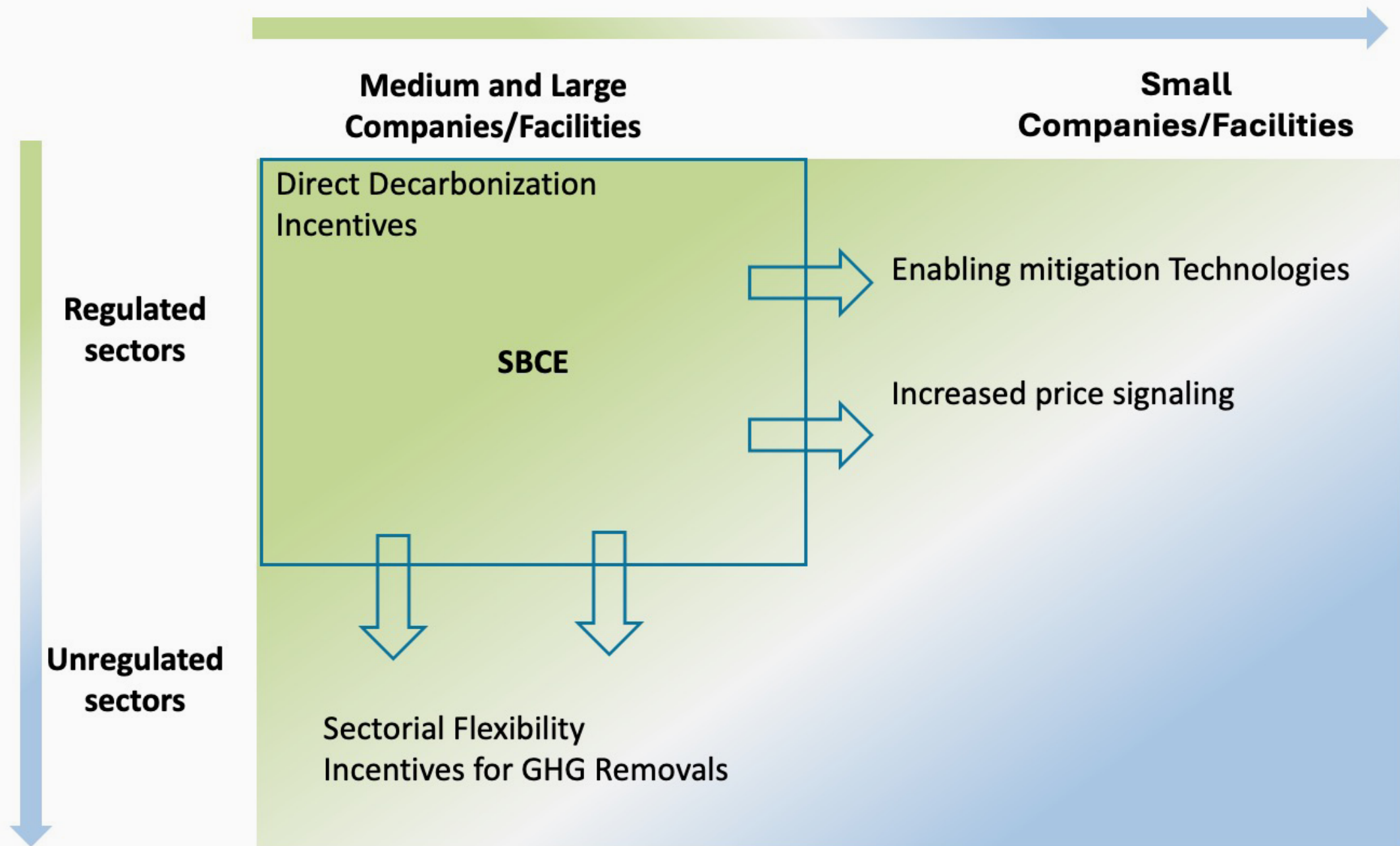
By COP 30, **the new round of NDC revisions aimed at increasing decarbonization ambitions, as well as increased transparency on the instruments to achieve the established targets, may provide greater clarity on the transaction potentials in the Article 6 market mechanisms.** An update in this regard is the new proposal by European Union – not yet approved by Parliament – made in July 2025, which aims to allow, from 2036 onwards, up to 3% of the bloc's emissions can be reduced through the purchase of carbon removal credits from developing countries, which could represent a potential demand of almost 280 MtCO₂e in ITMOs or A6.4ER (European Commission, 2025)(European Commission, 2025; IMF, [s. d.]). **Increased ambition from other regions may drive new demand for mitigation outcomes, as domestic emissions mitigation options tend to become scarcer, increasing the incentive to purchase emissions reductions in other jurisdictions.**

Brazil updated its NDC in 2024, aiming to reduce between 150 and 350 MtCO₂e over a 5-year period, while

the previous target was for a reduction of 120 MtCO₂e over the same period (WRI Brasil, 2025). In the coming years, the country could improve transparency regarding compliance with the NDC and how it intends to achieve these targets. **The National Mitigation Strategy, currently under development, has the potential to contribute this information, directing national and international investments to the sectors most relevant to reducing emissions in the country.** This and other mitigation strategies and policies, if communicated in biannual reports, with their ambitions and updates on their progress, can contribute to greater reliability in national climate commitments.

The establishment of SBCE is another factor that can enhance the credibility and transparency of Brazil's emission mitigation policies, extending decarbonization incentives to both regulated and non-regulated sectors under the national carbon market. Their structuring can strengthen Brazilian credits by establishing a minimum quality standard for methodologies to be accepted in the national regulated market, as well as criteria for verifying socio-environmental compliance in line with national regulations, which, in theory, would be verified in the current processes practiced in Voluntary Market, but which may not undergo coordinated control by independent auditors and certification standards. Figure 26, next page, illustrates the flow of these impacts.

Figure 26 – Impacts of SBCE on unregulated sectors and companies

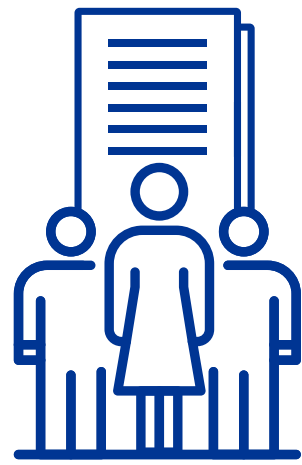


Source: Adapted from Wetterberg; Ellis; Schneider (2024).

In addition, the implementation of SBCE creates incentives for the emergence of a more efficient market infrastructure that reduces transaction costs for regulated agents, but also for unregulated agents. The lack of organization of Voluntary Market results in information asymmetries that weaken its full functioning and make it more vulnerable to opportunistic practices, inefficient decisions, and market failures, compromising trust among the agents involved (ICC Brasil; WayCarbon, 2025). In a scenario where

SBCE assets are recognized as financial assets, the opportunity arises for them to be traded on organized markets. Noteworthy in this regard is the initiative of the Brazilian stock exchange (B3) with AirCarbon Exchange (ACX), which has developed a trading platform where investors have access to credits with greater price transparency and lower search and information costs (B3, 2023).

Additionally, considering the advances in global cooperation (Article 6), the development of the Central Registry, provided for in Law 15,042, provides the legal and accounting basis necessary for the registration of ITMO transactions, which may allow for interoperability between markets, making easier the exchange of information in an efficient and secure manner, and enabling Brazilian participation in a global market that may have high transaction potential.



5. RECOMMENDATIONS

Carbon markets represent one of the main economic instruments for accelerating climate transition by pricing emissions and stimulating investments in less polluting activities and technologies. Brazil has the potential to lead the international carbon market within the scope of Article 6 markets, a factor that can represent significant economic opportunities by attracting international financial resources and consolidating itself in the supply of emission removal credits through forest restoration. The establishment of SBCE, on the other hand, could be the starting point for more coordinated and effective decarbonization actions, including for sectors not covered by the regulation.

However, harnessing this potential depends on a series of internal measures to ensure that emissions reductions occur at the necessary scale and speed. Recommendations were therefore drawn up for the public and private sectors in Brazil to overcome the challenges and take full advantage of the potential opportunities for the country.

5.1. FOR THE GOVERNMENT

The recommendations for the Government are aimed at fulfilling expectations surrounding the creation of SBCE and establishing the country's relevance in the transition to a low-carbon economy.

1. **Establish climate governance capable of acting in the strategic planning of the joint implementation of climate policies, in harmony with existing policies. In addition, the approved laws must be regulated in an integrated manner, ensuring legal certainty, predictability, and fiscal and contractual stability for investors.**
2. **Consider in National Mitigation Strategy not only the launch of new sectoral policies and plans, but also the reassessment and improvement of the effectiveness and alignment between existing policies and plans.**
3. **Establish a MRV process on compliance with the NDC, including the means necessary to achieve the established goals.** Monitoring and transparency regarding NDC compliance will be essential if the country wishes to trade ITMOs, increasing the reliability and predictability of national mitigation decisions.
4. **Establish an ITMO trading strategy, considering the opportunity cost of using the proceeds from ITMO sales to comply with the NDC:** the sale of a mitigation outcome should be considered as an advance on resources that can enable new emission reduction projects.

5. **Strive to comply with SBCE implementation schedule,** considering that late implementation of the market would entail higher costs to achieve the targets set by the NDC.
6. **Establish adjustment rules for projects already operating in Voluntary Carbon Market, ensuring their alignment with the new requirements for generating CRVEs and enabling the integration of pioneering initiatives.**
7. **Consider, together with SBCE, agendas for reducing Brazil's costs and promoting technological innovation to maintain the competitiveness of Brazilian industry in international trade.**

5.2. FOR THE PRIVATE SECTOR

The recommendations for **supply-side agents** aim to expand Brazilian participation in carbon markets through projects of social and environmental quality.

1. **Identify economic agents willing to commit to long-term purchase agreements.** Given that carbon markets are still maturing, long-term demand guarantees are essential to reduce the uncertainty of carbon projects.

2. **Invest in structuring carbon projects that enable emissions removal**, especially projects that benefit from **Brazil's competitive advantages**, such as forest restoration, integrated agricultural production, and biochar, due to their relatively low abatement costs compared to other emissions removal activities and considering the possible increase in demand from companies that have committed to climate neutrality targets.
3. **Given the disclosure of methodologies to be accepted in PACM and in SBCE, evaluate opportunities for developing carbon projects in these methodologies.**

For **demand-side agents**, the recommendations provide guidance on best practices for decarbonization and emission-neutralization strategies in the context of the emerging regulated market in Brazil.

1. For companies that have voluntary emissions offset commitments, **establishing predictable purchase commitments is essential to direct long-term investments in decarbonization projects.**
2. **Understand the impacts of establishing a regulated market for informed dialogue with the federal government regarding allowance allocations that consider the competitiveness of regulated sectors in the international market.**

3. **Assess decarbonization opportunities and structure processes while the guidelines for allocating allowances in SBCE are being established.**

In addition, the effective participation of the financial sector is considered essential, based on the structure of a transparent and regulated market. Guarantee, risk mitigation, investment, and financing mechanisms will be fundamental to the success of the carbon market in Brazil, consolidating a mature transaction environment that will allow the structuring of financial products based on environmental assets.

Further definitions are still needed on the operationalization of the mechanisms of Article 6 and SBCE so that the estimated potentials can be updated and more effectively reflect the opportunities for Brazil in these markets. Thus, we support the continued development of studies on carbon markets in the country, such as this one, in order not only to gauge expectations about these markets, but also to support their evolution and increase their potential, contributing to the global climate challenge.

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