



EXECUTIVE SUMMARY . 2023

OPPORTUNITIES FOR BRAZIL IN CARBON MARKETS

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COVER LETTER



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Since the launch of the last edition of the study in 2022, carbon markets have experienced important developments. From the voluntary markets and the growing pressure for greater transparency and quality of credits to the progress made in the negotiations on Article 6 of the Paris Agreement, the debates have become increasingly relevant and have brought more clarity to important aspects for the effective functioning of these markets.

In recent months we have also seen the start of the implementation of carbon adjustment mechanisms at the border and the progress of discussions on the establishment of a regulated carbon market in Brazil.

The latter is the focus of this third edition of the study, which seeks to understand the potential impacts of the Brazilian regulated market and analyze how the competitiveness of Brazilian products in the international market can be affected by the border adjustment rates of foreign regulated markets, investigating whether the regulation of our national market would be a potential risk mitigation instrument.

It is important to note that it is expected that there will be interaction between the Emissions Trading Systems (ETS) and the global carbon markets regulated by the United Nations Framework Convention

on Climate Change (UNFCCC) and with the voluntary market, but that it is up to national governments to decide how this connection window and the voluntary market credits will be used and to be selective when authorizing credits that will or will not contribute to their respective Nationally Determined Contributions (NDCs). It's worth remembering that although accepting carbon credits can reduce compliance costs, caution is needed to avoid flooding the market and reducing the effective result of emissions reductions. In other words, it's not a simple process.

Although this year brings a new look at the subject, the study "Opportunities for Brazil in carbon markets" continues with the aim of raising updates and recommendations for the evolution of the carbon market, contributing to the qualified debate on this transition mechanism that can leverage Brazil's sustainable development.

In this sense, the report anticipates several points that will remain open for infralegal regulation and the design of the national carbon market after the enactment of the Legal Framework and highlights the crucial role of using revenues to mitigate the negative impacts of the ETS and border adjustment mechanisms with the aim of reducing economic impacts, especially to avoid worsening social inequality.

I hope that the study will provide relevant information and that the conclusions presented here will be useful to decision-makers in the private and public sectors, negotiators, experts and society as a whole.

I would like to take this opportunity to thank the supporters of the 2023 edition - AES, Demarest Advogados, Indústria Brasileira de Árvores (Ibá), Itaú, KPMG, Marfrig, Natura &Co, Santander, Schneider Electric, Shell, Tauil & Chequer Advogados in association with Mayerbrown and Trench Rossi Watanabe Advogados - whose contributions have been essential for the publication and who, once again, have believed in this initiative.

Good reading!



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 international 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.

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WayCarbon is a global company, a reference in solutions focused on the transition to a low-carbon 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 ESG strategies. In 2022, WayCarbon was acquired by Santander Spain, which envisioned the opportunity of accelerating the adoption of solutions to tackle climate change by companies globally.

WayCarbon has served over 500 private sector clients, besides having an extensive experience in projects for multilateral organizations (Global Compact, UN, BID) in the areas of mitigation, adaptation, and compensation. It's technological solutions are currently being employed by customers in 40 countries.

WayCarbon's consultancy services, specialist software and high quality carbon projects are designed to help companies on their decarbonization journeys. It's forest preservation and reforestation projects value biodiversity and local communities. WayCarbon is the perfect partner to trace a holistic strategy when the subject is climate change.

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1. INTRODUCTION

Following the success of its publications in 2021 and 2022, the study “Opportunities for Brazil in Carbon Markets” presents a new publication in 2023 to update the market on this topic, but this time focusing on the regulated market. This study aims to analyze the potential impact of the establishment of a regulated market in Brazil. It is important to emphasize that even if the regulated carbon market in Brazil is created soon, the relevance of this study remains, since the analyses lead to recommendations that are not limited to the market implementation stage. There is a need for periodic assessments of the impacts of the system’s operation, infralegal aspects that will be defined after the law that will create the market and other fundamental elements that will be defined over time.

2. UPDATED GLOBAL PANORAMA

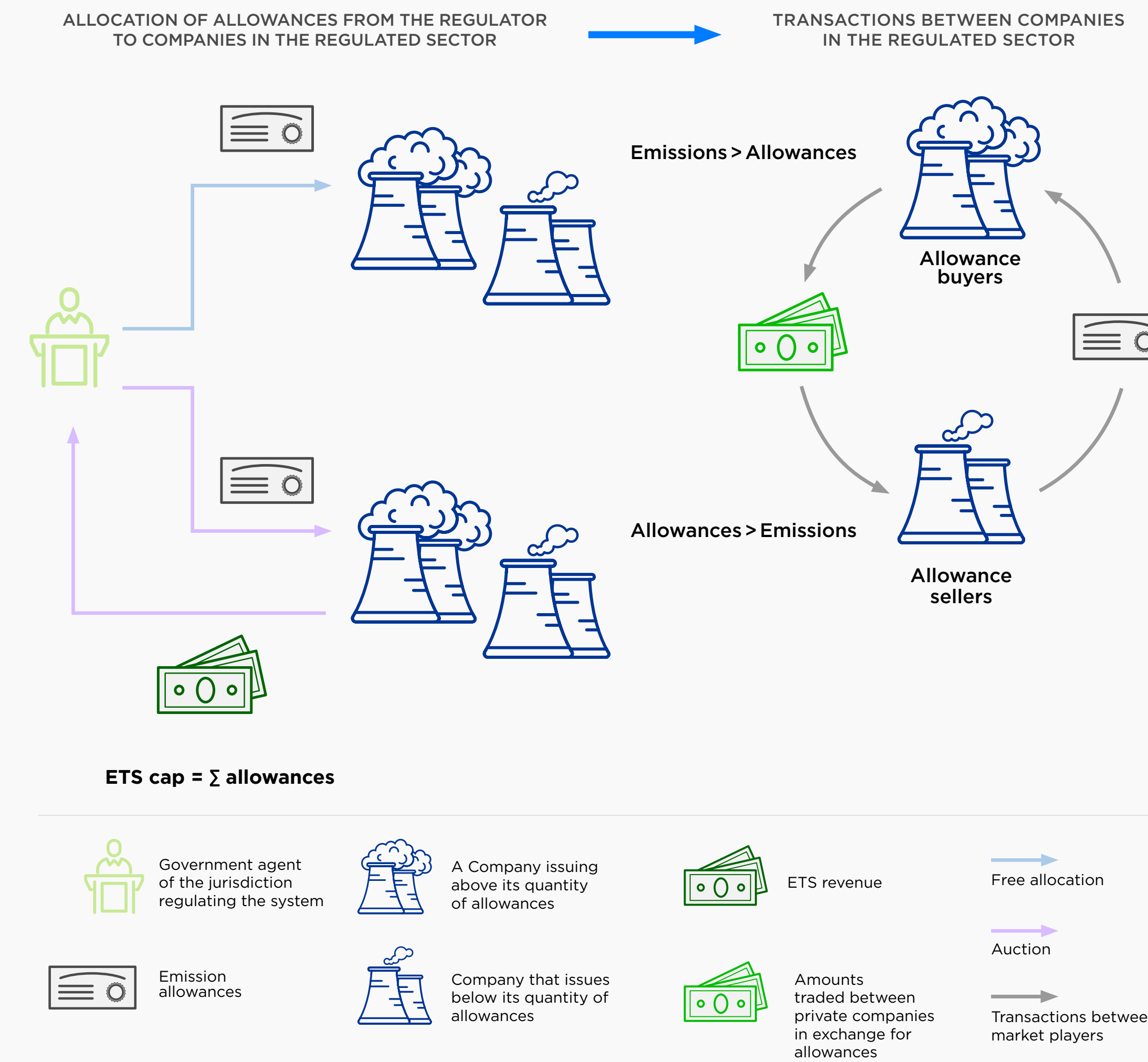
The need to develop economic strategies for the implementation of the Nationally Determined Contributions (NDCs) and the demonstrated effectiveness of carbon pricing in reducing emissions are therefore increasing the chances of making it a central element for many countries to meet the Paris Agreements goals (World Bank, 2023a). Considering carbon pricing mechanisms, it can be said that there are three diffe-

rent environments: the international regulated market under the Paris Agreement, which is being structured with Article 6 mechanisms; the regulated carbon markets at regional, national and sub-national level, in which companies in sectors follow specific arrangements in each jurisdiction; through carbon taxes or Emission Trading Systems (ETS)² and the voluntary market, in which companies make their voluntary climate contributions.

2.1. EMISSIONS TRADING SYSTEMS - ETS

ETSs are systems in which their regulator allocates or auctions emissions allowances - rights to emit a certain amount of Greenhouse Gases (GHG) considering a cap (the system’s emissions ceiling, which is equal to the total number of allowances in a jurisdiction/sector), to companies in the regulated sectors. Companies that emit below their allowances can trade their excess allowances with a company that emits above. The scarcity of allowances in circulation on the market encourages investments in decarbonization. Figure 1 shows how allowances are allocated and traded in an ETS.

Figure 1 - How an ETS works



Source: Own elaboration.

1. Directly establishes a price for carbon by setting a tax on greenhouse gas (GHG) emissions or - more commonly - on the carbon content of fossil fuels. There are 40 jurisdictions that have carbon taxes, according to data extracted on June 15, 2023.

2. As the bills currently being discussed in the country to regulate a carbon market consider the formation of an ETS, as recommended by the Partnership for Market Readiness (PMR) Brazil Project, this study focuses specifically on the structuring of this type of market in Brazil and the elements of its design.

The share of global GHG emissions covered by ETSs is currently over 17% (World Bank, 2023a). In June 2023, there were a total of 28 ETSs. In addition to these, eight other ETSs have been mapped that are due to come into operation in the next few years, including Colombia in South America. There are also 12 jurisdictions that are considering implementing an ETS, including Brazil (World Bank, 2023a; ICAP, 2023). A new European Union (EU) ETS is to be launched by 2028, with a more ambitious climate target of at least a 55% net reduction in emissions by 2030 compared to 1990, including new sectors not yet covered by the current EU ETS. Currently, the most regulated sectors in ETSs are energy and industry, and new ones may be included over time (ICAP, 2023).

There has been a general increase in the price level of allowances from 2021 onwards, however, achieving globally the US\$ 100/tCO₂e needed to reach the Paris Agreement's 2°C scenario remains a major challenge (Galdi *et al.*, 2022). It is believed that prices need to increase in the long term to achieve climate neutrality on the scale and at the pace required, being between US\$ 61 and US\$ 122 (excluding the effect of inflation) by 2030 (World Bank, 2023a). As for revenues, there was a growth of more than 10% in 2022, reaching almost US\$ 95 billion globally, with 69% coming from ETSs (World Bank, 2023a).

2.2. INTERACTION BETWEEN MARKETS

Each carbon market environment has a different transaction unit, but in all these markets, the unit of measurement is the same: tons of carbon dioxide equivalent (tCO₂e). In this way, given the permission of the systems' regulators, interaction between markets is possible (Figure 2). The inclusion of carbon market from **voluntary market** on a limited basis can be used as a system flexibility mechanism to help meet the goals of a regulated market.

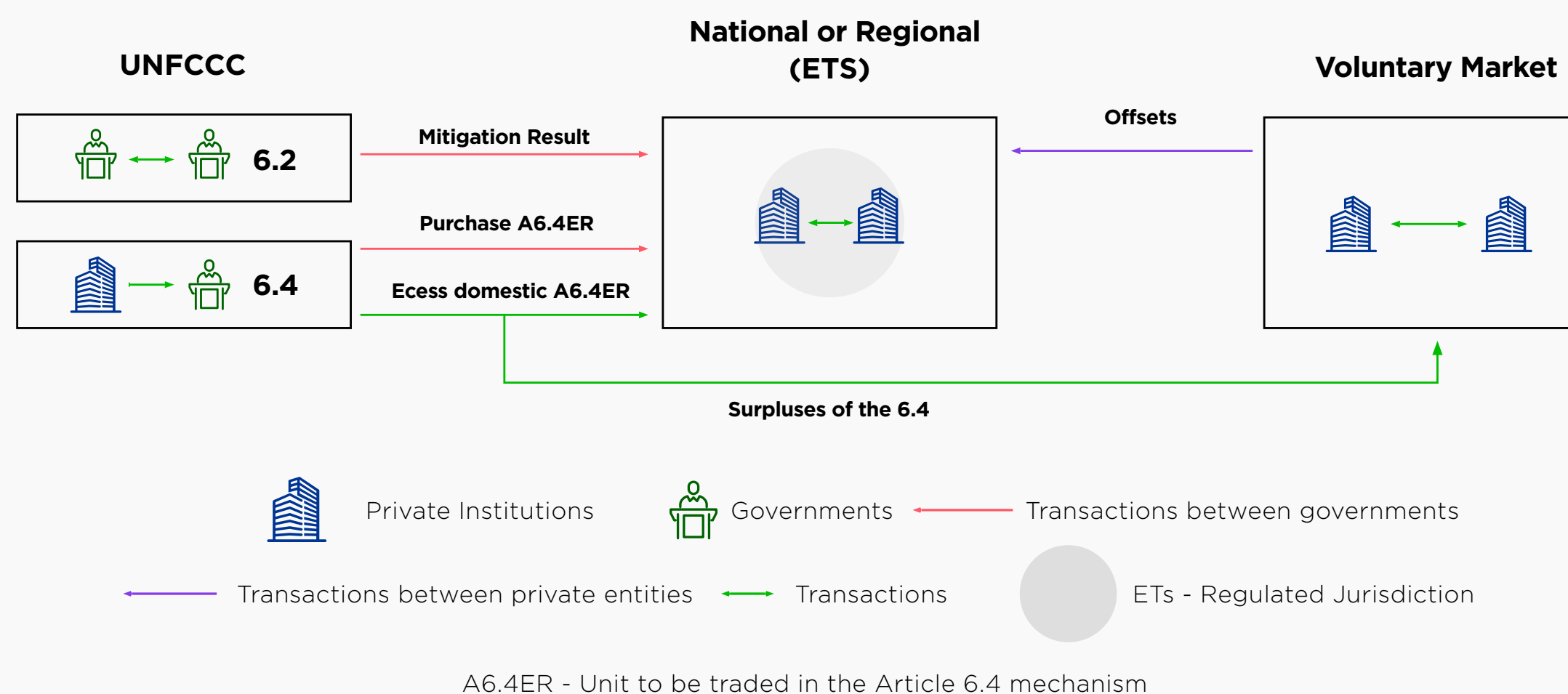
Carbon credits in ETS can reduce compliance costs by providing additional, potentially lower-cost abatement options for companies and, at the same time, encourage mitigation activities from other sectors and/or regions (La Hoz Theue *et al.*, 2023). In the short term, in its early stages, the flexibility to meet commitments through offset credits is useful for ETS participants to minimize the cost of GHG mitigation. However, dependent on long-term compensation, regulated sectors in the ETS tend to be locked into high-carbon technologies, delaying effective action and making emissions reductions more expensive in the future (Asian Development Bank, 2016). Thus, it can be inferred that if an ETS begins by accepting

offsets, it is necessary, as it matures, to reassess the inclusion of offsets, identifying whether their impacts are still advantageous for the system.

The requirements for the inclusion of credits in ETSs are percentage of inclusion (up to 10% in jurisdictions with restrictions on the inclusion of offsets), geographical delimitation (carbon projects in the national territory or jurisdiction) and specific types of projects. The system's strategic design and integration of offsetting measures may be necessary to reduce emissions, bypassing problems faced in other systems associated with reliance on and extensive use of credits (Asian Development Bank, 2016). Therefore, it is important to understand what types of credits are included to provide better value for money while protecting the environmental integrity, which jurisdictions are responsible for guaranteeing and is related to the capacity to represent a real, permanent, additional and verifiable reduction in emissions (Galdi *et al.*, 2022; La Hoz Theuer *et al.*, 2023).

Under Article 6, the relationship with voluntary markets is still uncertain, so several supervisory efforts are already underway to help reduce this uncertainty and provide more clarity for users of these markets (ICROA, 2021). The use of credits according to Article 6.2 could create incentives for host countries to transfer mitigation results from projects to sectors that are difficult to abate – with higher marginal abatement cost (MAC) – attracting finance to these sectors, and using the mitigation results of low abatement cost pro-

Figure 2 - Interaction between carbon market environments



Source: Own elaboration³.

3. This figure is an updated version of a similar figure presented in the first edition of this report. The understanding of the interaction flows between trading environments has changed since the development of the documents dealing with the functioning of the mechanisms of Article 6 of the Paris Agreement.

jects to meet their own NDCs (Fattouh; Maino, 2022). In Article 6.4, the 6.4 Emission Reductions (A6.4ER) could be traded and retired by voluntary market participants and may be authorized by the host country of the projects to be used for compliance in national regulated markets in other countries (IETA, 2023). It should be noted that it can be beneficial for the host country to attract funds from the private sector to collectively achieve emissions reductions, and it is important to identify priority sectors where the voluntary market can fund mitigation actions that would otherwise be more expensive.

3. POTENTIAL IMPACT OF THE EU CBAM ON SELECTED BRAZILIAN PRODUCTS

As national climate policies become more ambitious, the question of Carbon Border Adjustment Mechanism - CBAM comes into focus. These mechanisms consist of a charge on the carbon of imported products to guarantee treatment equivalent to the domestic price of carbon.

In December 2022, the EU announced its CBAM, the EU CBAM, with the following purposes: to replace

the free allocations given to exporters; to prevent European companies from transferring their production to less restrictive countries (carbon leakage); to prevent the loss of competitiveness of their products; and to encourage exporters in other countries, such as Brazil, to reduce their emissions. EU importers of goods covered by CBAM will need to declare the emissions embodied in the imported products and buy corresponding certificates, the price of which will be calculated according to the price of EU ETS allowances at auction. If they can prove that the imported products have already been subject to carbon pricing at source, the amount can be deducted from the total to be paid (European Commission, 2023). Canada, the United Kingdom and the United States are considering similar mechanisms (Canada, 2021; US Trade Representative, 2021; UK Government, 2023).

Since the application of this type of mechanism by Brazil's trading partners could affect the national economy and become one of the factors why it would be relevant to implement a regulated carbon market in the country, its main impacts are analyzed.

3.1 POTENTIAL IMPACTS OF A CBAM

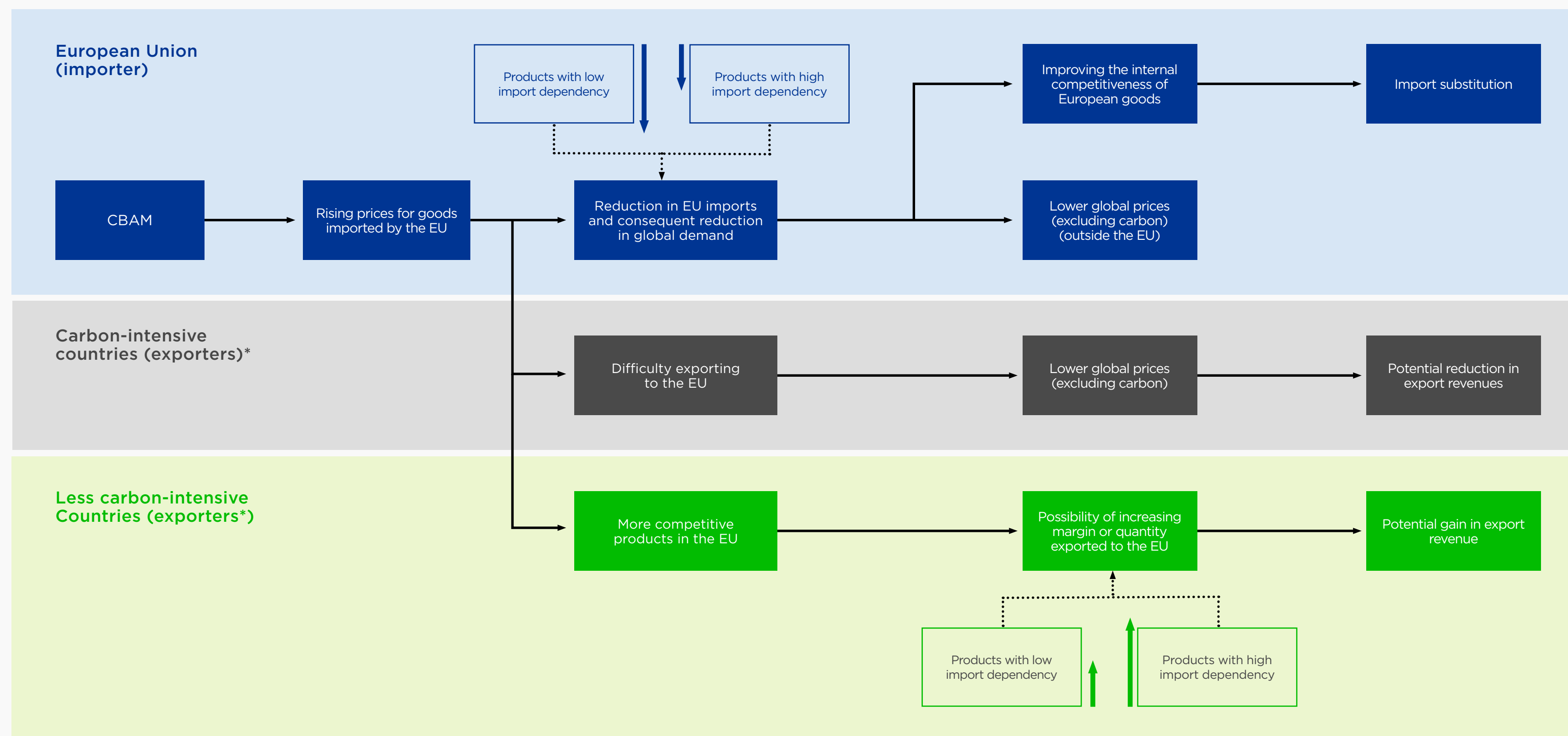
While carbon pricing encourages emission reductions and can result in carbon leakage, the introduction of a CBAM leads to a significant reduction in carbon leakage (UNCTAD, 2021)⁴. The reduction in

leakage would be partially offset by a slight increase in EU emissions and a decrease in global emissions (Markkanen *et al.*, 2021). Thus, if other countries were to adopt more ambitious climate policies in response to the EU CBAM, it would be possible to achieve even greater reductions in global emissions (UNCTAD, 2021).

EU CBAM may result in a slight increase in EU gross domestic product (GDP) and generate 600,000 jobs (Markkanen *et al.*, 2021), however, it may create negative distributional effects for countries subject to the measure, increasing inequality (Böhringer; Carbone; Rutherford, 2014). Thus, recycling revenue to support climate action in less developed countries may increase the acceptability of EU CBAM outside the bloc (Markkanen *et al.*, 2021). But the actual impact of a CBAM will depend mainly on the carbon incorporated into the products and the carbon prices already paid in the countries of origin, if any. You could say, then, that less carbon-intensive countries like Brazil, especially due to its electricity matrix, can benefit from relatively lower carbon-related production costs than their global peers, and could even attract foreign companies. The Figure 3 highlights the potential impacts on the economies involved in transactions subject to CBAM.

4. The analyzes presented by UNCTAD (2021) were carried out before the launch of the EU's plan for the CBAM and therefore do not reflect the detailed specifications of what is currently being implemented.

Figure 3 - Potential impacts of the CBAM on economies involved in the transactions



* Exporters who already have an internal carbon price can deduct the value of the carbon from the amount payable in the CBAM.

Large effect on reducing EU imports (blue arrow pointing down)
 Small effect on reducing EU imports (blue arrow pointing down)
 Large effect on exports from less carbon-intensive countries (green arrow pointing up)
 Small effect on exports from less carbon-intensive countries (green arrow pointing up)
 The straight connectors indicate the cause and consequence relationship (transmission channels) of CBAM on the economic variables of the countries
 Dotted connectors indicate the expected impact on the variables
 The term **excluding carbon** refers to prices without the impact of carbon pricing

Source: Own elaboration.

3.2. ANALYSIS OF THE POTENTIAL IMPACT OF THE EU CBAM ON SELECTED BRAZILIAN PRODUCTS

Based on the case of the EU CBAM, an assessment was made of the potential impact of levies on the products of the sectors likely to be covered by a Brazilian ETS, by means of their carbon footprint (CF). Currently, the methodology for this type of assessment requires the measurement of direct and indirect emissions from the production process, calculated according to Annex IV of the CBAM regulation (European Commission, 2023) and, in a forthcoming revision of the regulation, it is expected that a life cycle assessment (LCA) of the products will be requested. Based on this premise, the methodology used in this chapter evaluates the CF of the most common products currently exported to the EU. The selection of products was done in three steps:

1. Identification of the Brazilian sectors with the potential to be regulated, according to the PMR Brazil, current bills and international experiences: fuels and industry (chemicals, pulp and paper, steel, aluminum, cement, lime, glass, food and beverages, textiles, mining and ceramics);

2. Selection of sectors that are already covered by CBAM⁵ and those on the EU's list of those exposed to the risk of carbon leakage, which could therefore be included in CBAM at a later date (European Commission, 2019);

3. Verification of the sectors with the largest share of Brazil's exports⁶ to the EU. In this step, the

5. In its transition period, the mechanism will cover imports from the following sectors: iron and steel; cement; aluminum; fertilizers; hydrogen; and electricity.

6. The export values of products from these sectors were obtained from the Brazilian Ministry of Development, Industry, Trade and Services (MDIC).

following subsectors were identified: manufacture of basic iron and steel manufacturing, manufacture of vegetable and animal oils and fats, and extraction of crude oil.

A selection was then made to determine which products would represent each subsector based on the correspondence between the different databases used. Once the products had been selected, the CF of these products was calculated using an LCA. For this purpose, we collected both direct and indirect CO₂e emissions associated with a product or process. These emissions encompass all stages, from the supply chain to direct production emissions, such as the combustion of fossil fuels in vehicles and appliances⁷. In this quantification, the production of each selected product was considered in national and European territory and the average for the rest of the world, so that it would be possible to assess the “climate competitiveness” of national and international products by comparing their footprints in different locations.

From the original datasets⁸, in cases where the data was not specific to Brazil, adaptations were made to the emission factors in the database so that the CF could better reflect the Brazilian reality. Electricity from the National Interconnected System (SIN) was considered, with the contribution of each energy

source from the National Energy Balance (BEN) 2022 (EPE, 2022). For fuel consumption in the upstream production chain, the factors according to national datasets were used and, in their absence, datasets covering the Latin American region. As long as the data is reliable and the adaptations follow the guidelines set out in the regulations, CBAM allows this type of change to be made to prove the lower intensity of installations and/or production processes in a given geographical area (European Commission, 2023).

Generally speaking, products with more fossil fuels in their production process are likely to have higher emissions and thus a higher CF⁹ compared to those produced in the EU, which generally have more technological and less emitting processes. On the other hand, having less emission-intensive products compared to competitors represents a new element of competitive advantage for Brazil, since the EU is not self-sufficient in several products. One example analyzed in this study is Brazilian soybeans, which are one and a half times less carbon-intensive than their international competitors, including the EU, probably due to the adoption of modern conservation agriculture techniques, such as no-till farming, crop rotation and the use of crop-livestock-forest integration (CLFI) (Estevam *et al.*, 2022; Garofalo *et al.*, 2022) techniques. The results of the CFs of the selected products are presented in Table 1.

Table 1 - Calculation of CF in the production of 1 ton of products for Brazil, Europe and the rest of the world

Sectors (ISIC Classe)	Selected products	Main inputs	Brazil (tCO ₂ e)	EU (tCO ₂ e)	World (tCO ₂ e)
Manufacture of basic iron and steel	Steel production, converter, low alloy ¹⁰	Pig iron, Ferronickel and Carbon dioxide, fossil	2.14	2.08	2.18
Manufacture of vegetable and animal oils and fats	Soybean meal and crude oil production	Soybean	3.04	7.60	7.82
Extraction of crude oil	Oil and gas production ¹¹	Natural gas and Heavy fuel oil	0.34	0.18*	0.39**

Source: Own elaboration based on data from Ecoinvent (2023).

* Emission calculated taking into account average oil production in the Netherlands, Germany, Norway, and Romania.

** Emission calculated taking into account average oil production in Russia and Saudi Arabia.

This is followed by an analysis of Brazil's main competitors in the EU for the selected products and the implications of this analysis for the discussion on CBAM. To avoid double pricing, as already mentioned, agents who import products that are already subject to a carbon pricing system at their point of origin can have the corresponding payment deducted from the tax payable in the CBAM¹². The Frame 1 report pre-

sents an analysis of which countries export the most of the selected products in the world and to the EU.

7. We followed the methodology of the GHG Protocol (2011), which is governed by the ISO 14067 (FOOTPRINT) and ISO 14040/44 (LCA) standards (SHABIR *et al.*, 2023).

8. The openLCA[®] software was used for the calculations, the Ecoinvent v3.9.1 (ECOINVENT, 2023) database and the IPCC 2021 impact calculation method to convert GHG emissions into CO₂e and evaluate the production of 1 ton of each product.

9. It should be noted that the CF calculation considers the average emissions for the production of the selected products, so certain companies may have higher or lower CFs than those presented.

10. The use of natural gas rather than charcoal was considered according to the production profile in Brazil.

11. This data set represents the life cycle inventory of offshore oil and gas extraction using conventional extraction methods and may differ from more recent information released.

12. Products that have previously been subject to a pricing system at the place of origin already have this cost built into the value of their exports prior to submission to CBAM and therefore do not give rise to the inclusion of a new “cost” corresponding to the value of the fee to be paid to CBAM. This is because although the importer is responsible for the payment, the exporter may be forced to reduce its price by the same amount as the CBAM tax in order to remain competitive.

Frame 1 - List of the main exporting countries for the selected products in 2022

Subsetor	Main countries exporting to the EU	Main countries exporting worldwide
Manufacture of basic iron and steel	Brazil, South Africa and Russia	Indonesia, South Africa and Brazil
Manufacture of vegetable and animal oils and fats	Brazil, Argentina and the Netherlands	Argentina, Brazil and the United States
Extraction of crude oil	Saudi Arabia, Russia and the United States	Saudi Arabia, Russia and Canada

Source: Eurostat (2023) e OEC (2023).

Of these exporting countries, Russia and Saudi Arabia do not have a pricing system, but the others do, at least in some states. It is important to note that pricing systems in countries that are Brazil's commercial competitors create economic pressure for the country to adopt a similar policy. Brazil's competitive advantage with its cleaner electricity matrix does not exempt it from seeking clean initiatives for its industrial processes. However, it is also important that CBAM considers all the emissions incorporated into products, including emissions corresponding to the electricity matrix, which is not the case so far for most products in the definitive phase of EU CBAM.

4. BRAZIL'S POLICY AND REGULATORY UPDATES ON CARBON MARKETS

In Brazil, the creation of a regulated carbon market was envisioned in the National Policy on Climate Change (PNMC) and analyzed in studies such as the PMR Brasil (World Bank, 2020b) Project. However, the establishment of a regulated market in Brazil is expected to be established by law, as dictated by Article 170 of the Federal Constitution. As such, a national ETS is currently the subject of several Bills (PLs) being processed in the Chamber of Deputies and the Federal Senate, usually joined together or being processed jointly. As of the writing of this study, there was still a lack of a convergent proposal and the structuring of how the mechanisms will work, which will probably

come via presidential decree.

For the regulated carbon market to work efficiently, various mechanisms need to work together to encourage the reduction of emissions by regulated agents, making sure that the sectors most exposed to foreign trade do not lose competitiveness and that the most vulnerable families do not bear the cost of mitigation (World Bank; Vivid Economics, 2018). It should be noted that the operationalization of an ETS requires the creation of an implementing or regulatory body and institutional arrangements that can only be established by law.

Thus, Bill 2.148/2015 of the Chamber of Deputies and its appendices establish the governance structure for the Brazilian Emissions Trading System (SBCE), which would be made up of: a higher body, made up of members of the National Financial System; a deliberative and appeals body, made up of the Interministerial Committee on Climate Change and Green Growth; an advisory body made up of government and civil society representatives; and the Competent Authority, the public body designated to manage the SBCE, which would coordinate the institutions responsible for the system's Operational Reporting Registry and the ETS. The Federal Senate's substitute for Bill 412/2022, in turn, proposes governance made up of the Interministerial Committee on Climate Change, the SBCE management body and a permanent technical group. It is up to the Executive Branch to establish the composition and operating rules of the bodies that make up the SBCE governance.

In order for the pricing system to truly reflect actual emissions, a Monitoring, Report and Verification (MRV) system including a national database of emission factors must be created to ensure consistency in the calculations. The specific emission factors must be checked by a competent body. Ideally, the MRV system should be introduced before the ETS to collect data that allows a realistic calculation of the fulfillment target (WORLD BANK, 2020b).

In general, the regulated sectors and emission limits are not specified in the regulatory proposals currently being processed (BRASIL, 2022a, 2022b), and must be established by presidential decree. The substitute for Bill 412/2022, however, already considers emissions thresholds for regulated entities, establishing monitoring of sources that emit more than 10,000 tons of CO₂e and regulation of sources that emit more than 25,000 tons of CO₂e.

Emissions trading, on the other hand, must be set with a reduction target or an overall budget of carbon (cap) to be distributed and sold. In most cases, part is allocated for free and another part is auctioned. These free distributed allowances can be distributed based on historical indicators (grandfathering) or sectoral performance indicators (benchmarking) (World Bank; Vivid Economics, 2018). Given the lack of data and its simplicity, the grandfathering criteria is recommended at the initial stage in Brazil, with a free allocation of 50% for all sectors with competitiveness risk. For emissions not covered by free allocations, the allocation would be through auctions, reconciling emissions with the purchase of emission

rights (World Bank; Vivid Economics, 2018). The predictability of auction events allows for transparency and a stable price signal for participants and consumers, and can reduce volatility in emissions prices. In addition, this mechanism creates a revenue stream for the government that can be distributed to a wide range of potential beneficiaries (ICAP; World Bank, 2021).

Participation in auctions may or may not be limited to regulated agents, such as financial institutions. The participation of non-regulated agents can help the development of the market, especially by increasing the liquidity of allowances, making it possible to protect against price variations and increasing price signaling, which can support companies' decision-making (IOSCO, 2023). It is therefore understood that the solidity of permit markets would help to reduce information asymmetries and market opacity, one of the main barriers raised in the previous edition of this study (ICC Brasil; WayCarbon, 2022)¹³.

However, the Bills being processed provide for price control mechanisms and measures to protect competitiveness, such as free allocations or border adjustment mechanisms, but without specifying concretely how to implement them. In theory, the sectors covered by a border adjustment mechanism should be those that have high carbon intensity and are exposed to international trade. To promote greater acceptance and reduce controversy over the parameters used to define these sectors, it is suggested that in

the initial phase of the national ETS, sectors with a competitiveness risk be identified by indicators similar to the EU ETS, albeit with a less restrictive gradation, considering the initial phase and the degree of competitiveness of the industry in Brazil (World Bank; Vivid Economics, 2018).

With regard to the use of offsets, although the PMR considered that their use should be limited to 20% in the initial periods, being reduced to 10% in the following periods and international experience, shown in **Chapter 2**, indicates that the percentages of inclusion in other countries that have this type of restriction do not exceed 10%, Bill 2.148/2015 and its appendices¹⁴, however, provide that the maximum percentage of VERs (Verified Emission Reductions) acquisitions would be no less than 25% of the total emissions that exceed their allowances. Within the framework of the voluntary market, it is necessary to establish measures to involve and protect traditional communities and indigenous peoples, curbing abusive and illegal practices in the generation of credit. Bill 412 provides for the use of voluntary market credits for regulatory purposes in the SBCE (Brazilian Emissions Trading System), but does not establish a minimum or maximum percentage for the use of VERs.

In general, the design, adoption and operation of carbon pricing arrangements in Latin America are marked by considerable levels of learning by doing. It is important that governments in the region, such as

Brazil, recognize this possibility and ensure room for maneuver so that corrections and innovations can be proposed within the legal framework of a carbon pricing document (FGV EAESP, 2019). Furthermore, in the event of non-compliance with the obligations, it is also necessary to establish the penalties applicable to the agents.

5. COSTS AND SOCIO-ECONOMIC IMPACTS OF MITIGATION IN SELECTED SECTORS

The establishment of an ETS, such as the one being designed for Brazil, in addition to providing an opportunity for greater emission reductions, can have a socio-economic impact on the jurisdiction as a whole. In this way, the opportunities and costs of abatement with the inclusion of the Industry and Fuels sectors (the same sectors analyzed in **chapter 3**), the possible socio-economic impacts of establishing an ETS in Brazil as well as measures that can minimize them are analyzed.

5.1. OPPORTUNITIES AND ABATEMENT COSTS FOR THE INDUSTRY AND FUELS SECTORS

The CMA is the main driver of negotiation strategies in Article 6 of the Paris Agreement, since countries must first adopt the lowest-cost activities to comply with their NDCs, making use of the carbon markets to subsidize higher-cost projects. Some studies seek to estimate these costs in the national scenario, such as the study "Options for Mitigating GHG Emissions in Key Sectors", which served as the basis for the 2021 publication (ICC Brasil; WayCarbon, 2021) and others that will be brought here for updating.



INDUSTRY

According to the "Mitigation Options" study, the industrial segments have a significant joint potential for reducing 387 MtCO₂ in the Low Carbon scenario by 2050 in the Brazilian context and the results indicate an abatement cost of between -667 and 930 US\$/tCO₂ at the social discount rate. In addition, the most cost-effective measures are directly related to improving energy efficiency (Brasil, 2017).

Update of abatement costs and potentials

In the cement segment, replacing clinker with the use of slag carbide, the use of biomass and energy

13. Increasing liquidity and reducing opacity and informational asymmetry on prices can also help in the financing of decarbonization projects, since the cash flows of these projects can be estimated more accurately and therefore contribute to the credit risk assessment of these projects. If financial institutions participate in the market, they could eventually accept emissions allowances as collateral for financing, thus reducing the cost of credit.

14. Bill 2.148/2015 adds Bills: 10.073/2018; 5.710/2019; 290/2020 and Bill 528/2021.

efficiency measures could reduce around 421 MtCO₂ by 2050 (SNIC, 2019). And in the **pig iron and steel sector**, the reduction in emissions could reach 13% by 2050, with the production of pig iron using charcoal standing out (Instituto Aço Brasil, 2021).

From a global perspective, studies such as McKinsey&Company (2022) have analyzed the application of mitigation measures in the **steel and cement industries**. In the former, decarbonization strategies involve: i) replacing basic oxygen furnaces (BOFs) with electric arc furnaces (EAFs); ii) using steel scrap as a raw material and replacing natural gas with green hydrogen; iii) and applying CCUS (Carbon Capture, Utilization and Storage) in conjunction with traditional techniques. For the **cement sector**, the measures considered include: i) improving energy efficiency concentrated in kilns; ii) switching to alternative fuels, such as biomass; iii) replacing clinker with materials that do not release CO₂; iv) and the use of CCUS, recycling and alternative construction materials.

Along the same lines as “Mitigation Options”, but covering only some of the industrial segments, the Climate Center (2023) estimates that the implementation of traditional mitigation measures would lead to a 34% reduction in emissions between 2020 and 2050. The abatement potential of these measures could reach 91 MtCO₂ in 2050 at a carbon price of less than US\$ 20/tCO₂.

Opportunities and challenges

Most traditional technology options have significant abatement potential and boost the competitiveness and sustainability of industrial processes, but they have limitations. Obstacles such as high costs, difficulties in accessing credit, influences from the unfavorable economic climate, installation restrictions and uncertainties regarding the sizing of technologies, can hinder the adoption of these measures. As industry approaches these barriers, it is necessary to look for long-term disruptive solutions, such as the use of green hydrogen and CCUS, which are emerging as alternatives in almost all industrial processes.

The transition will require a joint effort between regulators, governments and stakeholders to reshape production chains, facilitate access to the necessary capital and stimulate demand. In terms of opportunities, producers who adopt these technologies in an advanced way will have a competitive advantage in the transition to a low-carbon economy. The adoption of these technologies can generate benefits for the entire ecosystem, including companies that offer equipment and services aimed at implementing mitigation options (McKinsey&Company, 2022).



FUELS

The fuel sector can significantly reduce GHG emissions by 2050, with abatement potential that could reach 415 MtCO₂ in the Low Carbon scenario by 2050. Some of the measures are already being adopted with low-cost technologies or even at negative costs. The results observed by Brasil (2017) identify the oil and gas extraction and production (E&P) segment as having the greatest potential for reducing emissions in the sector, with intermediate cost measures of between 10 and 50 US\$/tCO₂ being the most representative.

Update of abatement costs and potentials

In the oil and gas E&P segment, more recent studies highlight some solutions, such as the incorporation of “all electric” technology into new offshore platforms (Petrobras, 2021).

According to McKinsey&Company (2022), a 10% improvement in efficiency could result in an almost 4% reduction in the intensity of global emissions in the oil and gas Exploration and Production (E&P) segment. Potential measures include: i) the electrification of equipment; ii) the management of fugitive methane emissions and iii) the application of CCUS in carbon-intensive processes in the value chain.

The mitigation measures proposed by the Climate Center (2023) indicate to traditional practices for improving operational efficiency, which could reduce around 41 MtCO₂.

Opportunities and challenges

The implementation of mitigation technologies within the production process, together with the favorable characteristics of Brazilian pre-salt oil, could position Brazil strategically to meet remaining demands and reduce sectoral emissions (CEBRI *et al.*, 2021). Furthermore, the biofuel production segment is crucial not only for the decarbonization of the sector, but of the country as a whole. For example, a greater proportion of biofuels in the composition of fuels would have cascading effects on other sectors that sell and demand products dependent on fossil fuels. Thus, the adoption of mitigation technologies cannot be isolated, but in a coordinated sequence between the strategic sectors.

The sector presents some of the best opportunities for value creation, considering the mitigation options and the expected increase in capital investments. The industries based on hydrogen and biofuel can grow tenfold by 2050. However, the transition to low-emission assets requires caution to avoid substantial increases in costs and volatility in energy prices (McKinsey&Company, 2022).

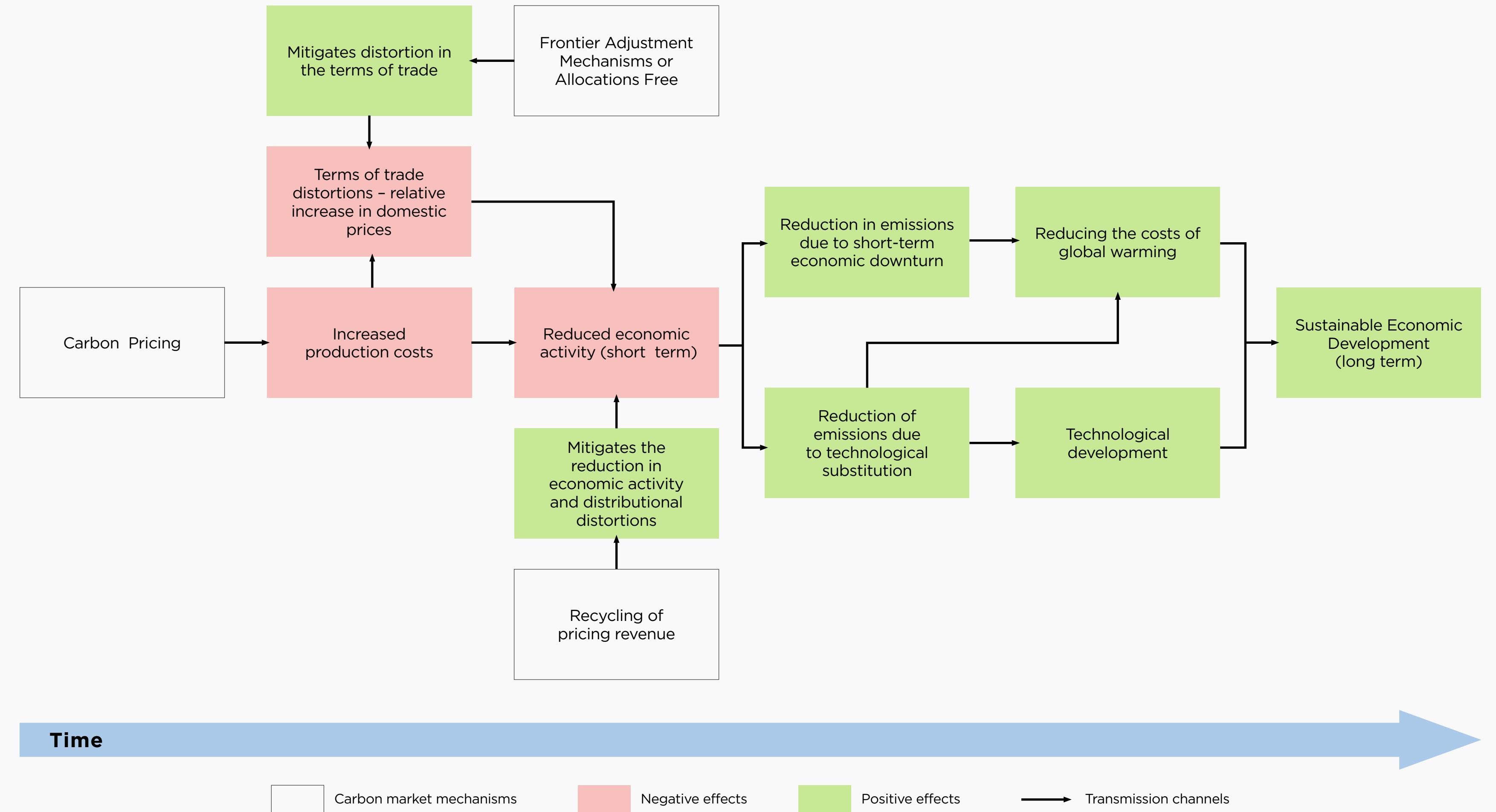
5.2. SOCIO-ECONOMIC IMPACTS OF CARBON REGULATION

Although carbon pricing instruments enable a better cost-benefit ratio for achieving an NDC, the pricing of GHG emissions has potential negative distributional effects. These possible impacts may be unavoidable on the road to a low-carbon economy, and need to be analyzed beforehand in order to minimize them.

The impacts of pricing can be considered negative for a specific sector or group of consumers, but desirable from the point of view of society as a whole. Without them, there can be no adjustments in production and consumption to enable low-carbon trajectories. As these impacts are a reflection of the need for adjustments in the economy, due to the commitment to an emissions control target, there is no way of zeroing them out, but the cost-effectiveness of economic pricing instruments allows them to be minimized. In addition, **it is considered that short-term economic impacts generate strong incentives for technological innovation, which increases the cost-effectiveness of emissions control, so that it becomes cheaper to control or emit less per unit produced or consumed** (World Bank, 2020a).

Figure 4 presents a simplified summary of the expected transmission channels of the short- and long-term macroeconomic impacts of carbon pricing.

Figure 4- Simplified summary of the expected transmission channels of the short- and long-term macroeconomic impacts of carbon pricing*



* Expected effects of carbon pricing, keeping all other factors that may affect short-term economic activity and long-term economic development constant.

Source: Own elaboration.

Some studies consider the Brazilian reality and present various results regarding the impacts of carbon pricing (Brasil, 2017; Carvalho; Magalhães; Domingues, 2022b; Instituto Talanoa, 2021; World Bank, 2020a). These studies analyze different scenarios¹⁵ and, in general, their results show that the introduction of a pricing instrument increases production costs in carbon-intensive sectors and, consequently, impacts household income and consumption, prices, the national competitiveness of these products and GDP. This reinforces the need to map the impacts and create a strategy to help minimize them in the short term.

Despite the necessary caution, it should be noted that in the PMR Brazil Project, even with the high ambition of the pricing scenarios applied, there was no economic loss compared to the reference scenario. The simulated measures have characteristics that play the expected role, protecting the competitiveness of regulated sectors, while taking advantage of opportunities, either through revenue recycling or incentives for low-cost mitigation via offsets (World Bank, 2020a).

Although the socio-economic impacts may vary depending on the design of each system, empirical literature and the experiences of other ETSs provide useful lessons to guide the implementation of a Brazilian market. Several studies on carbon pricing have found no evidence of a negative impact on the economic performance of regulated companies and competitiveness (Dechezleprêtre; Nachtigall;

Venmans, 2018; Jaraitè; Maria, 2016; Löschel; Lutz; Managi, 2019; Richter; Mundaca, 2013; Verde, 2020). However, one of the main short-term effects is the increase in prices. The burden of carbon pricing can be passed on to producers and consumers through higher prices, affecting lower income groups more. As for the impacts on jobs, the results of a model applied to China's ETS show an increase in the unemployment rate in the short term, but it tends to decrease, providing a transition of job vacancies from more carbon-intensive sectors to less intensive ones (Chen; Wang, 2023).

The socio-economic impact of any carbon pricing instrument is linked to how the revenues are allocated (Sager, 2019). **It is important to direct these revenues to promote tangible, widely distributed and easily recognized public benefits, adjusted to local needs** (Raymond, 2019). Except for EU ETS, only a few ETSs have implemented measures to support the most vulnerable households, partly due to the low levels of pricing in some of them (China, Colombia and South Africa). On the other hand, almost all of them include measures to mitigate the impact on companies (Shang *et al.*, 2023).

If done intelligently, recycling revenues can result in the reduction of both GHG emissions and social inequalities. Most studies on these impacts on the Brazilian ETS stress the importance of efficient allocation and proper use of revenues as a strategy to mitigate regressive effects on income and sustain

long-term economic benefits (World Bank, 2020a). This could include increasing investments to adopt more efficient and cleaner technologies, lowering taxes, transferring income to vulnerable families, increasing government investments, or even paying off government debt. As well as recycling revenues, increasing the investment rate as a proportion of GDP is a fundamental condition for achieving the benefits of pricing. In the case of Brazil, it is estimated that by 2030, low-carbon investments could add R\$ 2.8 trillion to GDP and create two million additional jobs compared to the current development model (Romeiro; Genin; Felin, 2021). On the other hand, the World Bank (2023d) estimated that investment needs for climate action represent approximately 1.2% of Brazil's GDP for the period 2022 to 2050, with around 0.8% of GDP between 2022 and 2030.

To meet the greater investment needs in a limited fiscal context and with pressure from an ageing population, it is essential to create an enabling environment (regulatory certainty and legal security) to attract private investment in resilient, low-carbon development (World Bank, 2023b).

Therefore, a carbon pricing policy should be treated as part of a broader fiscal reform, including the possibility of recycling carbon revenues. In addition to cost-effectiveness, well-targeted pricing can generate a "double dividend", i.e. **while reducing emissions, the regulated market can generate net macroeconomic benefits** when compared to a baseline sce-

nario (World Bank, 2020b). For this to happen, the revenues earned by the government through the auctioning of allowances, taxation on trading on the secondary market and, eventually, also from penalties imposed on agents, need to be returned to society (recycled).

Regarding the effectiveness of emissions trading in terms of reducing emissions, although it is difficult to determine what part of these results is attributable to the ETS without considering other factors such as technological innovations in production processes or the Covid-19 pandemic, a reduction of around 41% in emissions between 2005 and 2022 is identified for installations covered by the EU ETS; a relatively stable amount of emissions in New Zealand since 2015 with the ETS in force; and, in South Korea, a reduction only in the manufacturing and construction sectors and not in the energy sector (European Commission; ICAP, 2021).

15. These impacts are linked to the assumptions made in the reference scenario, making it inadvisable to directly compare the results of different models.

6. RECOMMENDATIONS

Based on the theoretical and empirical research conducted throughout the study and the trends highlighted in the key messages sections of each chapter, it is understood that there are several points of attention that the Brazilian government should consider in order to establish a carbon market in Brazil, as well as the private sector with regard to the impact of a national market and international border adjustment mechanisms. In this sense, the study presents recommendations with the potential to minimize negative impacts and boost the national market.

6.1. TO THE GOVERNMENT

The recommendations to the government are aimed at increasing the country's climate ambition, avoiding possible regressive effects on the most vulnerable populations and enabling a just transition to a low-carbon economy.

FOR THE IMPLEMENTATION OF THE BRAZILIAN ETS:

- 1. Ensure transparent and open consultation with the entities to be regulated and institutions with technical knowledge of carbon markets for the design of the rules of the Brazilian carbon market** during the process of drafting by the government.

- 2. Implement a regulated carbon pricing system (ETS) to ensure that the taxes imposed by EU CBAM are exempted or reduced for exported products**, which can safeguard competitiveness on the international market.

- 3. Define the institution that will be responsible for operationalizing the ETS**, whether it will be a ministry or an independent body to be created, as well as other institutions that could be involved in operationalizing the system, such as regulatory and implementing agencies.

- 4. Define the legal nature of the emissions allowances to be traded on the ETS** so that there is legal certainty and tax predictability for the regulated agents and other agents involved. This definition is fundamental in establishing the market regulator, which will deal with the technical and procedural issues related to the creation of this trading environment.

- 5. Establish phases for the implementation of the ETS** in order to:

5.1 Start implementation by regulating the oil and industry sectors and expand the number of regulated sectors. In order to increase the ambition to reduce emissions, distribute sectoral costs and mitigate the fall in the level of sectoral activity, the sectoral coverage of the market must be broader in the coming periods.

5.2 Gradually reduce the ETS cap in order to increase climate ambition and support the targeting of investments towards climate neutrality at the scale and pace required.

5.3 To initially include domestic offsets in the Brazilian ETS for project types that are eligible in order to reduce compliance costs for companies, encourage decarbonization in other sectors, thus minimizing the impact on emissions mitigation in regulated sectors.

5.4 Periodically reassess the impacts of the ETS in order to guarantee the effectiveness of the carbon pricing policy, taking into account the review of the system and when it will be done. If necessary, include more sectors, the reduction of the cap, greater restriction of the use of offsets and alteration of the use of revenue.

- 6. Reconcile free allocations and allocations through auctions:**

6.1 The adoption of the grandfathering criterion, to allocate 50% free of charge to all sectors with a competitive risk;

6.2 And a percentage of allocation through auctions designed to raise revenue that can boost emissions mitigation actions and minimize the socio-economic impacts of implementing the ETS, such as the increase in the price of inputs that must be passed on to the end consumer. The allowances sold in the auctions must have a minimum price so that the incentive to decarbonize is maintained.

- 7. Recycle any revenues effectively and fairly, in order to offset the negative distributive effect on the population's income and on sectors whose competitiveness will be affected by the pricing mechanism, and for investments in decarbonization or R&D projects.** The possible uses of the revenue should be studied, prioritizing, in the long term, increasing the incentive to adopt more efficient, clean and sustainable technologies, using robust targets and metrics for evaluating performance and effectiveness. Recycling revenue can help mitigate the increase in production costs and, consequently, consumer inflation. This allocation of resources should also help catalyze private investment.

- 8. Implement a system of stringent penalties to deter potential fraud**, considering that regulated entities will weigh the trade-off between paying fines or acquiring emission allowances.

- 9. Regarding the inclusion of compensation:**

9.1 Study the types of carbon projects eligible for inclusion as offsets in the regulated Brazilian carbon market, while considering the exclusion of project types that could oversaturate the market, jeopardizing allowance transactions and the effective reduction of emissions in the system.

9.2 Have as a criterion for the inclusion of compensation projects that benefit and count on the active participation of local communities - traditional, indigenous, rive-

rine and/or *quilombola* populations - including revenue sharing and income generation.

OTHER RECOMMENDATIONS TO THE GOVERNMENT:

1. **Implement, simultaneously with the adoption of carbon pricing, a robust MRV system for recording and monitoring mitigation results for compliance with the NDC and that integrates with other systems.** For example, public programs and policies linked to the progress of the different sectors in relation to the targets stipulated by the NDC, the ETS and the transactions to be carried out under Article 6, to provide data to guide the national strategy for action in carbon markets. This system, as well as being a prerequisite for the ETS to work, can prove the lower carbon intensity of its exported products compared to international competitors. This strategy would allow Brazil to better prepare itself to deal with the requirements imposed by EU CBAM.
2. **Supporting and directing the private sector in its decarbonization** so that Brazilian companies do not lose competitiveness internationally, since their competitors, who are currently under stricter regulations regarding the climate impact of their activities, are prioritizing this process. This can be done through sectoral trade associations, such as the State

Industry Federations and the Brazilian Banking Federation (FEBRABAN).

3. **Strive to fulfill the commitment to zero illegal deforestation and to reduce legal deforestation in the country**, given the representativeness of its emissions for the country and the non-inclusion of the forestry sector in the Brazilian ETS as a regulated sector. Furthermore, it is important to include among its actions the establishment of clear definitions so that the Federative Units (FUs) are able to carry out avoided deforestation projects at the jurisdictional level.
4. **Take a stand for the World Trade Organization (WTO) to guarantee clear rules regarding the equal measurement of the carbon intensity of products and their production processes, so that different production routes and the reality of each country are considered, as well as the electricity matrix.** This would protect national sectors from carbon leakage, provide better results for the footprint of exported products, and ensure Brazil's competitive advantage in terms of its cleaner electricity matrix;
5. **When discussing the methodology to calculate emissions according to the European Union's CBAM guidelines, it is essential to broaden the approach to include not only direct emissions, but also to consider car-**

bon removals from the sustainable implementation of forests. In the Brazilian context, where vertical companies use these forests responsibly in sectors such as charcoal-fired steel, pulp and paper, flooring and panels, it is crucial that the methodology recognizes this positive contribution to a more complete carbon balance. Therefore, it is recommended to consider the net balance between emissions and removals, promoting sustainable industrial practices and moving towards global carbon emission reduction targets.

6. **Support the debureaucratization and simplification of transaction processes, as well as implement digital technology for the MRV and carbon credit certification processes.**
7. **Enable a series of important institutional measures for the voluntary carbon market to facilitate the interaction of this market with the Brazilian and international regulated market within the scope of Article 6 and to support the use of carbon credits in the decarbonization process of Brazilian companies:**
 - 7.1. Define the legal nature of carbon credits and the roles of financial institutions and the carbon credit asset regulator. In addition, create a trading infrastructure, as well as bookkeeping and create identification codes for the credits.

7.2. Foster the development potential of the voluntary carbon market, considering that its projects can contribute to social equity and ecological balance generated by the protection of biodiversity, equitable access to sustainable development and the eradication of poverty and climate justice, in harmony with the Paris Agreement and the Climate Convention.

7.3. Strengthen the government's technical bodies on carbon projects, local community participation in these projects, REDD+ and Jurisdictional REDD+, for example.

8. **Given the planning for compliance with the NDC, establish the strategy for selling credits through Article 6 mechanisms**, considering the interaction between the regulated and voluntary markets in Brazil.

6.2. TO THE PRIVATE SECTOR

With the aim of strengthening national carbon markets and supporting companies exporting products potentially affected by border adjustment mechanisms and sectors to be regulated under the Brazilian ETS, the following recommendations have been drawn up.

1. **Prioritize decarbonization as an urgent strategy to be implemented, independently and in parallel with the process of creating a regulated market in Brazil**, with the aim of not losing competitiveness internationally, considering that its competitors are advancing on this agenda due to the more restrictive regulations to which they are subject.
2. **Draw up a greenhouse gas (GHG) inventory and calculate the carbon footprint of the products produced** as the first step in diagnosing companies' emissions profile. Calculations and monitoring must be continually improved.
3. **Expand the effort to reduce and remove GHG emissions by investing in technological development and innovation**, as advocated by initiatives such as the Science-Based Targets (SBTi), with a view to contributing to sustainable development and avoiding the loss of competitiveness of its products internationally with the implementation of EU CBAM and other border adjustment mechanisms that may arise.

4. **Strengthen the involvement of the financial sector to increase market liquidity and the possibilities of financing and financial mechanisms for decarbonization projects.** Pricing economically quantifies the advantage of reducing emissions and therefore contributes to assessing the credit risk of these projects. If emissions allowances can be used as collateral for financing, there is the possibility of reducing the cost of credit for decarbonization projects. Other financial mechanisms should be developed to reduce the cost of capital for regulated entities.
5. **Defend the reduction of legal deforestation and zero illegal deforestation** in the country and the expansion of reforestation considering its representativeness of the forestry sector's greenhouse gas emissions as a whole, since more and more trading partners are making demands in this regard.
6. **For those involved in the supply of carbon credits, with a view to including offsets in the regulated Brazilian market, invest in carbon projects that include the participation of and generate income for indigenous and traditional populations** directly affected by project activities, taking into account their historic contribution to environmental preservation and ensuring that they have economically viable alternatives for maintaining the forest and their culture.

The establishment of a regulated market in Brazil is urgent, given the climate crisis and the new dynamics of imports and exports that are emerging with border adjustment mechanisms. This market has the potential to put the country on a faster decarbonization path, consistent with the expectations of climate ambition. It is hoped that guidelines will soon be established to support its implementation and guide companies in the sectors to be regulated. In addition, at a national level, there are expectations of definitions that will support action in the voluntary market, favoring its growth and, at an international level, updates are awaited on the operation of Article 6 mechanisms. Thus, considering the changes in the dynamics of carbon markets in Brazil that are currently taking place, it is recommended that studies in the area of carbon markets continue to be developed with the aim of fostering and communicating their evolution.

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