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# Net Zero Political Economy Briefs

Brazil case-study

Full report

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## About this study

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## Table of contents

Summary on the national political economy context of net zero in Brazil .....	3
1 Introduction .....	3
1.1 Background and objectives .....	3
1.2 National and local commitments towards NZE .....	4
1.3 Analytical framework .....	5
1.4 Data and methods .....	6
2 Literature review .....	6
2.1 Land use, land use change and forestry (LULUCF) .....	6
2.2 Energy (transport) sector .....	8
2.3 Agricultural sector .....	10
2.4 Industrial processes .....	12
2.5 Waste management .....	13
3 Results .....	15
3.1 Land use change and forestry (LULUCF) .....	15
3.2 Energy (transport) sector .....	17
3.3 Agricultural sector .....	20
3.4 Industrial processes .....	22
3.5 Waste management .....	24
4 Discussion and recommendations .....	26
5 Concluding remarks .....	30
References .....	31
Annex 1: Interview questionnaire .....	37
Annex 2: Guidelines for a National Strategy on Climate Neutrality .....	38



## Summary on the national political economy context of net zero in Brazil

The transition towards a net zero economy in Brazil offers an opportunity, even a necessity, to focus on engaging actors at the local level (rather than national) and find groups willing to defend certain policies. For that, a broader perspective is required, persistently concerned with processes that lead to structural changes, e.g., in the incentives faced by local communities, agricultural producers, logistics' companies etc. (instead of the short-term implementation of narrowly focused measures). In particular, given the country's emissions profile, climate and deforestation policies need to be: i) better framed; ii) consistent with national development, income generation and jobs creation.

### 1 Introduction

#### 1.1 Background and objectives

In 2009, Brazil adopted its National Policy on Climate Change (PNMC), which encompassed a voluntary greenhouse gas (GHG) emissions reduction target between 36.8% and 38.9% for the year 2020, when compared with projected emissions for that same year. Although important emissions reduction results were obtained, mainly focused on reducing illegal deforestation in the Amazon Region in the years 2005-2012, the increase in deforestation rates in the years 2015-2020 resulted in Brazil just barely achieving the lower limit of its voluntary commitment at the end of 2020 (SEEG, 2021).

Although the PNMC target was narrowly reached, even though based on conservative assumptions, one could argue that the period 2009-2020 was important for the country to create the institutional bases for climate change policies to come, as well as to raise awareness and to engage the private sector in addressing climate change-related risks.

On December 9<sup>th</sup> 2020, Brazil's Ministry of Foreign Affairs submitted an updated version of the country's NDC, listing as its goals "to reduce greenhouse gas emissions by 37% below 2005 levels in 2025, and by 43% below 2005 levels in 2030", as well as indicating a long-term objective of achieving carbon neutrality in 2060, and considering a more ambitious objective ("for instance, the year 2050") conditional on the proper functioning of market mechanisms under the Paris Agreement (Brazil, 2020a).

At COP-26, these targets were revised and made more ambitious in order to reduce emissions by 50% in 2030; become climate neutral by 2050; and end illegal deforestation by 2028; among other commitments (MMA, 2021c). These new targets were then confirmed in a second update to Brazil's NDC, submitted in March 2022 (Brazil, 2022a). In addition, with the publication of the country's 4<sup>th</sup> National Communication to the UNFCCC, the absolute levels of emissions to be achieved in 2025 and 2030 were revised downwards<sup>1</sup>.

On October 25<sup>th</sup> 2021, the federal government created the National Green Growth Program, to be coordinated by the Interministerial Committee on Climate Change and Green Growth, with the objective of conferring greater transversality to this agenda, shared by eleven ministries (MMA, 2021b). The Committee's first meeting was held in February 2022 and discussed updates

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<sup>1</sup> In comparison with the levels established in accordance with Brazil's 3<sup>rd</sup> National Communication to the UNFCCC, since the emissions from the base year of 2005 were revised. The updated version of the NDC, however, still delivers higher total emissions than initially proposed in Brazil's 2015 NDC, which used the 2<sup>nd</sup> National Communication to the UNFCCC as its basis (OC, 2022).

to the PNMC (Casa Civil, 2022). Also, in May 2022, Presidential Decree 11,075/2022 was issued, establishing the procedures for the development of Sectoral Plans for Climate Change Mitigation, to be presented within 360 days, and creating a National System for GHG Reduction, which seeks to centralize all information about GHG emissions, reductions, removals, and compensations in a single registry (Brazil, 2022b).

Finally, 2022 is an election year in Brazil, with Brazilians voting to elect new president, state governors and members of Congress. It is within this context that this policy brief seeks to identify windows of opportunity for international cooperation as well as near-term actions consistent with long-term net zero pathways in the country, in particular in its most relevant economic sectors for climate change mitigation.

## 1.2 National and local commitments towards NZE

In terms of net zero targets, Brazil has adopted a formal commitment to achieve carbon neutrality by 2050 (Brazil, 2022a). Nevertheless, no specific policies or measures have been put in place to pursue this long-term goal. According to the Ministry of the Environment's Guidelines for a National Strategy on Climate Neutrality (MMA, 2021a), to reach the 2050 goal, the country intends to follow/achieve sectoral measures/targets (see **Annex 2**), primarily, in the following sectors: i) Forestry; ii) Energy; iii) Agriculture and livestock; iv) Industry; and v) Waste management.

The Brazilian federal government acknowledges that international financial resources will be needed, to complement national funds, in order to promote sustainable projects, programs and initiatives. The Interministerial Committee on Climate Change and Green Growth is responsible for securing these funds, for instance, via international cooperation endeavors. Cooperation areas of particular interest are those related to technology transfer in water desalination and ultra-efficient irrigation systems (MMA, 2021a).

In addition to the efforts and targets at the national level, the states of Acre, Amapá, Amazonas, Mato Grosso, Pernambuco, Rondônia, São Paulo and Tocantins (out of 27 states) have committed to reducing their GHG emissions and becoming net zero by 2050, as signatories of UNFCCC's Race to Zero Campaign (Climate Group, 2022).

Finally, there is also an increase in companies committing to Science-Based Targets (SBT) and/or net zero targets. Between September 28<sup>th</sup> and October 27<sup>th</sup> 2021, 20 different companies, which considered climate neutrality an important topic, responded to a survey conducted by FGV's Centre for Sustainability Studies. The following are some of the survey's main findings:

- Nine of the 20 respondents have a carbon neutrality target or commitment, four of which have publicly disclosed them;
- The main challenges to set a target mentioned by respondents include the need for investments and setting a target for indirect (GHG Protocol Scope 3) emissions;
- Companies are involved in private sector working groups to discuss climate neutrality, whereas less debate takes place with the public sector (Marquard, et al., 2022).

Also, in June 2021, 192 companies, all of which are members of the Brazilian GHG Protocol Program, were asked by means of a survey if they had adopted (or had plans to adopt) mitigation commitments. They were also asked what were the main topics of discussions ("hot issues") within the private sector when it came to climate change mitigation. Their answers were:

- 59% of the companies that responded (89 organizations) have mitigation commitments. 35% intend to adopt mitigation commitments in the near future.
- In terms of “hot issues”, the top 2 most mentioned by organizations were: “climate neutrality (27%) and “science-based targets” (18%) (PBGHG, 2021).

Overall, discussions about climate neutrality seem to be gaining momentum in Brazil, with national and subnational governments, as well as corporations, assuming net zero targets. Still, the programs, initiatives and investments necessary to fulfill these commitments appear to be at initial stages of development, for instance, via the realization of new studies and mapping out of existing solutions.

### 1.3 Analytical framework

This report uses Kingdon’s Multiple Streams Framework (MSF) as its analytical framework. The choice of such framework was based on the following reasons:

- i. The objective of this report: to identify windows of opportunity for near-term actions for climate neutrality in Brazil;
- ii. The prominent of the public sector in the economic sectors most responsible for GHG emissions in the country (see **Section 2**);
- iii. The need for any international cooperation projects to be approved by the Brazilian Cooperation Agency (autarchy under Brazil’s Ministry of Foreign Affairs) (ABC, 2020);
- iv. The analysts’ familiarity with the framework and the methods employed in its application; and
- v. The relevance of the framework, with over 12,000 citations since its original publication (Cairney & Jones, 2016).

Even though the framework was originally conceived to understand how certain topics rise in the governmental agenda, its use in the present report is justified given the not-for-profit character of (most) international cooperation projects, such as the harmonization of national policies or agreements over desired ends (Chan, Stavins, & Ji, 2018), as well as the understanding that any efforts aligned with governmental priorities are more likely to: i) be approved and; ii) succeed.

In the MSF, changes in the governmental agenda are explained by the coming together of three separate streams:

- **Problem stream:** where issues start to be recognized as problems that require solving, for instance, due to crisis (e.g., disasters); compelling indicators (e.g., mortality rates); and feedback from existing programs and policies;
- **Policy stream:** where alternatives (i.e., public policy proposals) are presented, discussed, reviewed and amended. Due to technical, budgetary and political concerns, only a few proposals survive and seriously taken into consideration by policy experts;
- **Political stream:** where bargaining processes take place in order to craft winning coalitions. Events in this stream are affected by interest groups carrying out public campaigns or elections (or other events) taking place and changing the configuration of the government. Shifts in the national mood are also relevant (Kingdon, 2014).

Within this framework, policy change has a greater likelihood of happening when these three streams are joined, given that there is: i) a clear problem; ii) a solution available; and iii) a favorable political environment. In those instances, a “window of opportunity” opens and actors (dubbed “policy entrepreneurs” in the MSF) may be able to shift the general attention towards certain problems or promote their preferred solutions (Kingdon, 2014).

Once such a window opens, it helps to establish the priority assigned to several items requiring governmental consideration. The decision agenda<sup>2</sup>, thus, is affected by the rising of a given proposal for legal enactment, legislative approval or presidential decision; the window may close if no alternatives are available (or appear to be viable) (Kingdon, 2014).

While a thorough description of the MSF is beyond the scope of the present report, the interested reader may refer to the original or more recent reviews, such as the one published by Cairney & Jones (2016).

## 1.4 Data and methods

The employment of MSF’s concepts adopts a qualitative approach, based on an initial literature review (**Section 2**), followed by semi-structured interviews (see **Annex 1**, results in **Section 3**)<sup>3</sup>. Interviewees were identified according to their expertise within (at least) one of the economic sectors of interest and their placement closer to the MSF’s policy stream. In this sense, preference was given to academics, researchers and consultants. 13 interviews were conducted, ranging from 36 min (shortest) to 67 min (longest). Whenever possible, interviewees discussed more than one sector. All interviews were recorded and coded. Items were classified into two categories:

- i. **Very or somewhat prominent:** if spontaneously mentioned during the interview; and
- ii. **Prompted, little, or no prominence:** if mentioned in response to a direct question or if never mentioned in the interview (Kingdon, 2014).

In order to aggregate the results from the various interviews, a given topic was deemed very or somewhat prominent if at least 50% of interviewees mentioned it spontaneously (within the context of a specific sector).

## 2 Literature review

### 2.1 Land use, land use change and forestry (LULUCF)

Over 60% of Brazil’s territory is covered by native forests (Rajão & Filho, 2015). Land use change accounted for 46% of Brazil’s GHG emissions in 2020, an increase in absolute<sup>4</sup> and relative terms with regards to 2019 (41% then), mostly due to greater levels of deforestation in the Amazon and Cerrado biomes. Indeed, 78.4% of LULUCF emissions come from deforestation in the Amazon rainforest (SEEG, 2021), over 98% of which happens illegally (MapBiomas, 2021).

<sup>2</sup> “The list of subjects within the governmental agenda that are up for an active decision” (Kingdon, 2014, p. 4).

<sup>3</sup> Interviews were conducted before the enactment of Presidential Decree 11,075/2022.

<sup>4</sup> Land use change emissions grew 23.7% between 2019 and 2020 (SEEG, 2021).

According to INPE, the Brazilian National Institute for Space Research<sup>5</sup>, monitoring by means of satellite images show that the deforestation rates in the Amazon Forest have increased 22% between 2020 and 2021 and 75% between 2018 and 2021 (INPE, 2022).

The main policy instrument is the country's new Forest Code (Law 12,651/2012), which establishes a limit of 20% of a farm's total that could be deforested in the Amazon biome<sup>6</sup>, whilst granting amnesty to those properties that had illegally deforested larger portions of their area prior to 2008<sup>7</sup>. In order to monitor compliance, the Law lists as one of its main instruments the Environmental Rural Registry (CAR<sup>8</sup>):

[...] national electronic public record, mandatory for all rural properties, with the purpose of integrating environmental information from rural properties and possessions [...] composing a database for controlling, monitoring, environmental and economic planning and combating deforestation (CAR, 2022).

Another instrument in Law 12,651/2012, only regulated in 2018 via Presidential Decree (Nº 9,640/2018), is the Environmental Reserve Quota (CRA<sup>9</sup>), which allow for a rural property to offset their share of legally required forest reserves by purchasing titles equivalent to the surplus area in other farms, within the same biome (Brazil, 2012). Given that the costs to conserve native forests are smaller than those to regenerate and restore deforested areas, such a market could compensate 74% (or 14Mha) of the deficit in legally required forest reserves in the entire country (Rajão & Filho, 2015). Currently, one of the most relevant platforms for trading CRA registers over 4.1 Mha in available quotas for sale (nearly 80% in the Amazon biome) (BVRio, 2022).

Still, land tenure problems emerge as one of the difficulties in enforcing the law. Land property rights in the Amazon region are weak and uncertain, for instance, Mastrangelo & Maia (2021) report that, between 2009 and 2018, almost 30% of deforestation in the state of Acre took place within areas with overlapping land rights, i.e., with multiple claims to the same land. Indeed, in that state, only 10.6% of the farms had no overlap of boundaries with other properties.

The Action Plans for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) and Forest Fires in Cerrado (PPCerrado), the main public strategies to address the problem since 2004, were discontinued in 2019 (SEEG, 2021) and substituted by an Executive Commission for Control of Illegal Deforestation and Recovery of Native Vegetation (CONAVEG) (Brazil, 2019).

Similarly, the Amazon Fund, results-based mechanism created in 2008 by an agreement between the governments of Brazil and Norway, which had disbursed R\$ 1.8 billion since its inception towards projects that combat deforestation, was halted and no new projects were approved since 2019 (Yamahaki, Breviglieri, & Vendramini, 2020).

With regard to the actions aimed at the Amazon region, CONAVEG works jointly with the National Council of the Legal Amazon (CNAL), which is chaired by the vice-president of the Republic (Brazil, 2021). Within this new governance, some recent efforts were put in place to revert the growing deforestation trends, such as:

<sup>5</sup> Instituto Nacional de Pesquisas Espaciais, in Portuguese.

<sup>6</sup> These shares are 65% for the Cerrado biome (within the Legal Amazon region) and 80% in other biomes and areas (Brazil, 2012).

<sup>7</sup> These producers could offset their deforestation in other properties, via purchase of Environmental Reserve Quotas (Rajão & Filho, 2015).

<sup>8</sup> Cadastro Ambiental Rural, in Portuguese.

<sup>9</sup> Cota de Reserva Ambiental, in Portuguese.

- **Operations “Verde Brasil 1 & 2” and Operation “Samaúma”:** Law and Order Guarantee Operations (GLO<sup>10</sup>), which deployed military personnel to combat environmental crimes and forest fires in the Amazon region. The operations started in May 2020 and ended in August 2021<sup>11</sup> and apprehended boats, tractors, fuel, guns, mining and logging equipment as well as timber, resulting in more than 5,600 fines and 330 arrests (Ministério da Defesa, 2021; Presidência da República, 2021).
- **Floresta+ Program:** created by the Ministry of the Environment “to consolidate the Market for environmental services”, is targeted at small landowners, indigenous communities and others who maintain and increase carbon stocks (among other eligible benefits), with monetary and non-monetary resources originating from international cooperation or from the private sector (MMA, 2020). Its application in the Amazon shall take place between 2021 and 2026 and has raised US\$ 96 million from the Green Climate Fund (GCF) (Projeto Floresta+ Amazônia, 2022).
- **Adopt-a-Park:** program created in order to raise funds to support the conservation of Brazil’s National Parks. Partners (individuals, businesses, cooperatives etc.) donate the money directly to the conservation units. Donations have a minimum value of R\$ 50 (or € 10) per hectare per year. 132 parks were made available in the first phase of the program (totaling 64Mha), with only eight being adopted until August 2021 (totaling 121 thousand ha) (ICMBio, 2021).

In summary, governance around land-use change, particularly concerning deforestation, has suffered a series of changes in recent years, while the country still experiences high (and recently growing) levels of illegal deforestation, its greatest source of GHG emissions.

## 2.2 Energy (transport) sector

The energy sector was responsible for 18% of Brazil’s total emissions in 2020, of which 47% originated in the transport sector; the second largest source within the energy sector was the production of fuels (responsible for nearly 15% of the total)<sup>12</sup> (SEEG, 2021). This pattern is partially explained by the fact that Brazilian freight logistics is heavily reliant on road transport: 65% of all cargo is moved by trucks; 15% by rail; 11% by maritime cabotage; and 5% via inland waterways (Ministério dos Transportes, 2018). Indeed, CO<sub>2</sub> emissions (g/ton/km) are substantially larger for road transport (101.2 for roads, 23.3 for rail, and 20 for cabotage) (CNT, 2019).

In order to alter this scenario and achieve a more balanced transport mix, as well as reduce carbon emissions, the following policies have been enacted:

- **RenovaBio (National Biofuel Policy), 2017:** seeks to contribute to Brazil’s commitments under the Paris Agreement by increasing the share of biofuels in the country’s energy mix, by setting decarbonization targets for the fuel sector. Fuel distributors must prove compliance with mandatory individual targets through the purchase of Decarbonization Credits (CBIO, in Portuguese) (ANP, 2022);

<sup>10</sup> Garantia da Lei e da Ordem, In Portuguese.

<sup>11</sup> With a brief interval between April and June 2021.

<sup>12</sup> Electricity generation accounted for 11.7% of all energy emissions, mostly due to Brazil’s extensive use of hydroelectricity (SEEG, 2021).

- **New Legal Framework for Railways, 2021:** seeks to facilitate private investment in the construction of railways, specially, by allowing for new projects to be proposed via authorization (rather than public concession). Since its enactment, the policy attracted 79 proposals (of which 27 already signed), amounting to more than 20 thousand new kilometers of railways (Casa Civil, 2022);
- **“Road of the Sea”<sup>13</sup> (Cabotage Transport Stimulus Program), 2022:** program that aims at increasing the use of cabotage between Brazilian ports, by making it easier for Brazilian navigation companies to charter foreign vessels (crewed or bareboat), and increasing the possible uses of the Merchant Marine Fund, the main source of financing available for national navigation companies (Ministério da Infraestrutura, 2022).
- **“Route 2030”, 2018:** program that seeks to establish mandatory criteria for the sale of new vehicles in the country, such as energy efficiency targets and adherence to labeling schemes. Also confers fiscal benefits to those companies that invest in R&D services (Ministério da Economia, 2022).

The transport and logistics sector in Brazil would require investments of approximately 2.26% of GDP in order for the country to overcome its infrastructure bottlenecks, according to the Brazilian Association of Infrastructure and Basic Industries (ABDIB). However, in 2019, the actual figure was only 0.34% of GDP, insufficient even to cover the depreciation of existing assets (ABDIB, 2020).

The state-controlled Brazilian Development Bank (BNDES) and Caixa Econômica Federal were the most important sources of finance for transport infrastructure, responding for nearly half of all investments in the area in 2014. However, the country’s fragile fiscal situation has resulted in a greater need for private investments in infrastructure (CNI, 2017). Two initiatives that seek to respond to this need are:

- **Incentivized (Infrastructure) Debentures:** enacted in 2011, series of debentures that can be issued by companies or special-purpose vehicles (SPV) to fund priority infrastructure projects, as stipulated by the federal government, which offer income tax exemptions for retail investors (ANBIMA, 2018).
- **Investment Partnership Program (PPI):** launched in 2016 in order to expand and develop infrastructure projects via privatization and partnership contracts with the private sector (PPI, 2022). Projects that belong to PPI are automatically eligible to issue Incentivized Debentures (ANBIMA, 2018).

As a result, in the 2010s, the private sector accounted for approximately 60% of all infrastructure investments (reaching 72% of the total in 2019) (ABDIB, 2020). Indeed, the volume of funds disbursed from Incentivized Debentures alone (R\$ 29.8 billion) exceeded the one stemming from BNDES (R\$ 20.5 billion) in 2021<sup>14</sup>. The transport sector raised nearly R\$ 40 billion in Incentivized Debentures since 2012 (Ministério da Economia, 2022).

In summary, two possible avenues appear to be present in order to reduce GHG emissions in the transport sector: i) increased use of biofuels (especially for road transport); and ii) shift of cargo from road to other means of transportation, such as railways and maritime cabotage.

<sup>13</sup> “BR do Mar”, in portuguese.

<sup>14</sup> Between January and September.



## 2.3 Agricultural sector

The agricultural sector was responsible for 27% of Brazil’s total emissions in 2020, of which 75% are associated with cattle raising activities, while 5.2% came from fertilizer use (SEEG, 2021). In terms of value added, when taking consideration of the agribusiness sector as a whole<sup>15</sup>, the sector was responsible for 27.4% of the country’s gross domestic product (GDP), of which 20.4% form agriculture and 7.0% from cattle raising (Cepea, 2022).

The most relevant policy in place to reduce GHG emissions from this sector is the “Plan for adaptation and low carbon emission in agriculture” (or simply ABC+). The plan, first developed in 2012 as part of PNMC (MAPA, 2020), is now in its second phase, which runs from 2020 until 2030, and seeks to promote the adoption of sustainable and resilient production systems in the country, based on three main pillars:

- **Integrated Landscape Approach (ILA):** seeks to take into consideration the different elements of rural landscapes, for instance, recognizing the value of native landscapes.
- **Synergy of adaptation and mitigation strategies:** recognizes the urgency of reducing the vulnerability and enhancing the resilience of farming systems.
- **Foster adoption and maintenance of Sustainable Systems, Practices, Products and Production Processes:** seeks to promote the use of conservationist farming practices, such as the reduction or suppression of soil mobilization (MAPA, 2021a).

The plan has the goal to reduce GHG emissions by 1.1 billion tons, in the agricultural sector, by 2030. In order to do so, it aims at expanding the area with ABC+ technologies (**Table 1**) to a total of 72 million hectares (MAPA, 2021b).

Table 1 – ABC+ technologies and targets (by 2030)

<b>Restore degraded pastures</b> 30 MM ha	<b>Areas planted with no-tillage system</b> Increase by 12.5 MM ha	<b>Areas with Livestock-Agriculture Integration</b> Increase by 10 MM ha
<b>Areas planted using agroforestry systems</b> Increase by 100 M ha	<b>Areas with planted forests</b> Increase by 4 MM ha	<b>Areas with bio-inputs (incl. Biological Nitrogen Fixation)</b> Increase by 13 MM ha
<b>Areas with irrigated systems</b> Increase by 3 MM ha	<b>Waste treatment from animal production</b> Increase by 208 MM m <sup>3</sup>	<b>Intensive termination</b> 5 MM animals (cattle heads)

Source: (MMA, 2021a)

Obs.: M = thousand; MM = million; ha = hectare.

With regard to livestock, two ABC+ technologies are especially relevant: restore degraded pastures and livestock-agriculture integration<sup>16</sup>. Over 167 MM ha are dedicated to pastures in Brazil, 42% of which are moderately or severely degraded and, thus, prone to loss of vegetal coverage and with reduced levels of organic matter in the soil, resulting in carbon emissions. Moreover, greater availability of nutrients in the pastures improve animals’ diet and can reduce the time of slaughter (and, consequently, CH<sub>4</sub> emissions). Similarly, the periodic rotation of

<sup>15</sup> In contrast with accounting only for the production within the farms’ gates (Cepea, 2022).

<sup>16</sup> Intensive termination can be associated with early slaughter of cattle and, in this case, also result in GHG emissions reduction (Observatório de Bioeconomia, 2021).

livestock, farming and forest in a given area also increases productivity and can even act as carbon sinks (Observatório de Bioeconomia, 2021).

In order to finance the adoption of low carbon technologies, ABC+ has a credit line (ABC Program), which since 2010/11 disbursed over R\$ 20 billion in loans (MAPA, 2021c), via the state-owned banks BNDES<sup>17</sup>, Bank of Brazil and BASA<sup>18</sup>. Funds for the ABC Program come from the National Treasury, as part of the annual Harvest Plan<sup>19</sup>. For instance, for the harvest 2021/2022, R\$ 251.2 billion were allocated to rural credit by the federal government, of which R\$ 5.05 billion for the ABC Program (MAPA, 2021d).

However, the program targets smaller producers, with a maximum value of the loans capped at R\$ 5 million per year per producer (with the average contract in 2018/2019 being R\$ 520 thousand) (Observatório ABC, 2019). Larger producers, therefore, tend to rely on other sources of finance, with an increasing participation of trading and input companies and commercial banks (WWF, 2017), via vehicles such as:

- **Agribusiness Letters of Credit (LCA)**<sup>20</sup>: security issued by a financial institution, pegged with receivables linked to rural producers; exempt from income taxes (for retail investors) (B3, 2022). Total stock in 31/12/2021 amounted to nearly R\$ 180 billion (Cetip, 2022).
- **Agribusiness Receivables Certificates (CRAs)**<sup>21</sup>: fixed-income product, alternative method of financing for rural producers through the securities distribution system; exempt from income taxes (for retail investors) and sellable in secondary-markets (WWF, 2017). Total stock in 31/12/2021 amounted to nearly R\$ 67 billion (Cetip, 2022).

More recently, some CRAs have been directed to low-carbon agricultural (and other sustainable) practices and issued as a Green Bond (deemed as Green CRAs). Indeed, since 2015, 199 Green Bonds were issued by Brazilian companies, 24 of which in the form of CRAs, amounting to approximately R\$ 6 billion (Sitawi, 2022). Thus, there are sources available for producers, both small and large, to fund their adoption of less emitting technologies and practices, even though at a fraction of traditional financing sources.

In spite of the policies put in place by the ABC Plan since 2012 (and ABC+ more recently), GHG emissions associated with the agricultural sector have increased 0.7% per year on average between 2012-2020 (SEEG, 2021), although production grew at an even faster pace during the same period (almost 3% per year, on average) (Cepea, 2022).

In summary, while the agricultural sector has a specific policy to promote good practices that reduce GHG emissions (ABC+), it has a narrow scope targeted at smaller producers. Larger producers may be incentivized to switch technologies via signals stemming from financial markets. As an activity, emissions reduction in the sector should focus more heavily on cattle raising.

<sup>17</sup> National Bank for Economic and Social Development (Banco Nacional de Desenvolvimento Econômico e Social, in Portuguese).

<sup>18</sup> Banco da Amazônia S.A.

<sup>19</sup> Plano Safra, in Portuguese.

<sup>20</sup> Letra de Crédito do Agronegócio, in Portuguese.

<sup>21</sup> Certificados de Recebíveis do Agronegócio, in Portuguese.

## 2.4 Industrial processes

Industrial processes were responsible for emitting nearly 100 MTCO<sub>2</sub>e in 2020 (4.6% of the country's total), a similar figure to the ones observed in the previous decade, of which 38.8% from the production of iron and steel and another 22% from cement manufacturing. When including emissions associated with the sector's energy use, the volume of total emissions rises to 155 MTCO<sub>2</sub>e (SEEG, 2021). This sector responds for 11.3% of Brazil's GDP and employs 14.8% of all formalized labor in the country (CNI, 2022).

With regard to cement production, the country produces over 60MT of cement per year, in 91 industrial units<sup>22</sup>. Between 1990 and 2019, the use of alternative fuels grew 520%, reaching 31% of the sectors' energy mix and the ratio of clinker/cement declined from 80% to 67%. Therefore, CO<sub>2</sub> emissions per ton of cement declined 19% in the same period. Indeed, the increased use of additions, alternative raw materials (such as steel slag and fly ash) and alternative fuels (such as urban solid residues) represent 80% of the sector's potential to reduce its emissions in the short term (SNIC, 2021).

To this point, Ordinance 499/2020 from the National Environment Council (CONAMA)<sup>23</sup> allowed for the co-processing of materials and waste in rotary kilns for clinker production provided that they are previously subjected to screening, classification or treatment and if they lead to environmental gains, such as the reduction of GHG emissions (CONAMA, 2020).

In 2020, Brazil produced 50MT of iron and 31.4 MT of steel in 31 industrial units, administered by 12 business groups; the country is 12<sup>th</sup> largest exporter of steel products globally (iABR, 2021). The most relevant sources of emissions in the sector, per technological route, are:

- **Integrated route:** reduction of iron ore in blast furnaces, which uses coal as fuel and reducing agent and accounts for nearly 70% of GHG emissions;
- **Semi-integrated route:** based on recycling of scrap metal, with 45% of GHG emissions stemming from the energy consumption in electric arc furnaces (CNI, 2018).

Climate change mitigation in this sector, then, is associated with the substitution of inputs and fuels, such as the use of charcoal as a bio reducer (in the short term) and greater use of scrap metal and natural gas (in the medium term). Medium term alternatives would require an increase in the supply and logistical improvements of/for these inputs in order to be viable opportunities (iABR, 2021).

More generally, one of the most important discussions regarding climate change mitigation and the industry sector in Brazil revolves around the adoption of carbon pricing instruments within Brazil's PNMC. In this sense, Draft Bill 528/2021<sup>24</sup>, which seeks to create a (mandatory) Brazilian Emissions Trading System as well as incentivize and support the voluntary market for carbon credits, gave rise to discussions by sectoral associations and relevant stakeholders, such as:

- **National Confederation of Industry:** defended that the private sector should be part of the system's governance; revenues should be reinvested in low-carbon technologies; offsets should be allowed and advocate for integration with other initiatives, such as RenovaBio (see **Section 2.2**);

<sup>22</sup> Exports and imports amount to less than 0.5% of all cement production and consumption in Brazil (SNIC, 2021).

<sup>23</sup> Conselho Nacional do Meio Ambiente, in Portuguese.

<sup>24</sup> Attached to Draft Bill 2,148/2015, regarding the creation of the Brazilian Emission Trading System (SBCE) and Registry Systems.

- **Brazil Steel Institute (iABR):** understands that a national carbon market is the best option to divert investments towards technologies that reduce GHG emissions. According to their view, this mechanism should include all economic activities in order for the country to reach its NDC targets (iABR, 2021).
- **National Cement Industry Union (SNIC):** positioned themselves in favor of a cap-and-trade systems (in opposition of a carbon tax); defended that all carbon-intensive sectors be included in the system, which should be implemented gradually (SNIC & ABCP, 2020).

Concerning the use of climate finance, 15 issuances of green and sustainability-linked bonds can be tied to Brazilian industrial groups, although only three with the use of proceeds specifically targeting ecoefficiency or renewable energy<sup>25</sup> (Sitawi, 2022). In summary, the two industrial segments that account for most of the sector's emissions have already mapped short-term opportunities to reduce emissions, which could be further fostered in the presence of a domestic cap-and-trade system.

## 2.5 Waste management

Waste management emitted 92 MTCO<sub>2</sub>e in 2020 (4.2% of the country's total), of which nearly two-thirds associated with the disposal of solid residues in landfills and open-air dumps<sup>26</sup> (SEEG, 2021). In 2020, Brazilians generated 82.5 million tons of solid urban residues (RSU<sup>27</sup>), an average of 390 kg/person/year, of which 92.2% were collected by municipal cleaning services<sup>28</sup> and only 3% were recycled (Abrelpe, 2021; Instituto Estre, 2019).

Of all RSU collected, 60% were sent to (sanitary) landfills, whereas the remaining 40% were inadequately destined to open-air dumps and improper landfills; although these shares vary greatly within the country, with over 73.4% of all RSU in the Southeast being properly disposed, against only 35.6% in the Northern region. In total, R\$ 27.3 billion were spent on waste management services in the country in 2020 (Abrelpe, 2021).

The main policy governing these activities is the National Solid Waste Policy (PNRS, Law 12,305/2020<sup>29</sup>), approved after 20 years of congressional debates (Instituto Estre, 2019), which lists as its goals/instruments (among others):

- **Elimination of all open-air dumps:** targets to eliminate and recover existing dumps shall be included in the National and States' Solid Waste Plans, to be updated every four years (Brazil, 2010).
- **Incentive for the development of waste pickers associations and cooperatives:** due to the recognition of the "social value" of solid residues, as source of income and promoter of social inclusion and citizenry (Brazil, 2010).
- **Creation of Intermunicipal Public Consortia:** alternative for smaller municipalities to jointly share the costs of a (sanitary) landfill or other solutions to dispose waste, in order to overcome financial and logistical limitations (Brazil, 2010; Instituto Estre, 2019).

<sup>25</sup> These issuances were made by companies in the aluminum and pulp and paper industries (Sitawi, 2022).

<sup>26</sup> Open-air dumps ("lixões", in Portuguese) are waste disposal sites that do not contain any leachate and Biogas collection and treatment systems nor controls for the quantity and characteristics of the residues being disposed (Instituto Estre, 2019).

<sup>27</sup> Resíduos Sólidos Urbanos, in Portuguese.

<sup>28</sup> In the country's North and Northeastern regions that figure lies closer to 80% (Abrelpe, 2021).

<sup>29</sup> Regulated further via Decree 10,936/2022.

- **Implementation of selective collection and reverse logistics:** based on a principle of “shared responsibility” between government, businesses, waste pickers’ associations and the general public; put in place via sectoral agreements;
- **Encouraging the development of environmental and business management systems:** aimed at improving production processes and reusing solid waste, including energy recovery and use (Brazil, 2010).

In order to eliminate existing dumps, the Ministry of the Environment created the “Zero Dumps National Program”<sup>30</sup> in 2019, which lists 12 actions to help implement the PNRS, mostly by assisting municipalities, for instance, via public notice for municipal projects (MMA, 2019). Since then, 645 dumps were closed in the country (equivalent to 20% of all dumps) (Government of Brazil, 2022).

With regard to reverse logistics, 12 sectoral agreements have already been signed<sup>31</sup>, for example:

- **Agricultural pesticide and herbicide packages:** managed by inpEV<sup>32</sup>, 94% of all primary packaging for pesticide and herbicide packages are collected and processed either via recycling (93.1%) or incineration (6.9%) within 411 processing units (Abrelpe, 2021);
- **Packages in General:** managed by the “Packaging Coalition”<sup>33</sup>, between 2015 and 2017 implemented 2,082 voluntary delivery stations, supported 802 waste pickers’ organizations, and, as a result, reduced by 21.3% the volume of packages sent to landfills (Coalizão Embalagens, 2017).

Although the PNRS and other public policies mentioned above are of immense value for public health and social well-being in Brazil, they do not directly target GHG emission reduction. When focusing specifically on opportunities to reduce emissions in this sector, one of the main measures lies in the capture and use of biogas from landfills, either to burn on flares or for energy purposes. Between 2003 and 2020, 49 Clean Development Mechanism (CDM) projects were developed with the goal of capturing and reusing biogas from methane in Brazilian landfills (SEEG, 2021).

More recently, the Ministry of the Environment launched the “Zero Methane National Program” as a consequence of Brazil joining the global effort to reduce CH<sub>4</sub> emissions by 30% until 2030<sup>34</sup>. The program seeks to set aside credit lines for financing the development of the necessary infrastructure to increase the energetic use of biomethane and biogas (MMA, 2022).

Although the use of biogas for energy generation in Brazil is very limited at present, it has great potential. Considering Brazil’s residue generation, biogas could supply 35% of the Country’s electricity needs; it could replace 70% of Brazil’s diesel consumption and it could provide 4.5 times the national demand for Liquefied petroleum gas (LPG) (ABiogás, 2022).

The incineration of residues, another alternative to reduce emissions, is still limited in Brazil and mostly employed for those residues from health services<sup>35</sup> (SEEG, 2021). However, in 2019, the Ministries of Environment, Mines and Energy and Regional Development published a joint

<sup>30</sup> “Lixão Zero”, in Portuguese.

<sup>31</sup> Available at: <https://sinir.gov.br/logistica-reversa> (in Portuguese).

<sup>32</sup> National Institute for Empty Packaging Processing (“Instituto Nacional de Processamento de Embalagens Vazias”, in Portuguese).

<sup>33</sup> “Coalizão Embalagens”, in Portuguese.

<sup>34</sup> During the 26<sup>th</sup> Conference of the Parties (COP26) in Glasgow.

<sup>35</sup> In 2020, 43.4% of all residues from the service sector were incinerated (Abrelpe, 2021).



ordinance to orient the energetic recovery of urban solid waste. To this point, in 2021 for the first time a project to generate electricity from the incineration of solid urban residues was contracted in an auction<sup>36</sup> to expand energy supply in the country (EPE, 2021).

Since 2020, waste management companies can also issue incentivized debentures (see **Section 2.2**) (Brazil, 2020b). So far, only one green bond<sup>37</sup> was issued by a Brazilian company, within the national market, with the use of proceeds tied to waste management, including the treatment and use of biogas generated by decomposing waste for energy generation (Sitawi, 2021).

In summary, gradually the country has been implementing its national policy to reduce the improper disposition of solid waste, although actions are not directly targeted at GHG emissions reductions from the sector. The use of RSU, other residues and biogas to generate energy is a recent but growing phenomenon with considerable potential.

### 3 Results

Below are the results from the interviews. All topics discussed were coded according to the three streams in the MSF. **Only those issues that were very or somewhat prominent are presented in the tables and further discussed.** While the MSF focuses on domestic policymaking, interviewees were also questioned about opportunities for international cooperation, within each sector, in the transition to a net zero economy.

A thorough, critical, appraisal of each suggestion is beyond the scope of the present report and results are relayed as presented by the interviewees.

#### 3.1 Land use change and forestry (LULUCF)

The most prominent problems, alternatives/proposals, and political events and participants in land use change and forestry are summarized in **Table 2** and briefly discussed below.

*Table 2 – Problems, alternatives and political events in land use change and forestry*

Problem stream	Policy stream	Political stream
1-(Insecure) Land tenure in the Amazon region; 2-Poor land use change governance; 3-Unemployment and inequality; 4-Weak local governments.	1-Economic instruments to assist in the enforcement of the Forest Code; 2-Public notices from commodity traders towards forest restoration projects; 3-Increase the number/area of national conservation units.	1-Campaign financiers and voters' priorities in Amazon states; 2-Agriculture and livestock producers and associations; 3-Civil society; 4-Brazil's armed forces (Military).

#### Problem stream

(1) Insecure land tenure and weak property rights in the Amazon region are a critical issue, which contribute for land grabbing activities taking place. Recent actions by local and federal authorities granting land titles without proper consideration about the previous behavior from occupiers (akin to amnesty) tends to further encourage deforestation. In other Brazilian regions, once the price of land increased, cattle raisers changed their practices and intensified their production (within their existing possessions). Hence, as long as expanding (even illegally)

<sup>36</sup> Bidding process conducted by the Ministry of Mines and Energy.

<sup>37</sup> An incentivized debenture.

farming area is seen as a cheaper alternative than restoring degraded pastures, some producers will likely keep this pattern of behavior.

(2) To this point, an improved, clear, transparent and consistent land use (and climate) governance, which consists of a broader range of players (such as the private sector and subnational actors) is seen by interviewees as a minimum necessary condition to properly tackling illegal deforestation in the country.

(3) The economic status of the Amazon states also needs to be included within discussions surrounding land use in the region, with six of the poorest states in the country being in the region. In this sense, the agendas of job creation and reduction of poverty and inequality are very prominent. For instance, the labor force in the region, particularly in rural areas, lacks adequate instruction and, therefore, is unable to work with greater technological and knowledge requirements. The assets available to some citizens are confined to their manual labor and the land they may work on.

(4) Finally, and related with the previous problem, local governments in the region are weak and dependent on (budget) transfers from the federal government. In Brazil, the brunt of tax collection takes place at the federal level; states can essentially only raise taxes on the movement of goods and services<sup>38</sup>. In this sense, unless the federal government emphasizes land use change and deforestation in its agenda, local governments are less likely to act by themselves.

### Policy stream

Given that most illegal deforestation takes place in public lands, countering it is mostly in the realm of command-and-control, i.e., with the enforcement of the country's Forest Code by police forces. (1) Beyond these efforts, interviewees noted that economic instruments and mechanisms could help in the application of the code or in reaching its objectives. For instance, efforts could be put in place to further develop the market for Environmental Reserve Quotas, already an instrument of the Forest Code.

Additionally, new mechanisms such as the Green Rural Product Notes<sup>39</sup>, created in October 2021, or even bilateral agreements between private players to finance the conservation of native vegetation within producers' properties, could be further developed and supported by the federal government.

(2) An example of private agreements that could be further encouraged are public notices from commodity traders (or other players) towards forest restoration projects. These organizations are increasingly concerned with environmental restoration, reforestation and forest enrichment in several biomes in Brazil, including to reach voluntary targets or adhere to international commitments.

(3) More generally, the federal government could increase the amount of forest areas designated as Conservation Units (environmental protection areas legally instituted by the public administration), either expanding existing ones or creating new units.

### Political stream

<sup>38</sup> As well as on the property of vehicles and transfer of assets due to death or donations.

<sup>39</sup> For a brief description, in Portuguese, see: <https://www.gov.br/agricultura/pt-br/assuntos/noticias/cpr-verde-titulo-ira-recompensar-o-produtor-pela-preservacao-ambiental>.



(1) 2022 is an election year in Brazil, both at the federal and local levels. Political campaigns can help elevate certain topics within agenda-setting process. However, limiting deforestation does not appear prominently in state governors’ campaigns: i) campaign financiers are often tied to local interests (mining, lumber, livestock activities) who benefit from the status quo; and ii) voters themselves have other concerns and are not convinced about the economic value of keeping native vegetation conserved. As one interviewee put it, in these local campaigns, “if you talk about reducing deforestation, you lose votes”.

(2, 3, 4) In terms of groups that need to be included in broad coalitions to support proposals to reduce GHG emissions from land use change, particularly in the Amazon region, are: i) the agriculture and livestock producers and their associations, which tend to overrepresent antiquated viewpoints from smaller producers; ii) organized civil society, in order to improve land use and climate change governance; and iii) Brazil’s armed forces, which do not want to lose control over the territory (public areas) with forest cover.

### Opportunities for international cooperation

International cooperation projects, in general, seem to work better when the administrations from the countries involved have common priorities (even ideological inclinations). To this point, countries currently leading climate discussions in the international arena would probably like to work with a more proactive and participative Brazilian government on deforestation issues.

However, Brazil’s federal administration lost credibility in the recent past, due to growing deforestation rates, for instance, leading to donations to the Amazon Fund being suspended by donor countries (Norway and Germany). As a result, rebuilding the country’s climate change and land use governance seems to be a necessary condition to resume talks concerning international cooperation projects.

## 3.2 Energy (transport) sector<sup>40</sup>

The most prominent problems, alternatives/proposals, and political events and participants in the transport sector are summarized in **Table 3** and briefly discussed below.

Table 3 – Problems, alternatives and political events in energy (transport)

Problem stream	Policy stream	Political stream
1-Inadequate transport and fuel infrastructure; 2-Legal uncertainty; 3-Overreliance on diesel fuel; 4-Supply chain bottlenecks (for trucks’ production); 5-Insufficient and unreliable electricity supply (for EV); 6-International opposition to biofuels.	1-Expansion of RenovaBio; 2-Development of alternative fuels (to diesel); 3-Biogas certificates; 4-Preferred treatment for vehicles that run on biofuels; 5-Programs to renew the truck fleet; 6-Insurance or collateral funds for large infrastructure projects.	1-Biofuel producers and associations; 2-Large multinational transportation and logistics companies; 3-Businesses with targets for Scope 3 emissions; 4-Truck drivers.

<sup>40</sup> Data for the transport sector was also derived from Brazil’s country study within the Strengthen national climate policy implementation: Comparative empirical learning & creating linkage to climate finance - SNAPFI project (see more at [https://www.diw.de/en/diw\\_01.c.697920.en/projects/strengthen\\_national\\_climate\\_policy\\_implementation\\_comparati\\_ical\\_learning\\_creating\\_linkage\\_to\\_climate\\_finance\\_-\\_snapfi.html](https://www.diw.de/en/diw_01.c.697920.en/projects/strengthen_national_climate_policy_implementation_comparati_ical_learning_creating_linkage_to_climate_finance_-_snapfi.html))

### Problem stream<sup>41</sup>

(1; 2) Even though road transport plays a predominant role in cargo transport in Brazil, even for this mode of transportation, the existing infrastructure is inadequate and insufficient, with several spots in the country lacking paved roads, rest stops (for drivers), among other facilities. Rail and water transportation serve mostly as channels to link commodity production to ports and are also underdeveloped and underutilized.

In part, the lack of greenfield infrastructure projects can be explained by legal uncertainty associated with doing business in Brazil, both from regulatory and judicial procedures. For example, rail projects are long-term endeavors and an investor needs assurance that a contract be valid over decades. Concession contracts also tend to be incomplete (given their long-term nature) and clear and robust processes are necessary to attract (more) investors. Rail and cabotage have recently seen new regulatory frameworks approved, which may provide additional impetus for the development of these modes.

(3) The overreliance on diesel fuel presents an additional problem. Trucks, trains and bunker fuel are all derived from oil and, thus, subject to great price volatility. For example, interviewees highlighted that the Russian invasion of Ukraine and the consequent rise in the price of crude oil have direct impacts in cargo transport in the country: fuel becomes more expensive, freight costs rise and, lastly, the prices of the goods transported rise as well.

(4; 5) With regard to trucks, there are recent bottlenecks on the supply of semiconductors, which affects the local production and delays new deliveries, in a country with an already “outdated” fleet. Moreover, the supply of electricity in Brazil is seen as insufficient and unreliable by interviewees, with three events when demand surpassed supply in the XXI<sup>st</sup> century, hence, acting as an obstacle to the (faster) adoption of battery powered electric vehicles and trucks (BEV).

(6) Finally, Brazil has an extensive and successful experience with biofuels, historically ethanol (from sugarcane but also corn) and more recently biodiesel. However, internationally these alternative fuels are poorly received due to concerns and misconceptions about their impact on food production and deforestation. If the automobile industry globally switches to electric vehicles (EV), these alternative fuels may lose their relevance (due to cars and trucks not running on them), despite their greater potential of contributing to a net zero economy.

### Policy stream

(1; 2) An initial alternative to be explored is the expansion of the existing National Biofuel Policy (RenovaBio) in order to include other fuels or even other activities. To this point, the policy could, thus, become broader and target bioenergy more generally, biopolymers and other biomaterials (that can substitute oil products). The development of alternative fuels to diesel (such as biomethane) to heavy-duty vehicles as well as biofuels to planes and ships is another alternative for this industry, given the greater difficulty of electrification in these modes of transportation. As one interviewee summarized: “the future of transportation in Brazil is eclectic, not only electric”. (4) To this point, vehicles that run on alternative fuels could receive preferential treatment, for instance, in public procurement and with reduced taxes or toll rates.

(3) Another proposal, particularly given the current absence of adequate infrastructure such as pipelines, is the creation of Biogas certificates in similar fashion to the existing renewable energy

<sup>41</sup> Topics that were prompted, with little or no prominence: Public health (local pollution); Physical risks: climate change impacts in transport infrastructure; Risk of deforestation and infrastructure projects in the Amazon region.

certificates (so-called I-RECs). This way, businesses that may not have direct access to biogas, due to logistical bottlenecks, could still purchase the certificate and nominally claim to be the bearer of the green attributes of the renewable fuel. (5) Programs to renew Brazil's truck fleet could present an opportunity to increase the share of vehicles able to run on biomethane (or other renewable fuels).

(6) Finally, in order to attract private capital to and expand the transport infrastructure in the country, the government could create a collateral or insurance fund (or restructure existing Funds) to leverage investments in low-carbon infrastructure, instead of funding the entirety or majority of the projects via public banks. A recent railway project (nicknamed "Ferrogrão") to be auctioned by the federal government was designed with a guarantee deposit from the treasury to cover non-manageable risks over the duration of the concession contract.

### Political stream

Relevant stakeholders in the discussions around the transport sector are, naturally, the producers and users of fuels (and transportation services). (1) For instance, biofuel producers and associations are very active in the promotion of their products and, recently, vocally opposed decisions to reduce the legally required share of biodiesel contained in diesel fuel<sup>42</sup>.

(2; 3) An important driver of climate discussions in the sector are the companies that provide transportation and logistics services, mostly large multinational groups, as well as the growing numbers of businesses that voluntarily assume reductions targets for their indirect emissions (Scope 3 emissions, in the GHG Protocol nomenclature). Due to their participation in international forums and public commitments towards decarbonization, these businesses are increasingly looking into their supply chains and demand low-carbon solutions from their suppliers, including in the transportation of inputs and finished products.

(4) Finally, another group mentioned by the interviewees are the truck drivers. This category went on strike in 2018, demanding higher pay, and greatly impacted the circulation of goods in Brazil. They also opposed the approval of the new regulatory framework to maritime cabotage (sanctioned in 2022). Their concerns regarding competition from other modes of transportation and rising fuel prices reverberate in the media and, consequently, reach those within and around government.

### Opportunities for international cooperation

The first opportunity, and maybe even a necessity from the Brazilian perspective due to its particularities in the use of biofuels in road transport, for international cooperation in the transport sector concerns the "internationalization" of RenovaBio and its instruments, i.e., the CBIOS. Whereas international discussions on transportation focus on EVs, there is a need to understand what role biofuels may play in the transition to a net zero economy in a global scale. If EVs are to also become a relevant technology in Brazil, the transfer of technology, for instance for lighter and more durable batteries as well as the development of EV infrastructure are additional opportunities to pursue.

In terms of policy transfer, good practices in different countries may serve as inspiration to Brazilian policymakers and regulators. Possible examples are experiences on how to fuel public

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<sup>42</sup> In Brazil, diesel and gasoline are mandatorily blended with a given percentage of biofuels (as established by the federal government).



transportation fleets with biogas from urban residues (as in Sweden), banning the sale or restricting the circulation of diesel vehicles (Mexican, Colombian and French cities, for example, have taken steps in this direction). Brazil could also benefit from greater use of inland waterway transport, particularly in the Amazon region, and could look for examples in countries that have already succeed in developing such a mode of transportation.

### 3.3 Agricultural sector

The most prominent problems, alternatives/proposals, and political events and participants in the agricultural sector are summarized in **Table 4** and briefly discussed below.

Table 4 – Problems, alternatives and political events in agriculture

Problem stream	Policy stream	Political stream
1-Deforestation (and concerns with sectoral image); 2-Lack of clear/agreed procedures for measuring GHG emissions and removals; 3-Overreliance on imported fertilizers; 4-CC impacts on productivity; 5-Overreliance on diesel fuel; 6-Lack of demand for certified products.	1-Payment for Ecosystem Services and carbon credits; 2-Green bonds (and green CRA); 3-Labeling schemes for carbon neutral meat and soy; 4-Adoption of public commitments and targets; 5-Expansion of RenovaBio.	1-Agricultural Financiers (demands/pressure from); 2-Large degree of sectoral heterogeneity, fragmentation and poor communication.

#### Problems<sup>43</sup>

(1) The first major concerns for the agricultural sector have close relation with land use change. First, some producers are increasingly concerned that any efforts to reduce emissions by the sector are overshadowed by the rates of deforestation in the country. To this point, large, organized players have publicly committed to implementing zero deforestation policies.

(2) Moreover, the lack of clear and agreed methods and procedures to measure, monitor and quantify the positive consequences of best practices in terms of reduced emissions or even carbon removal and storage in soil make it difficult to incentivize those practices, for instance with carbon credits.

(6) Similarly, interviewees pointed to a lack of demand for certified agricultural products. There seems to be only a niche market for soybeans, corn and cotton with labels attesting their provenance (without deforestation) and reporting their embedded GHG emissions. Niche markets do not provide sufficient economic incentives (price signals) that can reach the (smaller) producers and alter their decision-making processes in order to refrain from converting native vegetation into farm areas.

(3,5) Within the operational aspects of the farms, producers have apprehensions with the price volatility of their most important inputs: fertilizers and diesel. In the first case, there is the additional concern (by some) that Brazil is dependent in imports. Nonetheless, both inputs are heavily influenced by happenings in the global sphere. For instance, the Russian invasion of Ukraine, with the subsequent economic sanctions posed against it, contributed to decrease in the supply and sudden spikes in the prices of both inputs. (6) Lastly, there is a growing perception

<sup>43</sup> Topics that were prompted, with little or no prominence: Overreliance on public insurance (for small producers); Lack of public policies (plans) for family agriculture; Poor usage of existing pastures; and Traceability of indirect suppliers (for commodity traders).

that the impacts of climate change may already be affecting farms' productivity, for instance, due to changes in precipitation patterns.

### Policy stream<sup>44</sup>

(1) Given that emissions from the sector often come from land use change activities, economic incentives are deemed as necessary to increase the opportunity cost<sup>45</sup> of expanding production in new areas (i.e. deforested). Payment for Ecosystem Services' schemes or carbon credits can provide such an incentive (if carefully designed). (2) The ability to raise funding via green bonds, with better financial conditions, is gradually seen as an important avenue to fund best practices and technology change within the farms. (4) To this point, the adoption of public targets and commitments by producers/traders helps them to access this pool of funds (with proceeds targeted at socioenvironmental issues).

(5) In a similar fashion, possible expansions of RenovaBio (see **section 3.2**), which resembles and can be deemed as a carbon market, to include other products and sectors (e.g., bioenergy more broadly and not only for transportation) could also foster the adoption of best practices by (other) agricultural producers. Linking the program with international initiatives and allowing CBIOS to be traded internationally is another possibility to increase this market and its repercussions.

(3) Finally, labeling schemes, such as the "Carbon Neutral Meat", that acknowledge those producers that adopt Livestock-Agriculture (or Livestock-Agriculture-Forest) Integration, properly parametrized and audited by Embrapa<sup>46</sup>, could be extended to other products, most importantly soybeans, and, thus, provide additional impetus to the ABC+ Plan.

### Political stream<sup>47</sup>

(1) The increasing demands from financial institutions with regards to climate change (and other environmental concerns) already affects and has the potential to further influence the priorities of the agricultural sector in Brazil, especially for the larger producers that are more exposed to private sources of finance and external markets. (2) The large degree of fragmentation and heterogeneity within the sector, however, presents a challenge to build effective coalitions for the proposal, adoption and communication of best practices, especially with regards to the sector impacts on land use change patterns in the country.

### Opportunities for International cooperation

The opportunities for international cooperation discussed by the interviewees are related to the problems and policies discussed above. More specifically, there seems to be room for cooperation on the development of methods and procedures to adequately measure the amount of carbon emissions prevented by the adoption of different practices as well as to

<sup>44</sup> Topics that were prompted, with little or no prominence: Continuation of ABC+; Consortia between soy and livestock producers; Develop and apply regenerative agriculture at large scale; Genetic improvement of seeds; Use of blockchain technology to share information throughout the supply chain.

<sup>45</sup> In economics, opportunity cost is the "the potential benefits that an individual, investor, or business misses out on when choosing one alternative over another" (Fernando, 2021).

<sup>46</sup> Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation) is a public research company under the aegis of the Brazilian Ministry of Agriculture, Livestock, and Food Supply (Embrapa, 2022).

<sup>47</sup> Events or actors in the political stream that were prompted, with little or no prominence: National mood: polarization environment vs. production; Questions of jurisdiction: deforestation, Ministry of Environment and Ministry of Agriculture; Turnover of key personnel: presidential elections.



properly gauge the volume of carbon stored in the soil in preserved or restored areas, particularly in ways coherent with the Brazilian context (and its different biomes). Similarly, programs that remunerate the producers who adopt these practices (payment for ecosystem services and/or carbon credits) could be developed within international cooperation efforts.

### 3.4 Industrial processes

The most prominent problems, alternatives/proposals, and political events and participants in the industrial sector are summarized in **Table 5** below.

*Table 5 – Problems, alternatives and political events in the industrial sector*

Problem stream	Policy stream	Political stream
1-“Browning” of Brazil’s electric grid; 2-High cost of (imported) mitigation technologies; 3-CBAM; 4-Rising prices of scrap metal (for steel production); 5-Informality in the construction sector.	1-Carbon capture and storage; 2-Green/blue hydrogen; 3-Mandatory carbon markets; 4-Greater use of biomass (charcoal) in iron and steel production; 5-Use of byproducts and waste of other activities in cement production.	1-“Globalized” industrial subsectors and businesses; 2-Industry associations (and sectoral fragmentation); 3-Financial sector and ESG demands.

#### Problem stream<sup>48</sup>

(1) The industrial sector as a whole is intensive in the use of electricity (and energy in general). Although Brazil’s electric grid has a large share of renewables (mostly hydroelectric power), recently there is a trend of greater use of thermal power (coal and gas), thus, increasing costs and (indirect) emissions<sup>49</sup>. (2) Another feature of Brazilian industries is their trend of importing established technologies, rather than innovating. In this sense, the high costs of imported low-carbon technologies become another barrier for reducing emissions in the sector.

(3) For those industries that export part of their productions to European markets, the proposals for the adoption of a Carbon Border Adjustment Mechanism (CBAM), imposing a carbon price in imports into the EU, have been received with great attention and lead to increased mobilization (for instance with regard to the adoption of domestic carbon markets).

(4) For steel production, an important route for decarbonization is the use of scrap metal, for instance from end-of-life automobiles, in the production process. However, increasing prices in the market for scrap may render such an alternative economically unfeasible.

(5) With regard to the cement production, the construction sector in Brazil is marred by informality both in the production of concrete and in construction sites. In such a scenario, the adoption of more technology and good practices in general, which require investments, becomes compromised to due competition with informal markets as well as product use by poorly trained workers (resulting in wastage).

<sup>48</sup> Topics that were prompted, with little or no prominence: Lack of continuity of programs, plans and policies; Difficult economic outlook; High water demand (for steel production); Low levels of recycling of construction waste.

<sup>49</sup> The carbon intensity of the National Grid in 2020 was 0.0617tCO<sub>2</sub>/MWh. In 2020, it was 0.1264tCO<sub>2</sub>/MWh, According to the Federal Government ([https://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao\\_corporativos.html](https://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_corporativos.html)).

### Policy stream<sup>50</sup>

(1) Carbon capture and storage (CCS) will play an important role in industry contributions towards a climate neutral economy, even seen as a necessity by some interviewees. However, a key point to promote the adoption of CCS technologies is the (monetary) recognition of the emissions reductions achieved by deploying them, otherwise needed investments will not be made. (2) Another technology that holds promise, due to the sector's energy intensiveness, is the use of green or blue hydrogen. Small-scale experiences and startups can be found in Brazil, but large-scale deployment will require conducive public policies and additional sources of funding.

(3) Mandatory carbon markets, i.e., cap-and-trade schemes, are high on the list of proposed policies to reduce emissions in the industrial sector. Discussions were held, for a long period of time, within the World Bank's Partnership for Market Readiness (PMR), and there is now an understanding that the sector will need to purchase carbon credits in order to reduce (offset) its emissions. Developments of Article 6 within the Paris Agreement provide additional impetus for these discussions.

(4) In steel plants, charcoal can be used both as a fuel in blast furnaces and as a reducing agent (to remove oxygen during production). In addition to contributing to reduced emissions in the sector, greater use of charcoal also diminishes the need to import coal. However, it is necessary to increase the industry's base of planted forests.

(5) Finally, policies that facilitate the use of byproducts and waste from other activities in the cement sector could yield additional emissions reductions as well as contribute in the adequate disposal of urban solid residues and agribusiness waste. Cement kilns are very flexible and operate in extremely high temperatures; thus, being able to burn almost any inputs as fuel (for example, truck tires). Moreover, slag and ash from thermoelectric plants can be mixed into cement and decrease the need for clinker.

### Political stream

Few players were mentioned as relevant in the political stream. (1) Interviewees mentioned industries that have a larger degree of internationalization and connection with global markets and trends as leaders in climate change discussions in the sector. For example, the Global Cement and Concrete Association is very organized and active and, thus, there is a global sectoral target to become carbon neutral by 2050 in cement production. Consequently, local players in Brazil reflect this ambition domestically. In addition, those businesses that export or want to export their products, in particular to European markets, also behave proactively with regard to reducing emissions.

(2) On the other hand, the industrial sector in general is very fragmented and industry associations, thus, play a defensive role, generally opposing measures that may lead to higher costs to some of its affiliates. To this point, the proposal of any programs and policies to reduce emissions in the sector need to be discussed from its inception with these associations, so that they have some sense of ownership and become invested in the alternatives suggested to decarbonize the sector.

(3) Finally, growing demands from financiers with regard to ESG issues are becoming increasingly more relevant for the largest players in the sector and, consequently, affect their priorities.

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<sup>50</sup> Topics that were prompted, with little or no prominence: Concrete paved roads; Cement without clinker.



### Opportunities for international cooperation

Opportunities for international cooperation in the sector refer to the technologies already listed in the policy stream. The development and adoption of green and blue hydrogen technologies could be part of concerted, international efforts. Similarly, CCS technologies are more advanced in European and North American countries, which could assist in its transfer to Brazil.

Discussions around carbon markets are another venue for cooperation. Brazil could for inspiration abroad in order to develop a domestic, mandatory, cap-and-trade scheme, while the transfer of carbon credits internationally (within the Paris Agreement or more generally) require the development of mechanisms to ensure the credibility and quality of these credits to ensure wider acceptance.

### 3.5 Waste management

The most prominent problems, alternatives/proposals, and political events and participants are summarized in **Table 6** and briefly discussed below.

*Table 6 – Problems, alternatives and political events in waste management*

Problem stream	Policy stream	Political stream
1-Lack of clear responsibilities; 2-Lack of municipal state capacity and resources; 3-Logistical difficulties; 4-NIMBY and cultural issues; 5-Historical lack of compliance; 6-Social risks and informality.	1-Extended responsibility of the producer.	1-Urban focus/agenda from the Ministry of the Environment; 2-Consumer goods industry; 3-Waste pickers; 4-National mood: Greater public concern with plastic in the oceans.

#### Problem stream<sup>51</sup>

(1; 2) Brazil’s National Solid Waste Policy is based on the principle of shared responsibilities, which interviewees identified as a problem, since it creates “a game of pushing” (as phrased by one interviewee) in which all players (government, industry, consumers) try to avoid their responsibilities. Moreover, once responsibilities are assigned to small and medium municipalities in Brazil, there emerges a clear lack of institutional capacity, with local administrations not knowing “where to start” and without the financial resources to even migrate from open-air dumps to landfills.

(3; 4) Another issue highlighted by the interviewees is the fact that waste tends to travel long distances, for instance with collection and final destination sometimes being more than 400km apart, a reality that increases cost GHG emissions. Large distances also hinder reverse logistics, since it may not be economically viable to collect recyclable material (e.g., glass) from several regions in order to bring it to a manufacturing plant. Finally, there seems to be a cultural problem, with citizens not wanting waste management facilities close to their residences; local administrators, then, also do not seek to bring landfills or other facilities close to their cities.

(5; 6) Finally, interviewees mentioned that the sector has faced corruption problems in the recent past, given its large and long-lasting public procurement contracts (between local

<sup>51</sup> Topics that were prompted, with little or no prominence: Unfavorable risk-return ratio (for private investors); Lack of composting infrastructure; and Increase in the quantity of (complex) waste generation.

administration and service providers). With regard to waste collection, there is also a high degree of informality, with one interviewee estimating that around 80% of scrap dealers unable to issue an invoice or not even being constituted as legal entities.

### **Policy stream<sup>52</sup>**

Although several technologies and approaches were raised (separately) by the interviewees (see **footnote 52**), the general feeling is that a policy based on the extended responsibility of the producer, as in the case of the European Union, seems a better approach to increase reuse and recycling rates, given its proximity with the “Polluter Pays” principle. This approach is deemed as “simpler” and one that channels the resources (more abundant within the consumer goods industry) towards the recycling industry.

### **Political stream<sup>53</sup>**

(1; 2; 3) In the political stream, interviewees highlighted a recent shift in the focus of the Ministry of the Environment towards urban issues. Relevant actors, i.e., organized political forces, in the discussions around waste management are the consumer goods industry and the waste pickers and their associations; both groups were seen as able to influence the public policy process in the past.

(4) The national mood, indeed even international, also seems relevant for the sector with a greater public concern regarding plastic in the oceans leading large companies to adopt more ambitious targets, for instance, with several players from the food & beverage as well as cosmetics industries vowing to use 50% of recycled plastic (in their packages) by 2030.

### **Opportunities for International cooperation**

Interviewees noted that the challenges Brazil faces with regard to waste management are common to most of Latin America. These countries could receive support from developed economies in terms of technology transfer, such as automated sorting, although these need to be adapted to local conditions (for instance, residues in Brazil tend to be more humid than those in Europe). Policy inspiration could come from the United States of America, which managed to eliminate all open-air dumps in a short period of time as well as from European countries and their solutions to apply the extended responsibility of the producer.

Brazil, for its part, could share its knowledge with the development of the “social technology” of waste pickers’ associations to other developing countries. Jointly, countries could adopt ambitious targets to reduce emissions within waste management.

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<sup>52</sup> Topics that were prompted, with little or no prominence: Reverse logistics (offsetting) credits; Startups focused on waste management; Greater mechanization; Composting yards; Carbon credits; Refuse-derived fuel; Alternative fuels for waste and garbage trucks; Increase number of waste pickers associations; Increase share of reusable packages; Preferred tax treatment for recyclable waste; and (Projects to promote) Changes in consumer behavior.

<sup>53</sup> Events or actors in the political stream that were prompted, with little or no prominence: (Foreign) Technology providers; Greater sectoral concern about climate change (domestic and internationally); Greater pressure on municipal public managers; Large degree of knowledge fragmentation; and Current providers of waste management/disposition services.

## 4 Discussion and recommendations

Previously we described and analyzed the largest GHG emitting activities in Brazil individually, although within a common analytical framework. Here, we attempt to find common threads, similarities, inconsistencies and apparent trade-offs for a comprehensive carbon neutrality approach in the country.

Before doing so, however, it is important to preface that Brazil is a medium income country, with a GDP per capita of \$14,835.41 (against a world average of \$17,135.48)<sup>54</sup>, which experiences growth rates below world average since the 1990s (World Bank, 2022). Hence, economic growth is a necessary condition for any nationally relevant discussions, including around climate change. Moreover, cooperation may better serve the achievement of (domestic) long-term goals if devoted to building public goods<sup>55</sup> (Pritchett, 2015; Deaton, 2016).

With that in mind, a first point to consider is that not only the interviews revealed a longer list of problems than solutions (27 problems, 20 solutions), but also several problems seem to be of a more structural (macro) character, such as weak governance and informality, whereas a number of the proposed alternatives tend to be more focused and applicable at smaller scales, such as labeling schemes or payments for ecosystem services. Thus, opportunities seem to be available for policy entrepreneurs to attach broader, larger-scale, solutions to unanswered issues, which may not be necessarily framed as climate policies, but may help reducing GHG emissions (as well as achieving other developmental goals).

Indeed, informality, poor/weak governance, lack of (local) state capacity and resources and legal uncertainty are relevant for all sectors analyzed. Therefore, laws, policies and programs that are weakly and/or inconsistently enforced act as an impeditive for the adoption of new/best practices. Merely attaching new regulations on top of the existing ones may not achieve the desired goals, since these would be based on frail foundations (i.e., payment for ecosystem services may not work under a regime of insecure property rights in the Amazon region). For instance, such a reality needs to be acknowledged in the development of Sectoral Plans for Climate Change Mitigation, whose procedures were recently stipulated by Presidential Decree 11,075/2022.

Concerning possible synergies in a transition towards a carbon neutral economy, a greater degree of proximity can be found between the LULUCF and agricultural sectors. In effect, deforestation is listed as one of the main problems for the agricultural sector, although most policies to tackle this issue are coordinated by the Ministry of the Environment (MMA) and lie beyond the scope of the Ministry of Agriculture (MAPA). Similarly, Brazil's methane zero plan focuses on waste management (policies coordinated by MMA), although the largest source of methane emissions in Brazil is livestock production (policies coordinated by MAPA). Hence, questions of jurisdiction between MMA and MAPA limit the reach of carbon neutrality policies.

More generally, for deforestation policies to last, at least one (economically powerful) interest group needs to have ownership with regard to the policy and, subsequently, fight to keep it in place if the circumstances change (for instance due to turnover of key governmental personnel), as seen with the ABC plan in Agriculture and RenovaBio in the energy sector. Even at a subnational level deforestation (and land use change policies) also need to present opportunities for the local elites, which play a relevant role in gubernatorial political campaigns.

<sup>54</sup> In 2020, measured in Purchasing power parity (PPP) (current international \$).

<sup>55</sup> In economics, public goods are those that are neither rival (i.e., one's consumption does not reduce the consumption of others) nor excludable (i.e., no one can be prevented from accessing it).

It is also interesting to note that economic and financial instruments make up half of all solutions found in the policy stream, from biogas certificates and (mandatory or voluntary) carbon credits to insurance funds and green bonds (green CRA). In particular, the expansion of RenovaBio is mentioned by interviewees both in the agricultural and energy sectors, with the policy regarded as a successful experience that can be replicated or expanded in order to have greater connection with other fuels and economic activities (or even countries).

Waste management, even though responsible for a smaller share of Brazil's total GHG emissions, appears as a transversal issue that can assist other sectors in their transition towards carbon neutrality, for instance with biogas as an alternative fuel (for electricity generation and transportation) or with agricultural residues (among others) and metal scrap being used in cement and steel production.

Interestingly, waste management is the only activity with a single, clear, structural policy proposal: the adoption of the extended responsibility of the producer, in substitution to the shared responsibility currently in the National Solid Waste Policy. Such proposal could even benefit from international cooperation efforts, for instance, due to the European experience.

In the political stream two relevant forces can be transversally found across multiple sectors: the demands from the financial sector; and the combined efforts from large internationally connected companies. On this point, the industrial transition towards net zero, and to a smaller extent in the agricultural sector, seems to be driven by private actors, particularly by sectoral leaders immersed in global supply chains and accessing international credit and capital markets. However, both sectors are marked by large degree of sectoral fragmentation, which presents a challenge for building winning coalitions around climate neutrality targets/policies.

More broadly, the private sector has been at the forefront of climate neutrality discussions in the country, mostly from those businesses with international exposure. However, Brazil is still a largely closed economy<sup>56</sup>, for instance, with fewer than 0.5% of all private businesses in the country exporting at least some part of their production (Canuto, Fleischhaker, & Schellekens, 2015; Bahia, 2019). Trade and finance pressures, therefore, have their limits.

With regard to deforestation, transport and waste management activities, social issues are prominently featured in the discussions, whether concerning the economic prospects of the indigenous and local communities in forest areas<sup>57</sup> or the plights of waste pickers and truck drivers. Climate solutions, thus, need to also present opportunities to include these groups or to enable their transition to other industries and revenue sources.

Finally, current trends of deforestation in Brazil also appear to act as a hindrance for conceptualizing and implementing international cooperation projects in the country. Almost all of deforestation happens illegally. To address this issue consistently and with lasting impacts, Brazil needs to improve the enforcement of its basic legal framework (i.e., to truly have "Rule of Law"). Not only high deforestation rates point towards a weakening of land use change governance, but they also attract the attention of prospective partners towards this single specific issue, obscuring their vision towards other topics and opportunities.

International climate discussions tend to be more focused on energy transition, a topic in which Brazil may need assistance in order to make better use of its extensive experience with biofuels in a world moving towards electrification of transport matrices. At the subnational level, state governments lack the appetite to confront local elites and, therefore, cooperation projects need

<sup>56</sup> By some measures (exports plus imports as a share of GDP), only Sudan is less open to trade than Brazil (Bahia, 2019).

<sup>57</sup> Nearly 40 million people live in the Amazon region (Amazônia 2030, 2021).

to be tied to jobs creation and income generation agendas. Still, there seems to be room for capacity building, technology and/or policy transfer in the energy, industrial and waste management sectors, as well as cooperation efforts to properly measure and account for the impact of good practices in agricultural production.

The topics discussed above represent an initial, but not extensive, list of avenues to explore regarding climate neutrality in Brazil. Similarly, in **Table 7** (below) we offer examples of recommendations focused on processes within each sector (and transversally) that could lead to structural changes in GHG emissions in the country. Nonetheless, any prospective policy entrepreneur, including, for instance, philanthropists and philanthropy fund managers, should ideally identify the areas in which their resources and expertise may be better applied.

Table 7 – Examples of recommendations per stream (of the MSF) and sector

	<b>Problem stream</b>	<b>Policy stream</b>	<b>Political stream</b>
<b>Land use change and forestry</b>	To reframe the problem not only as a matter of pure environmental conservation, but appealing to the needs of interests of local communities (income and jobs).	To study/offer alternatives to increase land tenure security in the Amazon region.	To build broader coalitions in support of deforestation policies, by empowering locally relevant economic actors (need for policy ownership and more inclusive governance).
<b>Energy (transport)</b>	To diminish the exposure of the Brazilian economy towards fuel (oil) price volatility.	To accelerate/increase the pipeline of greenfield infrastructure projects (i.e., proposal and evaluation of new projects). To study the long-term role of biofuels within the energy matrix.	To address the concerns of truck drivers regarding competition with other means of transportation.
<b>Agriculture</b>	To identify arguments to convince (small scale) producers about the need to change production practices (behavioral challenge).	To develop/apply methodologies to quantify (and, later, monetize) the positive impacts of alternative production practices.	To overcome the opposition (from the meat industry) to include livestock production within the scope of the Zero Methane National Program.
<b>Industrial processes</b>	To face the challenges of little international exposure and declining relative importance of the industrial sector in Brazil's GDP.	To facilitate (disruptive) technology transfer from other countries towards the most emissions industrial activities in Brazil.	To overcome the high degree of fragmentation in the sector as whole (empower early movers).
<b>Waste management</b>	To find problems in other areas that waste management could help to address (such as biomethane as an energy source).	To conceive of alternatives to increase reverse logistics within a framework of "shared responsibility". To increase the use of waste as an energy source, such as biogas and biomethane from solid urban residues.	To address the concerns of waste pickers and their role in the event of greater mechanization.
<b>Transversal issues</b>	To (jointly) address economic concerns, such as income generation and job creation.	To develop methods, protocols, and registries to increase the knowledge and transparency about climate mitigation technologies.	To seize windows of opportunity due to electoral outcomes to promote structural changes. To build greater degree of support for climate policies outside government.

## 5 Concluding remarks

When talking about economic development, Lant Pritchett (Prichett, 2016) employs the following quotation from Tolstoy's novel "Anna Karenina" in order to contrast rich industrial countries of the West and developing countries: "All happy families are alike; each unhappy family is unhappy in its own way". The point is that economic growth dynamics are uniform for the first group while context-specific for the latter.

Similarly, such image may be employed here in order to talk about the transition towards a climate neutral economy in Brazil (and developing countries in general): there is a necessity to contemplate specific national needs and ambitions in order to successfully cooperate internationally. Put differently, the identification of opportunities to assist Brazil in its pathway to reduce GHG emissions may be more appropriate if tailor-made to the local characteristics of the Brazilian economy and its most relevant sources of emissions.

To this point, the present report summarized the most relevant problems, policies (both in place and being discussed by those in and around government), and events and participants in the public policy processes in the land use change and forestry, energy (transport), agricultural, industrial and waste management sectors. Although not limited to these, some key messages that can be extracted from the report are listed below:

- Climate policies, and in particular forest conservation policies, need to be better framed for domestic and local audiences.
  - For instance, the positive (economic) impacts of low carbon agricultural practices need to be properly identified, measured and communicated to producers as well as governmental officials.
- There is an opportunity, even a necessity, to engage relevant actors at the local level, addressing their concerns and environments, in order to find groups willing to defend certain policies and programs once they are enacted.
  - Net zero policies need to stay in place for longer time horizons than political cycles. Therefore, actors outside of government need to ensure that the turnover of government personnel will not result in policy termination.
- Given Brazil's economic realities, particularly in the Amazon region, climate and deforestation policy need to be consistent with national development, income generation and jobs creation (in formal settings).
  - Transport, energy, and waste management policies can yield GHG emissions reductions even if they are not framed (explicitly) as climate policies.
- Windows of opportunity may open and appear without predictability, but once they are open, a clear solution must be readily available. Research and communication endeavors to promote and keep certain policies high on the agenda are, thus, necessary, as exemplified by the experience with mandatory carbon markets.
  - Put differently, persistency is key to drive structural change.

In summary, discussions about Brazil's pathway towards a climate neutral economy may benefit from a broader perspective, concerned with the processes that lead to structural changes, for instance in the economic incentives faced by several actors (local communities, agricultural producers, logistics companies etc.), rather than narrowly focused on the (short-term) implementation of specific policies, programs and measures, conceived in a top-down manner (occasionally "borrowed" from other contexts), which may eventually be discontinued.

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## Annex 1: Interview questionnaire

1. What major problems are you and those concerned with SECTOR XYZ most occupied with / paying attention to these days?
2. Why do you think these particular problems are the ones that are receiving attention – how did they come to be the hot issues?
3. Let me shift now, and ask you not about general problems, but rather about climate-related ideas/technologies/opportunities. What are you and other people in SECTOR XYZ currently working on, in the way of new approaches or new programs that may reduce or offset greenhouse gas emissions – what’s on the front burner?
4. Why do you think these particular initiatives are being seriously considered – how did they come to be the most promising avenues to pursue?
5. If you were to look down the road a bit, which general problems and climate-related ideas/technologies/opportunities for governmental action and/or international cooperation in the SECTOR XYZ do you think will be prominent, say, two years from now and five years from now?
6. Is there anything else that you think I might be interested in with regard to climate-change mitigation (and net zero)?
7. Is there anyone else that you think I should interview about these issues?

## Annex 2: Guidelines for a National Strategy on Climate Neutrality

According to the Ministry of the Environment's Guidelines for a National Strategy on Climate Neutrality (MMA, 2021a), to reach the 2050 goal, the country intends to:

### Forestry:

- Eliminate illegal deforestation by 2028;
- Restore and reforest 18 million hectares of forests, for multiples uses, by 2030;

### Energy:

- Increase the share of renewable energy in the energy matrix by 45%-50% by 2030, including an increase in the share of sustainable biofuels;

### Agriculture and livestock:

- Implement the Low-Carbon Agriculture Plan 2030-2030 (ABC+ Plan) in order to:
  - Restore 30 million hectares of degraded pastures;
  - Increase areas planted with the no-tillage system by 12.5 million hectares;
  - Increase areas with Livestock-Agriculture Integration by 10 million hectares;
  - Increase areas planted using agroforestry systems by 100,000 hectares;
  - Increase areas with planted forests by 4 million hectares;
  - Increase areas with bio-inputs (including Biological Nitrogen Fixation) by 13 million hectares;
  - Increase areas with irrigated systems by 3 million hectares;
  - Increase waste treatment from animal production by 208 million m<sup>3</sup>;
  - Intensive termination of 5 million animals.

### Industry:

- Stimulate measures to unlock barriers to the creation of new green businesses;

### Waste management:

- Eliminate open landfills by 2024;

### Sanitation:

- Provide access to sanitation to 90% of the population by the end of 2033;

### Transport infrastructure:

- Strengthen the transition to low-carbon infrastructure, particularly in the transport sector;

### Green Growth:

- Implement the National Green Growth Plan, reaching economic growth through a green economy;

### Carbon market mechanisms:

- Strengthen carbon market mechanisms through projects that reduce or offset GHG emissions;

### Adaptation:

- Develop new public policies and improve existing ones to promote reduced vulnerability, increase resilience, manage and reduce climate risk.