The Brazilian Forum
for Climate Change

The Initial Proposal for the Implementation of the Brazilian NDC

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The Brazilian Forum on Climate Change was created by Federal Decree 3.515 in 2000, recognized by Federal Law 12.187 in 2009 as one of the institutional instruments of the National Climate Change Policy. Its composition and attributions have been reformulated by Federal Decree 9.082 in 2017, that established its objective to raise awareness and mobilize society and contribute to the discussion of actions required to address global climate change, in accordance with the provisions of the National Policy on Climate Change and the United Nations Framework Convention on Climate Change and international agreements resulting from it, including the Paris Agreement and Brazil's Nationally Determined Contributions, and in accordance with the legislation in force.

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The final form of this document is the responsibility of the Executive Coordinator of the Brazilian Forum on Climate Change. Not all the people and institutions who participated in the process necessarily agree with all the points made here, although a great effort was made to bring this Initial Proposal for the Implementation of the Brazilian NDC as close as possible to consensus.

THIS PROJECT WAS SUPPORTED BY

I.
Introduction

The purpose of the Initial Proposal for the Implementation of Brazil's Nationally Determined Contribution (NDC) is to provide a roadmap for achieving our mitigation targets up to 2030 in a way consistent with a long term strategy for net zero emissions and stimulating sustainable economic and social development. This English version contains some updates, specific explanations and a slightly different structure compared to the original.

The Brazilian Forum on Climate Change (FBMC) is formed by government and civil society actors. It promotes debates and facilitates decision making related to the climate agenda. It is chaired by the President of the Republic and constituted by government officials and members of society (private sector, third sector and academics) and an Executive Coordinator from civil society[1].

This document is the product of a participatory process mobilizing the nine FBMC Theme Chambers (TCs)[2] and of several seminars and workshops, with the participation of 537 people, from 214 organizations, among government officials, business sector representatives, NGO leadership and academia, from March 2017 to June 2018. It was based on relevant technical studies and workshops' multi-criteria analysis, online consultation through the FBMC website and bilateral discussions with some key actors, always seeking to get as close as possible to a consensus while selecting mitigation and adaptation actions, measures and policies[3].

The process was based on discussions within the TCs; four qualitative evaluations and prioritization of actions in multi-criteria workshops using the Macbet method (Measuring Attractiveness by Categorical Based Evaluation Technique) to evaluate them in the light of different criteria[4]; bilateral meetings; a consultation process through the FBMC web site and by email, and a high level seminar with former ministers.

1. The FBMC was created, in 2000, by Decree 3.515/00 and recognized, in 2009, as one of the institutional instruments of the National Policy on Climate Change by Law 12.187/09. Currently, the Forum is regulated by Decree 9.082/17. Nine Theme Chambers of the FBMC were instituted in 2017. Their objective is to contribute to the definition of priorities, levels of ambition and sequencing of actions relevant to the Brazilian NDC, short goals and long term strategy.

2. TC1 (Agriculture, Forestry and Biodiversity), TC2 (Energy), TC3 (Transport and Mobility), TC4 (Industry), TC5 (Cities and Waste), TC6 (Finance), TC7 (Defense and Security), TC8 (Long Term Vision), TC9 (Science, Technology and Innovation) and TC10 (Adaptation). Of the 10 TCs instituted in 2017 by the FBMC, TC7 is the only one that is not yet in operation.

3. The short-term actions were listed in a separate document.

4. The multi-criteria workshops took into account: mitigation potential, compatibility with long-term strategy, social impacts, local environmental impact, plausibility of economic cost and political-institutional viability.

Brazil is the only large economy developing country presenting its NDC mitigation targets in economy wide aggregate figures: -37% GHG, in 2025 and the indication of -43%, in 2030, related to base year 2005. In the wake of Brazil's Second National Communication of Greenhouse Gas Emissions this translates into 1.3 Gt CO_2-eq, in 2025 and 1.2 Gt CO_2-eq, in 2030 (GWP-100, IPCC AR5). The Third National Communication of Greenhouse Gas Emissions, announced after the INDC communication, at the UN in September 2015, has reevaluated Brazil's past emissions. The 2005 levels were found to be much higher than previously estimated[5]. The mentioned percentages, of course, continue to relate to the Second Communication's inventory. In this Proposal we will mostly use the two mentioned aggregate figures. We have recommended to the government that these two limits (1.3 Gt and 1.2 Gt) given in the "Additional Information on the INDC for Clarification Purposes Only" document, annex to the NDC, be included in its core text, as soon as possible.

The "Additional Information to the NDC" annex also specified some quantified sectorial goals in energy, land use and forests, and agriculture:

5. The total in CO2eq, in 2005, according to the Second National Communication of Greenhouse Gas Emissions was 2.0 Gt. The Third National Communication of Greenhouse Gas Emissions revised this to 2.83 Gt (GTP-ARS).

I) in the energy sector:

- achieving 45% of renewables in the energy mix by 2030, including:
- expanding the use of renewable energy sources other than hydropower in the total energy mix to between 28% and 33% by 2030;
- increasing the share of sustainable biofuels in the Brazilian energy mix to approximately 18% by 2030, by expanding biofuel consumption, increasing ethanol supply, including by increasing the share of advanced biofuels (second generation), and increasing the share of biodiesel in the diesel mix;
- expanding the use of non-fossil fuel energy sources domestically, increasing the share of renewables (other than hydropower) in the power supply to at least 23% by 2030, including by raising the share of wind, biomass and solar;
- achieving 10% efficiency gains in the electricity sector by 2030.

II) in land use change and forests:

- strengthening policies and measures with a view to achieve, in the Brazilian Amazon region, zero illegal deforestation by 2030 and compensating for greenhouse gas emissions from legal suppression of vegetation by 2030;
- restoring and reforesting 12 million hectares of forests by 2030, for multiple purposes.

III) in the agriculture sector:

- strengthen the Low Carbon Emission Agriculture Program (ABC) as the main strategy for sustainable agriculture development, including by restoring an additional 15 million hectares of degraded pasturelands by 2030 and enhancing 5 million hectares of integrated cropland-livestock-forestry systems (ICLFS) by 2030;

Some generic unquantified commitments were also presented for some sectors:

- in land use change and forests: strengthening and enforcing the implementation of the Forest Code, at federal, state and municipal levels; enhancing sustainable native forest management systems, through georeferencing and tracking systems applicable to native forest management, with a view to curbing illegal and unsustainable practices;

- in the industry sector, promote new standards of clean technology and further enhance energy efficiency measures and low carbon infrastructure;

- in the transportation sector, further promote efficiency measures, and improve infrastructure for transport and public transportation in urban areas.

These sectoral goals mentioned in the "Additional References" document are here regarded as a flexible reference since a much more comprehensive sectoral approach has now been developed in this process. Our focus is on how to accomplish these two economy wide targets of 1,3 Gt and 1,2 Gt for 2025 and 2030 in ways compatible with a long term decarbonizing strategy aiming at net zero early in the second half of the century.

Our exercise was basically one of policy construction, taking into account different visions, interests and political circumstances. On the technical level, tens of studies and sources were considered but basically four were used as our main reference, presented at the TCs and discussed: "Projeto Opções de Mitigação de Emissões de Gases de Efeito Estufa em Setores-Chave do Brasil" (Greenhouse Gas Emissions (GHG) Mitigation Options in Key Sectors) commended by the Ministry of Science, Technology, Innovation and Communications (MCTIC); "Implicações Econômicas e Sociais de Cenários de Mitigação de GEE até 2030 do Projeto IES Brasil" (Economic and Social Implications of GHG Mitigation Scenarios until 2030, from Project IES Brasil) and data coming from the "Sistema de Estimativa de Emissões e Remoções de Gases Efeito Estufa (Greenhouse Gas Emission and Removal Estimating System – SEEG, a civil society based service, linked to Observatório do Clima (Climate Observatory).

The FBMC highlighted the actions of greatest mitigation potential and informed the members of the TCs about these studies. Some additional measures considered relevant by members of the TCs were collected. Dozens of other studies were also consulted in the process, and more than 50 technical references were consulted by TC 1[6] related to forests and agriculture.

Between July and September 2017, the TCs discussed the actions related to their sectors. All measures proposed by TC members were published including all participants' suggestions. At this stage, suggestions were discussed at the TC meetings and conference calls. In the next phase, called "Compilation of Measures", the FBMC team organized the action suggestions into documents approved by the groups as drafts to be processed in a multi-criteria analysis. Similar or related measures were merged and the short-term actions, previous to 2020, were separated in a different document (The Short Term Actions).

The next step was the multi-criteria assessment of the selected actions. In this phase, we used the decision making support model Macbet (Measuring Attractiveness by a Categorical Based Evaluation Technique), developed at the London School of Economics and the University of Lisbon. This method allowed us to evaluate selected mitigation actions in the light of different criteria, with previously defined weights for: 1 - mitigation potential, 2 - compatibility with long-term strategy, 3 - social impacts, 4 - local environmental impact, 5 - economic plausibility and 6 - political-institutional viability[7]. This phase began in the second half of September and ended in the first week of October 2017, with three combined sectoral workshops: Forestry and Agriculture; Energy + Industry; Transport + Cities and Waste; and a fourth on economy-wide instruments.

A further consolidation effort was made, taking into account the need to keep the document as simple as possible, eliminate redundancies and include the results of the new consultation round. It became necessary to have an additional round of discussion on these latest consultations to complete their selection and inclusion since most controversies were related to them. Pre-2020, short-term, normative, measures were not included in this Proposal. They need further discussion and will be presented separately.

The second round of discussion for the Initial Proposal took place between September 2017 and May 2018.

6. The list of studies that subsidized TC1 is on the FBMC website https://www.fbmc.com.br/copia-2017 on the link of listing studies.

7. The multi-criteria analysis allowed a better understanding of the potential, the effects and the circumstances for the viability of the mitigation actions discussed and helped in the selection of those presented here. It was a useful but not consensual tool. The most controversial issue, that should be the subject of further discussion, was the precise weights to be assigned to each of the six criteria.

The online consultation through the FBMC web site registered more than one thousand visits and fifty formal suggestions or criticisms. Scientist Carlos Nobre helped revise the draft. A high level revision seminar was held, in March 2018 with historic participants in Brazilian climate policy building and international negotiation, including, at that time, the Minister of the Environment Sarney Filho and two former ministers, Izabella Teixeira and Carlos Minc; Brazilian negotiators at international conferences, like Luiz Gylvan Meira, Everton Lucero, Eduardo Assad, academics like Luis Pinguelli Rosa(former FBMC executive secretary), Emilio La Rovere, Sergio Besserman and NGO leaders, like Israel Klabin (FBDS), Tasso Azevedo (SEEG), Ana Toni (ICS) and Daniela Lerda (FF).

Two other workshops were held on fiscal and market economic instruments. There were also some bilateral discussions with relevant players like the presidents of Petrobras and Shell, Pedro Parente and André Lopes de Araujo. At that stage, the first draft was also presented to the GEx (Executive Group for Climate Change) constituted by representatives of seven ministries: environment; foreign affairs; agriculture; mines and energy; development, industry and commerce; planning and finance.

This NDC implementation roadmap proposes the reactivation of the Brazilian carbon market - which requires the establishment of sectoral targets for cutting emissions (in carbon intensity terms); establishment of a reliable MRV system (Monitoring, Verification and Registration of GHG emissions); and progress in carbon pricing[8]. Brazil has significant competitive advantages to attract investments in "negative emissions", especially in reforestation and biomass energy use. De-carbonizing criteria should be part of any future fiscal reform in Brazil's dysfunctional taxation system.

The economic and social impacts of the greenhouse gas emission mitigation actions proposed here were thoroughly considered. According to previous conclusions of MTIC Opções de Mitigação and the COPPE/UFRJ IES Brasil, two of the studies on which this proposal is technically based upon[9] these impacts will be globally positive for economic and social development, income, employment, and the competitiveness of the Brazilian economy, they demand however important upfront investments. Politically, some present hurdles need to be overcome.

8 It should be noted that the MCTIC Opções de Mitigação study for 2030 considers a carbon price of US $ 10 per ton, for accomplishing the 2030 mitigation target, either through taxation or through sectoral targets that could be supported by carbon credits in the Brazilian Carbon Market.

9 The studies Opções de Mitigação and IES Brazil were used as references.

The present proposal also includes adaptation measures from the discussions in TC 10 (Adaptation), which defined as its main focus the infrastructure and assessment of the mitigation measures defined by other TCs under the lens of risk management and climate change. In addition to sectoral adaptation issues – crop migration, new seeds, natural disaster warning plans, upgrading of urban, coastal and river infrastructure, etc. – it will be necessary to address health, food security, biodiversity protection and impact monitoring systems at national and international levels.

The implementation of the Brazilian NDC should be compatible with a Long-Term Strategy towards net zero emissions in the second half of the century, around 2060. The FBMC has been required by the President to evaluate this ambition.

The mitigation potential of the actions here proposed in the sectors of forestry, agriculture, livestock, transportation/mobility, waste and energy, were based on the latest data available of the mentioned studies and sources. In our conclusions, however, we question the current baseline scenarios of these studies based on the assumption of a full fulfillment of previously defined government policies, goals and budget appropriations, all set prior to the NDC and related to the Brazilian Nationally Appropriated Mitigation Actions (NAMA) domestically mandatory by means of the 12187/09 Climate Change Law, executive decrees and other normative and policy developments related to it: the National Policy on Climate Change (PNMC), the ABC (Low Carbon Agriculture) Plan, the National Policy on Solid Waste (PNRS) and others. The concrete results of all those government programs still need to be properly assessed. Concerning GHG emissions related to deforestation, there are differences between goals stated in the NAMA[10] and the domestic regulation related to it. The latter, expressed in square kilometers, is actually more ambitious.

To what extent are they actually being carried out? How is their execution schedule? Do their costs remain as previously calculated? Are their budget resources, previously defined, really available? What were the effects of the recent recession and the deep political/institutional crisis experienced by the country and, above all, what are the future consequences of the measures to curb public expenditures deployed over time? What are the precise consequences, on climate policies and on established goals,

10 In its NAMA communication Brazil establishes, quite approximatively, a target for deforestation related emissions below 415 MtCO2eq, by 2020. In the domestic legal framework established by Law 12187/09, the 7390/10 Decree establishes a target in square kilometers limited to the Amazon: under 3900 km2, in 2020, which implies emissions emissions below 384 MtCO2eq.

of the severe restrictions on public spending, resulting from Constitutional Amendment 95 strongly curbing public spending for the next 20 years? What will be the political consequences of the 2018 presidential, congressional and state elections for climate policies?

It is urgent to compile a realistic picture of the goals for 2020 defined in the legal, regulatory and policy framework related to the Nationally Appropriate Mitigation Actions (NAMA), Brazil has committed to, previously, in order to offer greater reliability to the NDC ones, by 2025 and 2030. This Initial Proposal establishes, in some cases, new estimates, which we have considered more realistic, for specific sectoral mitigation potentials, as well as an alternative baseline projection (the more-of-the-same scenario) for 2030.

It was not possible to establish here the overall costs of the NDC and of its specific actions. Available studies tend to take for granted all previously announced investments and budget allocations related to the NAMA. The great recession of the last few years and economic decisions of great repercussion, especially the ones resulting from Amendment 95, have significantly de-funded governmental programs and eroded the availability of public investment greatly increasing the demand for new sources of financing yet to be identified.

The very limited resources of the FBMC, at this stage, did not allow us to estimate these costs beyond what is already mentioned in the above mentioned studies. For example, the Opções de Mitigação project (MCTIC 2017), which was based on maximum effectiveness/cost for mitigation actions, estimated the cost to meet NDC targets of 2025 and 2030 at U$ 28.5 and U$ 41.2 billion, respectively, in addition to what would have already been invested in the set of public policies that constitute its baseline scenario. This study has also correlated the achievement of the economy wide mitigation target for 2030 to pricing carbon at US$10 a ton. The various cost estimates of different studies and sources are based on a set of diverse assumptions. As for the adaptation costs, they are even more complex to assess. A precise and up-to-date calculation of all these NDC costs is essential and demands an urgent specific study.

The next steps in this process include new proposals relating to the definition of sectoral mitigation targets and the assessment of its costs; short term pre-2020 actions; a new climate change governance; coordination with subnational and local governments; the development of comprehensive adaptation plans; MRV mechanisms to follow implementation; a conditional proposal for ratcheting our NDC in the future and a long term strategy aiming at net zero emissions before 2060.

As stated in its title this document is an initial proposal. Its most relevant asset is the political clout of its participatory process. However, to become Brazil's strategy for truly implementing the NDC it will have to face a new cycle of discussions with government bodies and private sector in order to structure, fund and execute the actions here defined. It will also have to deal with the complex issue of continuity in variable political and governance circumstances. Quite a challenge, indeed.

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FLAVIO FORNER / AMBIENTAL MEDIA

II.
Mitigation Actions for Brazil's NDC

1 – Forests

Forests is the sector where Brazil has achieved the largest emission reduction since 2005, its "base year", by bringing down substantially deforestation in the Amazon by 82% between 2004 and 2014[1]. It is undeniable that we are today at a different level from that peak period.

Reducing illegal deforestation continues to be the mitigation action producing the fastest and most intense results. The short term goal is the fulfillment of the NAMA commitments expressed in the Decree 7.390/10, which regulates Law 12.187/09. The decree establishes a reduction of deforestation in Amazon by 80% over the 1999-2008 average for 2020, which would correspond to approximately 3,900 km². In 2017, it was close to 6,900 km². There is some controversy on how to calculate these targets due to ambiguity in the NAMA regulation.

1. Deforestation in the Amazon, which reached 27 thousand km² in 2004, fell to 4,5 thousand km² in 2012. It then rose again to almost 8 thousand km² in 2016, with a possible new inflection point in 2017, when it fell to 6,9 thousand km².

The FBMC has adopted the target in square kilometers, in 2020, the reference year for assessing this goal.

Two scenarios have been put forward for attaining our economy wide mitigation targets: "the Balanced Scenario"(BS) that besides measures related to land use already presupposes reduction of emissions by burning of fossil fuels and the "AFOLU Scenario" (AS) based on an effort very much concentrated on actions related to land use. The FBMC strongly recommends the first scenario because of its modernizing effects on the rest of the economy and its compatibility with a long-term strategy towards zero net emissions.

The main goal of forest emissions reduction in the NDC as stated in the 2015 "Additional Information to the NDC" is zero illegal deforestation by 2030. During the NDC period (2020-2030), the forestry sector is the one likely to produce most of the Brazilian mitigation results, even in the Balanced Scenario (BS), in which some aggregate mitigation is achieved by reducing fossil fuel emissions.

This Initial Proposal contemplates two kinds of actions in the forestry sector: those directly delivering emissions' reductions or carbon sequestration and those facilitating it.

1.1 - Reducing deforestation

Meeting the goal of zero illegal deforestation in the Amazon would correspond to a mitigation potential, in 2030, of approximately 550 MtC02eq. Although the legal obligation seems quite obvious, the feasibility of achieving 100% success against all illegal suppression is questioned by experts. The reduction of legal deforestation in other biomes, especially the Cerrado[2], could add an emission reduction of around 47.7 MtCO2eq. However, it depends crucially on the success of certain economic incentives, such as Payment for Environmental Services (PSA), for ecosystem services rendered by the "standing forest" and the Environmental Regularization Program (PRA) mechanism[3] since new legislation for restricting deforestation, at the federal level, depending on Congress, is highly unlikely. Legal deforestation has become a big problem especially at the Cerrado Region, where deforestation, mostly legal, attained 7,408 km2, in 2017, a larger area compared to the illegal deforestation in the Amazon in the same year. One should consider, however, much lower emissions per km2 in the Cerrado savanna forest compared to the Amazon tropical rainforest.

These two broad lines of action against both illegal and legal deforestation could, in the projections made here, result in an emissions' reduction of 597.7 MtCO2eq, in 2030. This would rely on a full blown accomplishment of command and control actions as well as the success of economic stimulus mechanisms to avoid the legal deforestation. An intermediate hypothesis, however – still reasonably optimistic – would be to attain 60% of this performance: -358 MtC02eq, in 2030.

For an "AFOLU scenario" – without the significant contribution of aggregate reduction of fossil fuel emissions in transport – this cutback in deforestation would have to go up to 95%, of the overall theoretical potential i.e. – 567.8 MtCO2eq.

Proposed mitigation actions:

2. In the Amazon, legal deforestation represents only 5%. In the Cerrado, deforestation is mostly legal.

3. That allows to compensate the so called "legal reserve" (part of a rural property for compulsory guarantee of the preservation of local biodiversity). The owner who does not have the percentage of Legal Reserve required by law at his property, can acquire this compliance in another rural property, preserved beyond its own Legal Reserve.

1.1.1 – New protected areas on undesignated public lands in the Amazon.

Facilitate the fight against land grabbing by means of designating public areas. There are large areas of undesignated federal and state forests that have been already technically studied for this kind of designation. Land grabbing does not occur only in these undesignated federal lands but increasingly in legally protected areas as well. Therefore, the legal designation is not a panacea for conservation. It demands sets of subsequent actions. Nevertheless, it constitutes a low cost measure that can help curb deforestation. It must be coupled with policies for the maintenance of protected areas, involving public resources. Land grabbing of protected areas and indigenous reserves can only be interrupted by vigorous command and control action.

We propose the conversion of 50% of the undesignated public forests, approximately 35 million hectares, mostly in the Amazon, into environmental protected areas or indigenous lands. There is a mitigating effect to it that is merely statistical: it would increase the volume of carbon sequestration to be accounted for as negative emission (according to the IPCC criteria used in the National Communications of GHG emissions) by approximately 70 MtC02eq. As such, it would get into the calculus of Brazilian net emissions[4]. However, it does not physically constitute new carbon sequestration. A smaller part, truly effective but difficult to calculate, a priori, represents emissions effectively prevented by the restriction of land grabbing of public forests by stronger law enforcement following the designation of new protected areas.

4. The carbon sequestration by Conservation Units (UCs) and Indigenous Lands (TIs) is currently of approximately 320 MtCO2eq. This total is discounted from gross emissions in order to estimate the Brazilian net emissions. New UCS and TIs would add to this statistical effect without, however, altering the physical reality of carbon sequestration that already occurs. There are also questions about the lastingness of this absorption capacity of forests. According to some studies it may be dwindling. It is also important to note that the Brazilian way of accounting is stricter than the one used by several OCDE nations that count in carbon sequestration by most kinds of monitored green areas when calculating their net emissions.

1.1.2 - Expansion of command & control actions against deforestation

The federal and state command and control structures a very much depleted compared to the previous period. Strengthening the IBAMA and ICMBio with the restoration of its depleted staff and equipment, as well as those of the states' environmental institutions. Expansion of volunteering for monitoring and alert using new digital tools, including 'big data' analysis. Increase the value of fines for deforestation, equalizing state and federal ones. Currently state fines are much cheaper. Development and expansion of satellite monitoring capacity for swift embargo punishing non-compliance with the Forest Code. Reinforcement of credit restriction mechanisms based on the CAR (Rural Environmental Register) with the creation of independent verification systems.

1.1.3 – Actions to minimize emissions from agriculture and forest fires

Forest fires are a very serious and complicated problem since they tend to increase as a result of the climate change already under way producing droughts and more vulnerability. Emissions from these fires are not accounted in GHG inventories - there is no IPCC-approved methodology as yet. They can reach high peaks close to 1 GtCO2eq during periods of drought. In the not-too-distant future there will be reasonably reliable methods for differentiating truly natural occurrences from man triggered ones due to criminal action or mismanagement.

This Initial Proposal advocates the expansion of command and control to prevent fires on pastures from reaching the forest; the acquisition of fire-fighting aircraft; the participation of state and local organizations in education/prevention; the mobilization of volunteers aiming at the diffusion of agricultural techniques without fire and/or with their sustainable management, and always respecting the traditional culture of indigenous communities, which must be a core objective of a specific program.

1.1.4 - Payment for environmental services rendered by forests (PSA)

Economic incentives to provide better local political conditions to combat illegal and avoid legal deforestation. It is possible to expand and better target the different modalities of PSA for local populations, by helping to prevent deforestation and protect soils and water, or as compensation to the private sector for avoided deforestation there where it is legally permitted. In both cases it must be associated with the financing of some kind of productive activity. In addition to the immediate political effect of stimulating the reduction of illegal and legal deforestation, such an instrument must also stimulate the inflow of resources for a sustainable local economy.

1.2 - Expansion of native forest restoration/planting

Natural restoration of native forest with investments in fencing and monitoring the area to be recovered. Reforestation of native species. The annual mitigation potential of this action, for 2030, covering 9.3 million hectares, would be 9.5 MtCO2eq, according to the MCTIC Opções de Mitigação study. There are significantly much higher estimates, up to 72 MtCO2eq, of this potential for mitigation by restoration of natural forests if we take into account the new mechanisms and obligations of the Forest Code Law for the restoration of Permanent Preservation Areas (APP) and Legal Reserves (RL), identified by SEEG.

This variation of in the estimate of mitigation potentials seems to be related to different assumptions as to their levels of implementation and particularly the inclusion or exclusion of native forest restoration related to these Forest Code obligations concerning APP and RL. There are also some difficulties to discern these carbon removals from those coming from legally protected areas, already accounted for the calculation of net emissions. At this time, we have adopted the more conservative estimate of MCTIC Opções de Mitigação.

1.3 - Expansion of commercial forest cultivation

Expanding the plantation of commercial forests in degraded areas relies upon the growth of market demand for more diversified use of timber beyond current ones – mostly paper/cellulose – such as the energy generation from biomass, pellets for export and increased use of wood in construction and infrastructure. This provides a double mitigation effect: carbon sequestration in the afforestation process and subsequently, cleaner energy production. Planted forests also have a stronger potential for finance and can, to some extent, help fund forest restoration with native species[5], through combined projects.

With 3 million hectares in 2030, in addition to the existing area of planted forests, these new forests would contribute 18 MtC02eq (SEEG, 2017). In a larger expansion scenario they could cover up to 10 million hectares, in 2030 and absorb 23.6 MtC02eq (MCTIC Opções de Mitigação). There is controversy on the feasibility of this extension. The median mitigation potential hypothesis[6] is 20.8 MtC02eq.

Supporting measures:

5. Research for the development of species of better economic potential from the immense diversity of Brazilian trees (estimated between 15 and 16 thousand different species) and landscape planning, considering agricultural production mosaics, interspersed with native vegetation. In a long-term strategy, growing commercial forests, always in degraded areas, could reach up to 14 million hectares by 2050 (MCTIC Opções de Mitigação).

6. It is important to note that the "median hypotheses" used in this Initial Proposal obviously do not stick to scientific or academic benchmarks. They are a way of dealing with discrepant mitigation potentials evaluation of equally respected sources regarding the mitigation potentials of certain actions/measures in order to provide decision-makers with figures we consider the most plausible.

1.4 - Creation of a unified Registration system for forest carbon

It is necessary to develop an internationally recognized and technologically state-of-the-art registration system for the accurate register of emission reductions from avoided deforestation and carbon sequestration from reforestation and afforestation projects. Such a system will improve future national and international opportunities related to the preservation of native forests and the negative emissions resulting from carbon by sequestration restoration and planted forests.

Indeed, up to 50% of the negative emissions required for a global scenario of 1.5°C increase may come from new forests. There is already reasonable scientific confidence that natural carbon sinks in the existing forests will tend to decline greatly in the coming decades. Thus, negative emissions will have to come from natural regeneration, reforestation and afforestation. This is part of a long-term strategy and will be an important element of a more ambitious NDC in the next review cycles.

1.5 - Tax stimulants for states and municipalities that reduce deforestation or increase forest cover

Creation of mechanisms that encourage states and municipalities to participate in actions to prevent deforestation and encourage reforestation. This type of incentive already exists in the areas of health, social assistance, etc. The reduction in the cost of water treatment, or the increase of useful pollinators to agriculture provided by more preserved systems, should be accounted as PSA producing fiscal benefits for the municipalities where those ecosystem services take place.

2 – Agriculture and Livestock

Agriculture is the power house of Brazilian economy and is also responsible for more than 20% of the energy matrix (liquid and solid fuels and bioelectricity). It has an important mitigation potential and it faces major adaptation and risk management challenges due to climate change. Its major emission source is the enteric fermentation of bovine herds emitting methane (CH4). Removals of vegetation associated with certain farming techniques produce CO2 emissions.

There is a strong convergence potential between good agricultural and livestock practices, of economic interest for the private sector, and the reduction of CH4, N2O and CO2 emissions. This requires the expansion of the ABC Plan/Program (Low Carbon Agriculture), but above all, the extension of its techniques to the Safra Plan[7].

Proposed policies:

7. The ABC Plan had R$ 2.1 billions allocated for 2017/18. The Safra Plan had R$ 190 billions, in the same period.

2.1 - Adoption of ABC techniques in the Safra Plan and expansion of the current ABC Program for the period 2020-2030

The Safra Plan is the big instrument for financing agriculture and it should adopt - with less bureaucracy – the criteria, methods and good practices of ABC, such as: pasture recovery, the biological fixation of nitrogen, the crop-livestock and crop-livestock-forest integration, no-till farming, treatment of animal waste for composting, agroforestry systems (SAFs), and planting of commercial forest; all of them no regret mitigating measures.

In relation to the ABC Plan, there is need for expanding existing resources; the promotion of its forestry component; the creation of a Guarantees in Fund for financing in those regions with precarious ownership notary record; a greater availability of resources and technical support; the equalization of its interest rates with those of the so-called “constitutional funds” benefiting conventional agriculture, in the North and Northeast regions; easing bureaucratic hurdles and bottle necks by allowing private banks to act as financing agents along with the public ones. There is also the possibility of creatively using agrarian debt amortization to promote the adoption of ABC techniques.

Mitigation actions:

2.1.1 – Pastures' recovery

Pasture recovery is the ABC measure with the greatest mitigation results. Currently the Brazilian GHG inventory does not fully include the associated potential for carbon sequestration in the soil. There is an unresolved controversy about how to calculate the mitigation potential of this. The estimates range from 49 MtC02eq, corresponding to 15 million hectares of reclaimed degraded pastures (SEEG, 2017) to a much more conservative potential of 7.4 MtC02eq estimated by the MDIC Opções de Mitigação study, i.e. 32 million hectares.

This big difference is due to the fact that until now Brazilian GHG inventories do not include soil carbon sequestration resulting from pastures' recovery. There are important discrepancies in these assessments due to different estimates of the capacity for carbon absorption by diverse kinds of soils. We here adopt, yet again, the more conservative estimate. However, in the future, this can change depending on new IPCC directives on the issue and scientific progress in the ability to measure carbon sequestration and forecast its permanence in different kinds of soils.

2.1.2 – No-till farming and biological fertilization of nitrogen

No-till planting and biological nitrogen fertilization offer a strong convergence of mitigation of GHG emissions with more productive agricultural techniques and is being implemented on a fast growing scale by agrobusiness. According to the calculation of MDIC Opções de Mitigação, it currently presents a mitigation potential of 2.5 MtC02eq. In the SEEG assessment, the value is estimated at 35 MtC02eq. Again, we face very divergent and difficult to reconcile estimates by reliable sources. Our working hypothesis a median estimate of 16.2 MtC02eq.

2.2 - Improve productivity of livestock management

The issue of mitigation potential in livestock also faces controversial claims. There is a consensus that enclosure confinement and improved pasture quality lead to early slaughter, which in turn reduces the enteric emissions of methane (CH4) from beef cattle. In this sense, this kind of higher productivity and shorter life span can reduce emissions, ensuring lower carbon intensity per head. However, an increase of the herd may reverse this gain and produce an increase in aggregate CH4 emissions.

What would be a realistic projection of herd growth in Brazil? In 2012, the herd was estimated at 212 million. The MDIC Opções de Mitigação study adopted data from the Ministry of Agriculture (MAPA)[8] which forecast a herd of 313 million in 2035, a projection strongly disputed for which no evidence has been seen in the recent years. The same MAPA estimate projects a herd of 348 million by 2050. There are, however, uncertainties regarding the long term role of beef in food diets and the impact of the development of synthetic meat products.

8. In this evaluation there are civilizational components, biotechnology trends, economic interests and divergent long-term economic evaluations. Here we opt for a conservative evaluation in the herd growth projection that differs from the governmental one.

The second controversy is fairly traditional and of a scientific nature, it concerns the correlation between CH4 and CO2. There is a challenge to the established formula the Global Warming Potential (GWP) metric of one ton of CH4 equal to 28 tons of CO2. GWP, however is better fit for long lived climate gases which is not the case of methane. Another form of calculating, the Global Temperature Potential GTP metric, could indicate a proportion closer to 1 to 5. However, the IPCC adopts the former methodology and does not seem bound to change it in a foreseeable future. For this reason, the estimate used in our inventories is maintained here[9].
MDIC Opções de Mitigação estimates that the expansion of cattle enclosure and confinement will affect 10.5 million cattle, in 2030, with a mitigation potential of 36.7 MtCO2eq in 2030. The SEEG estimates this to account to 9 MtCO2eq. The median hypothesis adopted is 22.8 MtCO2eq

9. This controversy already occurred in the 1990s and there is apparently no political environment for a review under the UNFCCC and the IPCC, although the questioning remains scientifically quite plausible.

3 – Transport and mobility

For a Balanced Scenario (BS), the transport / mobility sector will have to contribute by reducing CO2 emissions from burning fossil fuels, in the aggregate, through a set of measures that stimulate medium and high capacity transit and disincentivize individual motorized vehicles in urban areas; promote low-emission areas in central urban areas; greater use of rail and water modes (cabotage and inland navigation); greater efficiency in the burning of fossil fuels; specific energy efficiency targets for heavy vehicles and a large-scale adoption of biofuels, and electrification substituting fossil fuels. It is possible to achieve significant benefits through the establishment of national mobility and logistics sustainability programs integrating all these actions and structuring them consistently with the expected results.

The automobile industry has been signaling a very insufficient mitigating contribution in an apparent mismatch with the international trend towards electrification by the automakers' own headquarters. This apparently reflects an intention of keeping the Brazilian market as a haven for less efficient fossil fuel vehicles.

Collective and individual passenger transport can reduce significantly emissions through increased use of both biofuels and electrification, starting with the full potential of flex-fuel engines, by expanding their mix - which depends on legislation - and by reducing the relative price of ethanol. GHG emissions should be included in the list of atmospheric pollutants, as well as a more stringent regulation of emissions of pollutants with local and non-greenhouse effect such as black carbon. A Balanced Scenario(BS) for the NDC, which would not depend almost exclusively on the AFOLU sector, requires Brazil to promote a resolute advance in energy efficiency, automotive biofuels and some electrification by 2030.

In the cargo transport, the country's huge dependence on road and diesel (66% of the cargo) has become a national security conundrum. Significant expansion of rail and water freight transport, increased use of biofuels and electrification are actions that combine mitigation of CO2 emissions and pollution with a response to this extremely serious vulnerability affecting Brazilian society and economy.

Proposed actions:

3.1 - Expansion of public transport, active mobility and rationalization of individual motorized transport

This set of actions with direct and indirect effects includes incentives for high capacity public transit (train, subway, tram, etc.); establishment of measures to discourage motorized individual transport in supersaturated urban areas; the promotion of active transport with widespread implantation and expansion of the cycle network; the adoption of intermodal integration systems and applications; imposing a burden on congestion and establishing parking restrictions; and providing comfort and safety for the pedestrian with the adequacy of sidewalks and squares. All these constitute "background" measures that contribute to NDC's goals and to medium- and long-term strategies with positive, immediate consequences in terms of reducing local-effect pollution with a positive effect on health and quality of life for the population.

The mitigation potential of all these policies, by 2030, is estimated at 15 MtCO2eq in the MCTIC Opções de Mitigação and 9 MtCO2eq in SEEG. Our median hypothesis would be 12 MtCO2eq.

3.2 - Diversification of modes and optimization of cargo transportation

This proposed action involves the implementation of already existing projects to extend the rail and water modes (cabotage and inland navigation), the anticipation of renewal of rail concessions, the extension of its network, as well as multimodal logistics platforms and other measures to reduce inefficiency in the transport / logistics operation.

Potential for mitigation by 2030: 3.8 MtCO2eq, according to MCTIC Opções de Mitigação.

3.3 - Increased energy efficiency of the fossil and flex fuel fleet, including diesel in freight transport

Improved energy efficiency of diesel trucks and buses with the adoption of advanced international standards in the Brazilian automotive regime, establishing progressive energy efficiency targets and the recovery and paving of federal highways. Assistance to the workers for the transition and the retraining of the autonomous truck drivers. Improved energy efficiency of fossil fuel vehicles with significant decrease in fuel consumption per kilometer. Utilization of the full potential of the ethanol component in flex-fuel engines, nowadays far behind, because of the relatively high price of ethanol in relation to gasoline.

Change in yearly licensing of vehicles in Brazil, going from the current model "by cylinder capacity" to charging for "energy efficiency and emission of pollutants". Preferential financing for less emitting and zero emissions electric vehicles in urban transit. Public sector partnerships with automakers and dealers in the repurchase for immediate scrap of old vehicles providing cheap credit for the acquisition of new, less polluting vehicles.

Mitigation potential of this measure is estimated at 5.0 MtCO2eq, in 2030, according to MCTIC Opções de Mitigação.

3.4 - Expanding vehicles on biofuels, electric and hybrid

In the Balanced Scenario(BS) for the NDC, in the period up to 2030, conventional (biodiesel and ethanol, anhydrous and hydrated) and advanced biofuels[10] (e.g. cellulosic ethanol) will surge aside the dominant fossil fuel automotive fleet. An incipient but fast growing electrical component will come into view demanding the development of adequate power network infrastructure. In the long term, vehicle fleets tend toward electrification. This will be instrumental in a long-term strategy for zero net emissions. Electrification is the future trend of the global auto industry. Clear targets have already defined by countries like Norway, France, China, India, the Netherlands and the United Kingdom[11]. Its development in Brazil will depend on industry decisions and market circumstances, still unclear at this time, as well as on the pace of establishment of a comprehensive smart grid capable of supporting the electric vehicles on a national scale.

10. Associated with the implementation of technological development and technological innovation mechanisms for energy efficiency and an adequate pricing policy so that it does not generate negative socioeconomic impacts, especially on consumers with high vulnerability.

11. France, India, the Netherlands, Norway and the United Kingdom have announced that the sale of new gasoline and diesel cars will be banned from 2040, 2030, 2025, 2025 and 2040 respectively. China plans electric and hybrid cars to account for at least 20 percent of sales by 2025.

Federal and state fiscal stimulus for electric mobility in public transport and for a nascent electric car industry would be beneficial. Currently, electric cars are taxed as luxury items (golf carts!). The creation of programs prioritizing flex and electric hybrid vehicles in public sector fleets should be encouraged. The improvement of the regulatory framework is already in progress with the RenovaBio Law (in the normative phase), and some the changes in Rota 2030, a new Brazilian – still very lax – automotive regime.

This set of actions represents mitigation potentials of 5.0 MtCO2eq in 2030, according to MCTIC Opções de Mitigação while SEEG estimates a potential of 19 MtCO2eq (SEEG, 2017). Average estimate: 12 MtCO2eq. The IES Brasil best case scenario estimates in 5% the proportion of electric vehicles, in 2030.

3.5 - Fostering aviation bio-kerosene and greater efficiency in air transport

Brazil can become highly competitive in the aviation bio-kerosene market. Its production comes mainly from macaúba oil. Macaúba's culture is of great interest because it combines carbon sequestration (negative emissions), with production of a lower emissions biofuel in substitution of a fraction of fossil aviation kerosene and has a positive socioeconomic impact as well.

There is also some margin for mitigation through optimization of the air operations and airport infrastructure. Domestic air transport will inevitably increase its emissions in the aggregate[12]. In the context of a well-balanced scenario (WBC) for the NDC these emissions require setting goals consistent with the specificities and limitations of the air transport sector. An important unresolved issue is the one related to an early adhesion of Brazil to The Carbon Offsetting and Reduction Scheme for International Aviation (CORCIA). No consensus related to it could be obtained in this process.

12. Long term projections indicate that Brazil will become the 3rd largest domestic air traffic market in the world, with an expected increase of approximately 95% in fuel consumption of international flights departing from Brazil from 2014 to 2050 and approximately 102% between 2014 and 2050, exclusively in the consumption of Brazilian companies that operate in the international segment. Source: SAC / PR - Secretariat of Civil Aviation / Presidency of the Republic of Brazil.

Emissions of Brazilian-flagged aircraft in international flights should also increase significantly as a result of the increase in the number of passengers. These emissions will be dealt with by CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation), which establishes, from 2020, neutral emissions growth through offsets or the use of biofuel[13], estimated at around 1,5 MtCO2eq, in the year 2030. This should include neutralizing post 2020 growth of all emissions from aviation kerosene marketed in Brazil, in addition to meeting CORSIA requirements. The neutralization demand related to these domestic aviation emissions increases is estimated in 8.3 to 12.4 million tCO2e, in the 2020/2030 period.

The establishment of a national policy for biokerosene, encompassing research and development, financing, public-private partnerships, regulatory framework, distribution and logistics infrastructure, financing, and tax incentives, will allow the development of air transport with a lower carbon footprint, contributing to the achievement of the goals of the Brazilian NDC. There is a great potential related to the global biokerosene market (estimated at 314 million m^3 / year). In the short term, Brazil has good conditions to produce it and to establish bilateral partnerships for its supply.

13. Starting in 2020, air transport companies will have to neutralize their emissions on international flights that exceed the limit issued that year. This scenario preliminarily points to a need to avoid around 1.5 million tCO2e in the year 2030, which will represent approximately 678 thousand tons of sustainable aviation fuel. However, the Brazilian government and companies, so far, do not accept to join the first "voluntary" phase of CORCIA.

4 – Cities and waste

The effects of modernist urbanism and segregation of uses, from the past, will remain for a long time and replicate a pattern inducing higher emissions. Cities, in the future, should aim for less sprawled and carbon-intensive urban tissue. They are home to most GHG emissions, but local power has instruments of regulation and control over just part of them: public urban mobility policies, consumption patterns of electricity, construction materials, solid waste and sewage treatment and green spaces: parks, squares, public afforestation, roofs and facades.

A WBC demands a strong participation of subnational, metropolitan and local institutions, through actions also related to a long-term strategy for which it is fundamental to adopt decarbonizing urban norms: density patterns; mixed uses; taking advantage of existing infrastructures, avoiding urban sprawl and segregation of uses, spatial and social, as well as the promotion of low emission zones, favoring pedestrians, cyclists and urban public transport with low emission of pollutants and GHGs. Cities with these attributes and which are "smart", with intensive use of digital technologies will help to accomplish the NDC and the long term strategy for net zero. Given that most of those are qualitative actions, the precise quantification of their mitigating potential is difficult at this time.

The quantitatively more measurable mitigation actions are the ones related to reducing methane emissions from waste and sewage, which have been increasing with a troublesome potential for growth in an area where emissions have been expanding steadily in the last two decades.

Proposed actions:

4.1 - Expanding capture and use of methane from dumps, landfills and effluents

The use of CH4 from waste for energy production and transport. Very few landfills have this capacity at this time.

4.2 - Increase the volume of composting

Large scale production of food waste, sewage, twigs and leaves from urban pruning and compost can contribute significantly to carbon fixation in the soil with biogas as a byproduct.

Actions of 4.1 and 4.2, combined, have mitigation potential of 8 MtCO2eq.

4.3 - Degrading landfill methane with flare

Incineration, in landfills where reuse is not viable is a cheap alternative with considerable mitigation potential: 20.8 MtCO2eq in 2030, according to MCTIC Opções de Mitigação .

4.4 - Reverse logistics, reduction at source and selective waste collection

The proportion of non-recycled waste should be reduced by reverse logistics circuits by companies and by selective collection, with federal support to local and regional programs. It should be associated with wide-ranging Environmental Education programs. Schools at different levels are important in stimulating and implementing this action.

5 – Electric power

The Brazilian electricity sector is comparatively clean, but the role of its hydroelectric component will decrease in the NDC period and even more so in the long run. Growing GHG emissions in this sector come mostly from gas plants and secondarily from oil and coal ones. Gas kicks in when water reservoirs get low, which is happening more frequently in different regions. The electric sector plays a role in reducing emissions from other sectors of the economy. There will be an increasing demand for energy for the electrification of urban mobility systems – when available – and other uses of electric power replacing fossil fuels. Therefore renewables like wind[14], sun and biomass will play a crucial mitigation role in the future.

The expansion of renewables, in Brazil, is growing fast given their increasing economic competitiveness. However, it implies assuring a "base" generation to cover their intermittence. The existing hydro potential (130 GW) and the almost completely interconnected Brazilian nationwide grid will continue to contribute substantially to compensate the short-term intermittence of wind and solar. Further on, increased storage capacity of batteries will favor renewables. The discussion of the future role for hydro could not be fully settled in the process for this Initial Proposal, which nevertheless selected actions that will allow the electric sector to participate in the mitigation effort aiming at NDC's goals (28% to 33% of renewables) and towards a long term strategy.

The reduction of hydroelectric generation due to the lower flow of rivers caused by climate change and the limited possibility of this generation being replaced due to increasing impediments to the construction of new hydroelectric dams are issues to be considered over this period. The climate scenarios all point towards less rain in the northeast and north regions. Even in the south-eastern and southern regions, where there may be a small increase in rainfall, there will be no significant rise in river flows due to greater evaporation. The six consecutive years of drought in the northeast (2012-2017) seem to be a sign of the new normal. For different reasons consensus could be reached relating to the role of nuclear and coal that remain a relatively small component of Brazil's overall electric generation. [15]

Proposed actions:

14. In 2017, wind energy totaled 8.10% of the Brazilian electricity grid (source: ABEEÓLICA).

15. There are no plans approved for new nuclear plants despite intense lobbying. The one currently in construction, for decades now, Angra III, has no completion in view and demands an additional investment of at least R$ 14 billion (U$ 3.5 billion). Nuclear produces 2.5% of the Brazilian electric generation. Coal accounts for 4,2%. No consensus was reached on a policy for coal with the industry favoring new investment on renewal associated to Carbon Capture and Storage (CCS) while other participants supported its gradual decommissioning. While not economically significant coal has a powerful lobby in Congress.

5.1 - Increase in energy efficiency levels on the consumption end

This demands actions such as the improvement of energy management on on the demand side in the industrial sector, energy, electric, buildings and agriculture through programs of energy efficiency; adherence to efficiency-based packages with new normative basis and ISO 50001 certification for industries and the promotion of LED in street lighting.

Energy efficiency and distributed generation in buildings also demand new models of financing and regulation so as to benefit all consumers, including residential ones, so as to stimulate the management and the reduction of demand by the consumer, especially at peak consumption times. This method reduces the need for thermoelectric GHG emitting power supply.

5.2 - Expanding generation from renewable sources, both centralized and distributed, in interconnected and in isolated systems. Developing energy storage capacity

This implies structuring appropriate regulatory conditions for the expansion of renewable sources (wind, solar, small hydropower and biomass) in centralized generation, distributed and self-generation/co-generation, through improved financing conditions, tax adjustments and better standardization. Effective producer/consumer credit lines for distributed solar. Facilitation of private consumer consortia for the generation, transmission and distribution of energy from renewable sources. New regulation for generating plants with fast modulation capacity. Strategy for the establishment of a national wide smart grid connecting distributed generation and electric mobility.

Development of large capacity energy storage technologies to cope with intermittency in renewables and of hybrid renewable systems, such as wind + solar, wind + solar + storage, among others, to optimize costs, reduce intermittence and increase the participation of renewables in the expansion of the generating sources.

Introduction of the pricing of environmental and social externalities, positive and negative, for all sources of generation, recognizing how they impact the country's system and economy. Reduction of natural gas leaks in the pipeline system and other facilities.

Mitigation potential by 2030: 33.2 MtCO2eq according to the study MCTIC Opções de Mitigação and 61 MtCO2eq according to SEEG. Average hypothesis: 47.1 MtCO2eq.

5.3 - Repowering of hydroelectric plants

This implies a specific regulation for pricing repowering, improving its generation capacity and its role in flood prevention. The design of new hydro projects only in acceptable socio-environmental conditions, with ample communication and consultation with society and local communities. Also, where appropriate, the pumping installation for reversible operation, increasing storage capacity.

Potential for mitigation: 2.9 MtCO2eq, in 2030, MCTIC Opções de Mitigação.

5.4 - Expansion of renewable energies in isolated locations

Currently there are about 250 isolated systems in Brazil, mostly concentrated in the Amazon Region, with a very large diversity of energy supply conditions, 95% using mostly diesel. The recent drop in costs of renewable generation equipment, especially photovoltaic solar power, and storage solutions enable installing them to replace diesel generators or to promote hybrid solutions, reconciling conventional thermoelectric generators and renewable sources (including biomass and biogas), which combines low consumption of fossil fuels, lower cost and security of electric power supply in isolated systems.

If diesel generators in isolated areas were to be fully replaced by renewable energy sources, the resulting mitigation potential, in 2030, would be 3.95 MtCO2eq. There is, however, fierce resistance by local and regional interests linked to the trade and distribution of oil. For this reason, our median estimate of the mitigation potential of this action would be closer to 2 MtCO2eq.

6 – Industry

Energy efficiency clearly appears as the central line of action and demands well-focused industrial policies. The carbon-intensive sectors, steel, cement, concrete and chemistry, present differentiated situations although their carbon intensity, in general, is below the international average. In the chemical sector, in particular, there are many opportunities for mitigation action by substitution of raw materials for petrochemical by more renewable inputs processed in biorefineries, using liquid biofuels, applications in green chemistry (alcohol chemistry, sucrochemistry, vegetable oil chemistry) and an array of diverse bioproducts and biomaterials. It demands, however, maintaining current quality standards for natural gas provided to the chemical industry.

Decarbonization in various sectors of industry is a potential plus to its international competitiveness, in the short and medium term, however, it can generate big challenges and difficulties that must be taken into account. As a whole the sector is currently facing intense crisis[16]. The implementation of the NDC in industry should consider this as well as differentiation among branches. In the industrial sector mitigation goals are best expressed in carbon intensity which will facilitate the introduction of carbon market mechanisms.

16. Brazilian industry suffered losses of -3%, in 2014; -8,3%, in 2015; -6,6%, in 2016 and a small + 2,5% recovery in 2017.

6.1 - Energy and process efficiency measures

6.1.1 - Efficiency of steam, heat, waste and effluents use

This covers measures for the reuse of heat and steam in different segments, such as the steel, chemical and petroleum industries, as well as energy recovery from industrial waste and effluents (transformation of environmental liabilities into production inputs), particularly in efficient cogeneration heating and power systems.

Mitigation potential of 42.9 MtCO2eq, by 2030.

6.1.2 - Exchange of solid fuels and inputs

Recovery and reconditioning of CSR (Recovered Solid Fuel). Exchange of fuels and some inputs in the cement and steel industries, such as the substitution of the clinker for steel slag. The new technologies for reducing GHG emissions in the industrial sectors mentioned are still incipient. In some cases, there is a need to establish legal and infra-legal acts, which can break down barriers and boost the use of alternative fuels. One example is the necessary alignment between climate, energy and waste policies.

Development of new plants designed to use more efficient and less polluting fuels must take into account the market need and the economic-financial viability. Investments in new technologies to reduce GHG emissions in the industrial sector need to take into account different strategies for those companies with plans for new plants and those that will continue to operate older ones.

Mitigation potential of 7.3 MtCO2eq in 2030 (SEEG, 2017).

6.1.3 – Reduction of flare and steam recovery

Reduction of the flare system, used to avoid the risk of explosions by burning the excess natural gas from industrial processes. The flare can be a waste of energy and it emits considerable GHG. Steam recovery can also avoid emissions from burning gas and eliminate waste.

Mitigation potential of 22.3 MtCO2eq in 2030 MCTIC Opções de Mitigação.

6.2 - Finance for energy efficiency projects

Specific credit lines should be made available for energy efficiency projects in the industrial sector for reducing GHG emissions especially for SMEs that have particular difficulty obtaining credit in favorable conditions for technological development and a more efficient, less carbon-intensive and less polluting production.

7 – Economic instruments

A major issue at the global level is how to pay for both mitigation and adaptation. In Brazil, this becomes even more serious because of the strong restriction on public spending in the coming years, due to the Constitutional Amendment 95. As previously explained, it was not possible to estimate the NDC's overall and per-cost here. Existent tentative studies on this were based on previous public investment assumptions, budgetary allocations and funding possibilities that may have changed quite a lot since the 2015 crisis as explained in section II.

It is crucial to establish new financing mechanisms for decarbonizing. Budget legislation, planning and allocation need to interact with the commitments of the Paris Agreement and the Sustainable Development Goals - SDG. Mitigation action can be supported by activating the Brazilian carbon market and the development of a wide range of assets and derivatives. Issuing green bonds on the national and international market and setting up guarantees' funds are two major potential assets. All this requires the definition of sectoral targets and structuring Monitoring, Reporting and Verification (MRV) for NDC mitigation actions.

MCTIC Opções de Mitigação study has considered a carbon pricing of US $10 per ton in order to achieve the 2030 target. This carbon pricing can be done either through market mechanisms or through taxation. Both this study and the IES Brazil study have analyzed economic and social effects of carbon pricing and found that, at this initial level, economic growth will not be affected and there can be beneficial social consequences to it[17].

Proposed actions:

17. References: MCTIC Opções de Mitigação at page 39.

7.1 - The establishment of sectoral mitigation targets, activation of the Brazilian carbon market and the establishment of a reliable MRV system

Brazil defined its NDC targets as economy-wide, translating into emission limits of 1.3 Gt and 1.2 Gt, in 2025 and 2030 respectively. They depend on sectoral efforts and therefore should generate sectoral goals in a flexible framework. For carbon market purposes, in the industry sector, those should be expressed in carbon intensity parameters as well as with the establishment of technical emission coefficients in the sectors where they fit.

By setting the various technical emission coefficients (also known as "Intensity Targets"), the sectoral distribution of targets would allow to reactivate, with due adaptations, the Brazilian Market for Emission Reductions (MBRE), which worked during the period of the Kyoto Protocol and was implemented at the BM&F Bovespa through a project developed by the Getulio Vargas Foundation, at the request of the Ministry of Industry and Commerce. Without sectoral targets there won't be any demand for carbon credits apart from a quite limited voluntary market.

The Brazilian Forum on Climate Change must take on the task of formulating and conducting an inclusive dialogue process for the establishment of these sectoral targets that will build up the NDC economy wide ones.

7.2 - Decarbonizing criteria in taxation and subsidies

Decarbonization must be incorporated into any structural discussion of tax reform in Brazil. This will be critical for a long-term net zero strategy for the second half of the century and will certainly help the implementation of the NDC. The roadmap for carbon taxation, however, does not presuppose the institution, first hand, of an isolated carbon tax. In our process this suggestion was resisted especially by most representatives of the private sector. In fact, the outcome of this discussion recommended a more comprehensive approach: taking into account carbon intensity in a comprehensive tax reform. Given the heavy tax burden on Brazilian society and the dysfunctional nature of our taxation system, as a whole, it has to be part of an overall restructuring of federal and state taxes' aliquots, carbon intensity becoming one of the criteria for taxation.

No consistent technical studies taking into account carbon intensity criteria are available, at this time, to orientate the review of existing tributes (federal, state and municipal) and their aliquots. These studies are very urgent and must be carried by the Ministry of Finance, possibly under the scope Program for Market Readiness (PMR). The implementation of such reform will face a complicated process of political negotiation in Congress.

7.2.1 - Short term: improvement of CIDE

In the short term, what could be done is to adapt the CIDE[18]. First, conceptualize it as "CIDE-Carbon", considering a carbon intensity yardstick especially on gasoline. In the case of diesel oil its social impacts must be compensated to avoid unrest. Overall fiscal neutrality should also be assured considering Brazil's already very heavy tax burden: any tax increase impact should be offset by reductions in other tributes like the PIS / Cofins that impedes on investment and labor wages[19]. Low carbon public transit must be prioritized in the allocation of its proceeds on transport infrastructure at the federal and state levels.

18. The Contribution of Intervention in the Economic Domain (CIDE-fuels) was established in 2001 with the purpose of ensuring a minimum amount of resources for investment in transportation infrastructure, environmental projects related to the oil and gas industry, and subsidies for transportation of alcohol fuel, natural gas and oil products. It applies to the importation and sale of gasoline, diesel and related fuels, aviation kerosene and derivatives, fuel oil, liquefied petroleum gas (LPG), including natural gas and naphtha, and ethyl alcohol fuel.

19. The Social Integration Program (PIS) was established in 1970 and is intended for the payment of unemployment insurance, payment and participation in the revenue of organs and entities for workers. The Contribution for Social Security Financing - COFINS was established in 1991 to finance Social Security, Social Assistance and Public Health, focusing on monthly revenues and total revenues.

7.2.2 - Technical study for a review of subsidies in the light of a long-term decarbonization strategy

The Program for Market Readiness (PMR) and the Ministry of Finance have an overall assessment of subsidies across the Brazilian economy that amount to roughly R$ 300 billion. Other estimates go up to R$ 400 billion. However, there are no studies on subsidies from the angle of carbon intensity. Such studies are urgently necessary. The elimination of fossil fuel subsidies has been recommended by the International Monetary Fund (IMF), the World Bank and numerous international findings. However, as eliminating some of them may cause great social unrest, they need to be considered in a much broader context and coupled with relevant social compensatory measures.

7.3 - Advances in the modalities of carbon pricing

Approximately 50 Brazilian companies adopt shadow prices for carbon, following a trend that is advancing in several countries. Currently those are arbitrary and variate a lot due to the lack of arbitrage opportunities, resulting from the absence of organized markets for emission reductions. Nevertheless, there is a very interesting experience of a simulated internal carbon market with around 30 companies coordinated by FGV that plays the role of a public regulator. This experience can be used in the future structuring a reactivated Brazilian carbon market.

Another aspect of carbon pricing is what is known as “Positive Pricing”. Rather than imposing limits, fines or fees onto emitting activities, positive pricing remunerates properly verified actions that result in emission reductions. It is based on the assumption that certain activities generate positive externalities, thus deserving recognition for their mitigation, social, economic and environmental benefits. This minus-carbon was assigned an intrinsic value in Paragraph 108 of the Paris Agreement, in accordance to Brazil’s proposal.

Positive pricing already exists, in practice, while not being called so. An example is the payments by Norway to the Amazon Fund, proportional to the reduction of deforestation. Decrease of deforestation surface in square kilometers can be easily convertible into minus-carbon calculus in CO2eq. Positive pricing can be applied at the international, national, state and local levels whenever there is the possibility to monitor, verify and register results. Its various applications would depend on the establishment of new financial and guarantees instruments. At the national level, positive pricing can generate specific mechanisms based on federal and state PSA legislation. In this case, one of the environmental services to be rewarded is precisely the mitigating action producing minus-carbon.

7.3.1 - Guarantees Funds

In the short term, at the international level, the Brazilian government should favor the establishment of a guarantees' system to help finance projects that contribute to emissions reduction with access to the lowest interest rates and best conditions available in the international financial market.

This, in fact, would be the initial way of applying the recognition of the economic value of the minus-carbon for further financing mitigation activities. We propose that the establishment of such a Fund, that could be operated by existing multilateral agencies, should be put forward as a condition for ratcheting our NDC in an eventual early revision cycle. Similar funds can be structured at the national level using resources from the Amazon and Climate Funds, the GCF and others.

III.
Scenarios and estimates

Both in the MCTIC Opções de Mitigação and the IES Brasil Mitigation Scenarios (FBMC-COPPE) studies, present baseline scenarios with trends up to 2030, taking for granted a consistent compliance with the Brazilian NAMA goals and previously defined government policies, sectoral expansion plans and budget allocations. The net emission projections for 2030 presented in these baselines --in fact, more-of-the-same scenarios-- are 1.46GtCO2eq and 1.66GtCO2eq, respectively. The average baseline is therefore 1.56GtCO2eq. This was perfectly plausible at the time the mentioned studies were carried out. However, the country's situation has since evolved as a result of a series of economic, political, social and institutional factors. It is necessary to consider a high probability of these governmental policies previous to the NDC will be running short of some of their goals.

In 2016, a year of brutal recession and, consequently, falling fossil fuel emissions, the Brazilian net emissions, estimated by SEEG, were at 1.74GtCO2eq. This clearly illustrates the risk mentioned above if Brazil does not return to a trajectory of strong emissions reduction. The outcome of the 2018 political electoral process adds uncertainty to the process. Therefore, we have adopted here a less optimistic baseline scenario, the New Reference Baseline (NRB).

The NRB reflects a context of relative disregard. It is based on projections from SEEG's net GHG emission estimates for the year 2016, the most recent Brazilian emissions data available at the time this Initial Proposal was completed[1] and simulates net emissions by 2030. In the NRB, we estimate to be more realistic, at this time, that Brazil's net emissions could go up to 1.84GtCO2eq.[2] Once this new baseline hypothesis is established, our first scenario for a successful implementation of the NDC, in 2030, is the Balanced Scenario (BS).

1. http://plataforma.seeg.eco.br/total_emission.

2. The NRB simulated here seems to reflect the current economic and political trends. The net emissions of 2016 were the base for this adjusted projection for 2030. The AFOLU emissions of 638 MtCO2eq were maintained at the same level for 2030. The sum of energy emissions, including fossil fuel combustion in the transport / mobility and energy generation areas, are projected from those in 2016, considering an average GDP increase of 2.5% per year, between 2018 and 2030, would result in 573 MtCO2eq, in 2030. Of this total 10% is deducted, corresponding to a (quite conservative) projection of the reduction in carbon intensity per percentage point of GDP in the sum of these sectors, until 2030, duo to technological advances. This gives approximately 515 MtCO2eq. Emissions from agriculture, livestock, waste and industrial processes are maintained at the same level as in 2016, a total of 687 MtCO2eq. This gives us net emissions NRB of 1.84 GtCo2eq, by 2030.

The sum of all mitigation actions, from all sectors previously mentioned, 642.9 MtCO2eq, is subtracted from this 1.84 GtCO2eq NRB. The result, 1.19 GtCo2eq, achieves the Brazilian NDC target. In addition to land use mitigation action it incorporates the reduction of CO2 emissions from fossil fuel combustion, industrial process, energy and methane from cattle herds and landfills. The BS is the one compatible with a long-term strategy for net zero.

A second possible scenario offered to decision makers is the "AFOLU Scenario" (AS), in which Brazil is not able to reduce its aggregate emissions from fossil fuels burning by 2030. In AS fossil fuel emissions are kept as projected in the NRB. Any reduction in carbon intensity due to technological improvements is counterweighted by the increase of production. GHG mitigation, in the aggregate, is obtained solely by reducing illegal deforestation, reforestation/afforestation and by no regret measures in agriculture and livestock. These actions add to 435.3MtCO2eq.

Subtracted from the NRB, they would bring emissions down to 1.4GtCO-2eq, in 2030, falling short of Brazil's NDC goal. Its success would then rely on the substantial increase the percentage reduction of illegal and legal deforestation as mentioned above in 1.1. It would have to rise from 60% to 95% of its estimated full potential. The AFOLU Scenario (AS) would, therefore, demand a reduction of approximately 644GtCO2eq, in illegal and legal deforestation. Subtracted from NRB it would thus attain 1.19 GtCO-2eq.

To be sure, all of these estimates are quite uncertain. The average 2.5% GDP projection may have been underestimated, if economic growth were to become more robust. On the other hand, while calculating the mitigation potential of several actions, we have cautiously opted for the more conservative estimates and excluded perfectly admissible mitigation accounting due to the potential expansion of legally protected forest areas. At this time, with the information available, it would be impossible to make more precise and indisputable projections. Nevertheless, the numbers presented here are quite plausible.

The big picture, however, is evident and our overall, qualitative assessment, unequivocal: by current IPCC parameters, an absence of fossil fuels emissions reduction would imply a robust additional effort in the AFOLU sector reversing the current context of rigid containment of public spending and erosion of the Ibama's and states' environmental law enforcing institutions. The rise of legal deforestation, especially in the Cerrado region will have to be strongly reversed as well.

The AS depends heavily on maximum curbing of illegal and legal deforestation,

which is by no means trivial, if we consider recent political developments, the consequences of the Constitutional Amendment 95 on public expenditures and how it affects the environmental sector: significant weakening of Ibama and ICMBio in terms of staff; dwindling of the states' enforcing institutions; increased challenge of organized crime and land-grabbing. The future profile of deforestation is one in a multitude of smaller areas rather than in big ones as in the past and it can be aggravated by the ongoing political offensive to weaken the environmental legislation and obstruct the work of environmental agencies.

Furthermore, the AS is significantly less compatible with a long-term decarbonization strategy than the Balanced Scenario (BS). NDC mitigation targets could eventually be met by 2025 and 2030 but emissions could start going up again in the following years as the AFOLU reduction opportunities become scarcer and energy emissions shoot up.

IV. Adaptation

Societies develop with a certain capability to withstand variations in climatic conditions. Irrespective of global warming and climate change, many countries are ill prepared in their capacity to deal with extreme weather events. One cannot consider adapting to future climate change without tackling this present capacity deficit. Thus, adaptation to climate change involves first creating the capacity to defend and respond to present climate conditions - resilience.

This includes maintaining well-functioning infrastructure (energy, transport, communications, natural disaster prevention, storage silos, water supply, sanitation, etc.), water source conservation, ecosystem protection, good health systems for the population, risk management, etc. It has been noted that measures to adapt to climate change are typical measures of development and protection of natural and human capital as well as physical infrastructures. Measures to adapt further to more severe future climate conditions need to be gradually implemented.

Infrastructure can include operations with life cycles of more than 100 years, like a bridge for instance. Considering that projections of river outflow can reach new extremes over

the next decades, should the resilience of this infrastructure be increased now, or should we wait for a floods to threaten its safety? Already the infrastructure in the agricultural sector (e.g., silos), has shorter lifecycle spans, and adaptation measures can thus be taken closer to the moment in which climate change turns a region suitable for new types of crops.

Adapting to projected climate change is a critical component of Brazil's commitments under the Paris Agreement. In its NDC, the Brazilian government emphasized that key elements for adaptation policies are: (1) risk areas, (2) housing, (3) basic infrastructure, especially in the areas of health, sanitation and transport.

The Brazilian vision for adaptation actions includes integrating as far as possible the management of vulnerabilities and climate risks into public policies and strategies, as well as to increase coherence of national and local development capacities through adaptation measures, via the PNA - the National Plan for Adaptation to Climate Change, published on May 10, 2016, which aims to promote vulnerability reduction and manage the risks associated with climate change.

The risks associated with climate change will affect food production, especially family farming, to an extent that goes beyond impacts on infrastructures. Urbanization has already been marked by climate change; "urban heat islands" have already become permanent in urban settings. Policies and practices in large cities that already suffer from such changes have systematically been reactive rather than preventive actions.

Climate adaptation is not yet ingrained in the culture of the major sectors that will be affected by climate change in Brazil. Except, perhaps, agribusiness, mainly large-scale farming - a sector that is both strongly linked to the climate and that represents the most competitive sector of the country. Other sectors and key issues of the country, notably infrastructure - such as energy, water resources, sanitation, urban development, coastal zones, natural disasters, and others not related to infrastructure, such as biodiversity, development of the semi-arid region of the Northeast, health, and small-scale agriculture, have not given enough attention to or not obtained sufficient resources to deal with the topic of adaptation. The best example is that the PPI (Advance Partnerships Program) does not yet provide the adaptation that is needed and has to be reviewed immediately.

The TC 10 Adaptation of the FBMC defined as its main focus infrastructure and the evaluation of the mitigation measures defined by the other TCs considering climate risk management. In addition to the sectoral adaptation issues - crop migration,

new seeds, natural disaster warning plans, upgrading of urban, coastal and river infrastructures, etc. - it will be necessary to address health, food security, biodiversity protection and monitoring systems of impacts at national and international scale.

8.1 - Transversal adaptation measures

8.1.1 - Incorporating of standards for adaptation in the PPI, where the new possibilities of investment in infrastructure are.

8.1.2 - Evaluating and assessing risks and vulnerabilities in all sectors that require the downscaling of at least 10 GCMs (global climate models). We also need to consider that the climate change scenarios are just one of the elements considered in risk assessments. The whole question on values and perception of risk still requires a specific approach.

8.1.3 - Specific planning at the federal level to support cities and municipalities in developing vulnerability maps, risk assessments and adaptation plans.

8.1.4 - Cross-cutting climate adaptation in sectoral planning and support to state and municipal governments for the same purpose.

8.1.5 - Implementation of PNA by defining sectoral targets with the use of indicators, identification of financing sources and prioritization of sectoral and regional level actions.

8.1.6 - Establishing the PNA's operational governance model, defining responsibilities, actions, decision-making, and indicators as well as how the NAP should exchange with sectoral policies at each level of government.

8.1.7 - Developing studies evaluating adaptation costs over time and identification of funding mechanisms to share these costs equally.

8.1.8 - Developing management and environmental education programs to reduce greenhouse gas emissions for the sectoral measures of adaptation to be elaborated and implemented with the support of public universities, considering the local specificities.

8.2 - Sectoral adaptation measures

8.2.1 - Energy and industry

8.2.1.1 - Evaluating future water availability of the main rivers and reservoirs, mainly in the regions of the North and Northeast, to enable planning of future production in the electric and industrial sectors.

8.2.1.2 – Assessing of the increased demand for electricity

resulting from the greater need for cooling to minimize the impact of heat waves and global warming. In this regard, distributed renewable energies are also a means of adapting to this increased demand, as well as the promotion of electric vehicles as a tool to reduce consumption at the chain's end (removing houses from the grid at peak times).

8.2.1.3 – Identifying new partnerships with the industrial sector to meet demands for new infrastructures or adapt existing ones to climate change.

8.2.1.4 - Training, standardization and dissemination of the concepts regarding adaptation to climate change for the entire value chain of finance and industry.

8.2.1.5 – Establishing new standards to turn electric power transmission systems resilient to climate extremes (extremes of winds, rainfall, electric discharges, etc.).

8.2.2 - Forests and biodiversity

8.2.2.1 - Quantifying risks of Brazilian biodiversity loss and designing adaptation strategies with risk assessment of accelerated extinction of species and analyzing their viability. This is one of the hardest areas in the science of adaptation and touches its absolute limits.

8.2.3 - Agriculture and livestock

8.2.3.1 - Genetic research to adapt agricultural species to the extreme climatic conditions projected for the different Brazilian biomes.

8.2.3.2 - Analyzing irrigation demand as an adaptive measure, mainly in the basins that already face water scarcity, and suggest more efficient technologies for irrigation.

8.2.3.3 - Supporting the work of Embrapa and state institutes of agricultural research mapping climate risks and suggest new agricultural zoning in response to different climate scenarios.

8.2.3.4 - Informing and defining strategies to support small producers to adapt to climate change.

8.2.3.5 - Defining the role of ABC Plans and forest restoration also in light of adapting the Brazilian agriculture to climate change.

8.2.4 - Transport and logistics

8.2.4.1 - Vulnerability analysis of the main paved and unpaved roads in the face of projected extreme climate events, mainly intense rains and heat waves.

8.2.4.2 - Vulnerability analysis of the main ports in light of rising sea levels projections and related floods, undertows and other local conditions.

8.2.4.3 - Vulnerability analysis of the main waterways in the face of extreme weather events, mainly heavy rains and prolonged droughts.

8.2.4.4 - Air transport vulnerability analysis.

8.2.4.5 - Vulnerability analysis of information and communication technology systems.

8.2.5 - Cities and waste

8.2.5.1 - Training states and municipalities in the management of climate risks, preparing vulnerability assessments and adaptation plans.

8.2.5.2 – Urbanizing the favelas (shanty towns) and poorer urban areas, improving infrastructure and services, including natural disaster warning systems in areas at risk, mainly slopes and lowlands.

8.2.5.3 – Protecting structures in proximity of areas subject to landslides and restore native vegetation to stabilize soils and prevent flooding, recover riparian forests, and protect water supply, including quality and reduction erosion and sedimentation.

8.2.5.4 - Implementing and improving natural disaster warning systems as well as civil defenses.

8.2.5.5 - Green sustainability initiatives - green/intelligent buildings, water reuse, rainwater harvesting, improvement/expansion of major urban drainage systems, permeable pavements, etc.

8.2.5.5 - Tree planting and implantation of sprinklers in the hottest areas of cities.

8.2.5.6 - Developing legal framework for the use of coastal areas taking into account sea level rise.

8.2.5.7 - Promoting low emission zones in urban areas, considering the increase of pollutants concentration and the lower rainfall regime.

8.2.6 – Water resources

8.2.6.1 - River basin plans and water resources management in these territories should incorporate projections of climate change impacts on water availability and demand of uses, including decision making on water allocation.

8.2.6.2 - The water supply and irrigation sectors should incorporate projections of impacts on the outflow in their planning, projecting possible conflicts with other sectors (such as hydropower generation and industrial use) in the basins where water supply is expected to decrease.

8.2.6.3 - Coastal and lagoon regions, especially those with high population density, should anticipate fluctuations in water levels of these bodies as well as the potentially severe resulting in local impacts.

8.2.6.4 - Management of reservoirs and dams should include projections of hydrological fluctuations from climate change, both at federal (ANA) and state level (Water Resources Managing Bodies), as well as within the Basin Committees, considering vulnerabilities and impacts for the main users.

8.2.6.5 - Water use efficiency should be promoted through initiatives such as reducing wasted water and leakage (supply and distribution), recycling waste water and capturing rainwater, among others.

8.2.6.6 - Resilience to climate fluctuations should be encouraged through measures with multiple co-benefits such as water conservation and recovery, soil conservation, maintenance of ecological corridors, restoration of APPs, etc.

8.2.6.7 - The increasing degree of uncertainty in hydrological behavior in Brazilian river basins should be incorporated into water resource management tools so as to become more flexible and resilient.

8.2.6.8 - New arrangements and tools for the management of water resources, regarding their suitability for extreme hydrological events should be encouraged.

V.
Annex

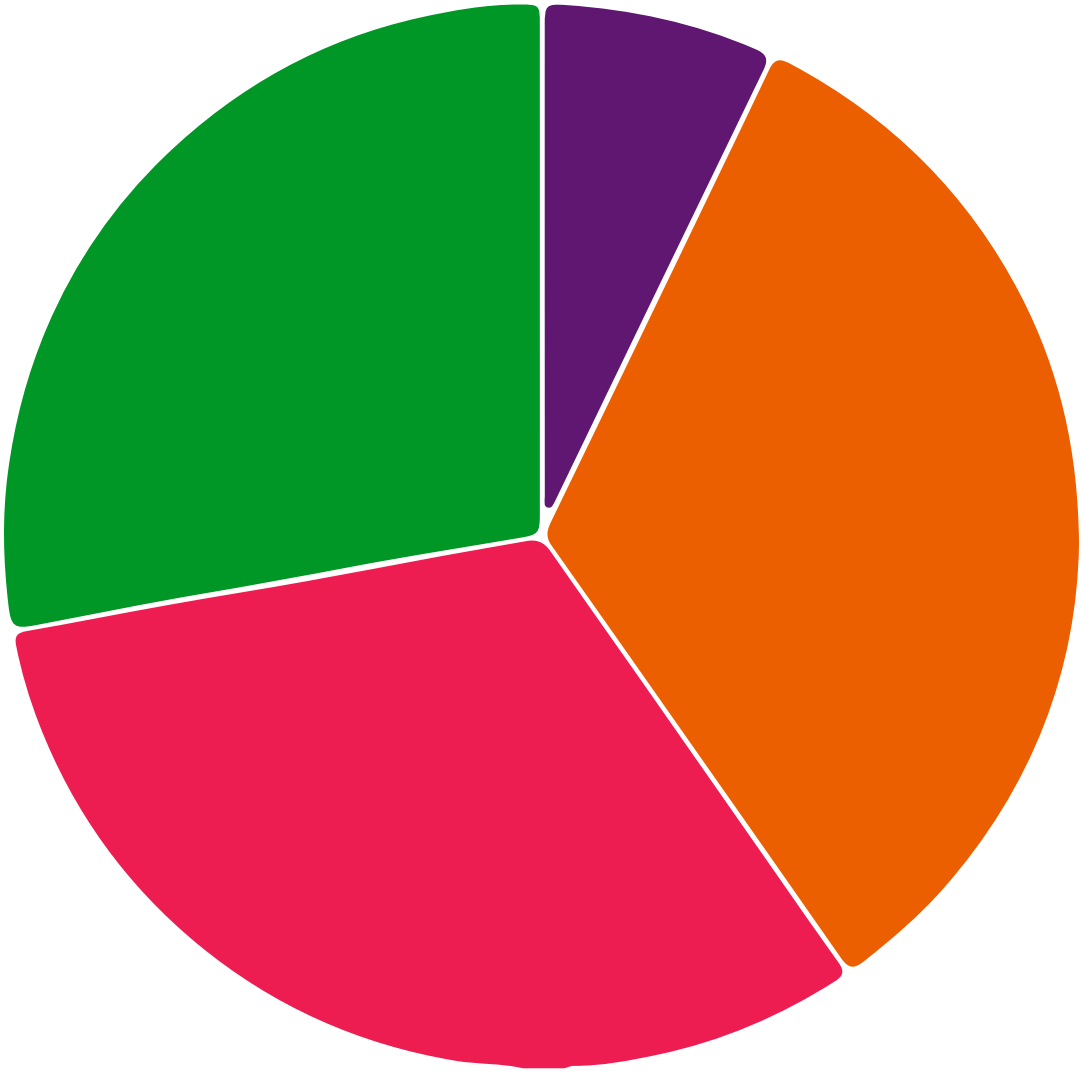
Participants of the Brazilian Forum on Climate Change (FBMC)

537 participants from 214 organizations / institutions / entities[1] took part in the discussions for this Initial Proposal for the Implementation of Brazil's Nationally Determined Contribution (NDC), between March 2017 and May 2018.

315 men

222 women

1. These numbers originate from the attendance lists that appear in the minutes of the meetings. Entities representing business were listed as private sector along with corporations. Academics who are also active in NGOs were listed in the Third Sector.



39 from academia

178 from the private sector

171 from the public sector

149 from the third sector

Public organizations, entities and companies[2] who participated in meetings of the FBMC:

- Centro Clima Coppe/UFRJ - Centro de Estudo Integrado sobre Meio Ambiente e Mudanças Climáticas
- Coppe/UFRJ - Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa de Engenharia
- FGV - Fundação Getulio Vargas
- IEA/USP - Instituto de Estudos Avançados
- PBMC - Painel Brasileiro de Mudanças Climáticas
- Tyndall Centre for Climate Change Research
- UERJ - Universidade Estadual do Rio de Janeiro
- UFAC - Universidade Federal do Acre
- UFJF - Universidade Federal de Juiz de Fora
- UFMG - Universidade Federal de Minas Gerais
- UFRJ - Universidade Federal do Rio de Janeiro
- UnB - Universidade de Brasília
- UNIFESP - Universidade Federal de São Paulo
- UNOESTE - Universidade do Oeste Paulista
- USP - Universidade de São Paulo
- ANAC - Agência Nacional de Aviação Civil
- ANAMA - Associação Nacional de Órgãos Municipais de Meio Ambiente
- ANEEL - Agência Nacional de Energia Elétrica
- ANP - Agência Nacional do Petróleo, Gás Natural e Biocombustíveis
- ANTAQ - Agência Nacional de Transportes Aquaviários
- ANTT - Agência Nacional de Transportes Terrestres
- BB - Banco do Brasil S.A.
- BNDES - Banco Nacional do Desenvolvimento Econômico e Social
- Casa Civil/PR
- CDSA - Companhia de Desenvolvimento de Serviços Ambientais do Acre
- CEF - Caixa Econômica Federal
- CETESB - Companhia Ambiental do Estado de São Paulo
- CNM - Confederação Nacional dos Municípios
- COR/RJ - Centro de Operações da Prefeitura do Rio de Janeiro
- CVM - Comissão de Valores Mobiliários
- Eletrobras - Centrais Elétricas Brasileiras S.A.
- Eletrobras Furnas
- Embrapa - Empresa Brasileira de Pesquisa Agropecuária
- EPE - Empresa de Pesquisa Energética
- EPL - Empresa de Planejamento e Logística S.A
- FINEP - Financiadora de Estudos e Projetos
- FNP - Frente Nacional dos Prefeitos
- FUNAI - Fundação Nacional do Índio
- Fundo Verde/UFRJ
- Governo do Distrito Federal
- Governo do Estado de Pernambuco
- Governo do Estado de São Paulo
- Governo do Estado do Acre
- Governo do Estado do Amapá
- Governo do Estado do Amazonas
- Governo do Estado do Ceará
- Ibama - Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis

2. Additionally to listed entities and organizations, congressmen and senators were present at the discussions.

- IMAP - Instituto do Meio Ambiente e de Ordenamento Territorial do Estado do Amapá
- IPJB - Instituto de Pesquisas Jardim Botânico do Rio de Janeiro
- IPEA - Instituto de Pesquisa Econômica Aplicada
- MAPA - Ministério da Agricultura, Pecuária e Abastecimento
- Marinha do Brasil
- MCid - Ministério das Cidades
- MCTIC - Ministério da Ciência, Tecnologia, Inovações e Comunicações
- MDA - Ministério do Desenvolvimento Agrário
- MDIC - Ministério do Desenvolvimento, Indústria e Comércio Exterior
- MDS - Ministério do Desenvolvimento Social
- MF - Ministério da Fazenda
- MMA - Ministério do Meio Ambiente
- MME - Ministério de Minas e Energia
- MP - Ministério do Planejamento, Desenvolvimento e Gestão
- MRE - Ministério das Relações Exteriores
- MS - Ministério da Saúde
- MTPA - Ministério dos Transportes, Portos e Aviação Civil
- ONS - Operador Nacional do Sistema Elétrico
- Petrobras
- PGE/AC - Procuradoria Geral do Estado do Acre
- Prefeitura de Belo Horizonte
- Prefeitura de Campinas
- Prefeitura de Fortaleza
- Prefeitura de João Pessoa
- Prefeitura de Juiz de Fora
- Prefeitura de Salvador
- Prefeitura de São Paulo
- Prefeitura do Recife
- Prefeitura do Rio de Janeiro
- SEA/RJ - Secretaria do Estado do Ambiente
- Secretaria de Meio Ambiente do Estado de São Paulo
- Secretaria Nacional de Portos
- SFB - Serviço Florestal Brasileiro
- 350.org Brasil
- C40 - Cities Climate Leadership Group
- Catavento Cultural e Educacional
- CBC - Centro Brasil no Clima
- CBCS - Conselho Brasileiro de Construção Sustentável
- CGHG - Centro de Gestão e Estudos Estratégicos
- Climate Reality Brasil
- Climate Tracker
- Coalizão Brasil Clima, Florestas e Agricultura
- CPI - Climate Policy Initiative
- Comissão Pró-Indio, Acre
- CUT – Central Única dos Trabalhadores
- EII Brasil - Earth Innovation Institute
- Engajamundo
- FAS - Fundação Amazonas Sustentável
- FBDS - Fundação Brasileira para o Desenvolvimento Sustentável
- Ford Foundation
- Fundação Grupo Boticário de Proteção à Natureza
- Fundação Solidaridad
- GIP - Gestão de Interesse Público
- Greenpeace Brasil
- Grupo Carta de Belém
- GTA - Grupo de Trabalho Amazônico
- ICCT - International Council on Clean Transportation
- ICLEI Brasil - Local Governments for Sustainability
- iCS - Instituto Clima e Sociedade

- IDESAM - Instituto de Conservação e Desenvolvimento Sustentável da Amazônia
- IEMA - Instituto de Energia e Meio Ambiente
- IIS Brasil - Instituto Internacional de Sustentabilidade
- Imaflora - Instituto de Manejo e Certificação Florestal e Agrícola
- INEE - Instituto Nacional de Eficiência Energética
- Instituto Acende Brasil
- Instituto BVRio
- Instituto Escolhas
- Instituto Ethos
- International Rivers
- IPAM - Instituto de Pesquisa Ambiental da Amazônia
- ISA - Instituto Socioambiental
- ISPN - Instituto Sociedade, População e Natureza
- ITDP Brasil - Institute for Transportation and Development Policy
- OC - Observatório do Clima
- Plant-for-the-Planet
- Projeto Vivart
- RAPS - Rede de Ação Política pela Sustentabilidade
- Resama - Rede Sul Americana para Migrações Ambientais
- SEEG Brasil - System for Greenhouse Gas Emissions and Removals Estimates
- SOS Mata Atlântica
- STVBrasil - Sociedade Terra Viva
- TNC Brasil - The Nature Conservancy
- WRI Brasil - World Resources Institute
- WWF Brasil - World Wildlife Fund
- AGGREGO Consultores
- ABAG - Associação Brasileira do Agronegócio
- ABCM - Associação Brasileira de Carvão Mineral
- ABCP - Associação Brasileira de Cimento Portland
- ABEAR - Associação Brasileira das Empresas Aéreas
- ABEEólica - Associação Brasileira de Energia Eólica
- ABIQUIM - Associação Brasileira da Indústria Química
- ABIVIDRO - Associação Técnica Brasileira das Indústrias Automáticas de Vidro
- BRACE - Associação Brasileira de Grandes Consumidores Industriais de Energia e de Consumidores Livres
- ABRADEE - Associação Brasileira dos Distribuidores de Energia
- ABRAGE - Associação Brasileira das Empresas Geradoras de Energia
- ABSOLAR - Associação Brasileira de Energia Solar Fotovoltaica
- ABVE - Associação Brasileira do Veículo Elétrico
- AGGREGO Consultores
- Agroícone
- Amyris
- ANFAVEA - Associação Nacional dos Fabricantes de Veículos Automotivos
- ANPTrilhos - Associação Nacional dos Transportadores de Passageiros sobre Trilhos
- ANTF - Associação Nacional dos Transportes Ferroviários
- ANTP - Associação Nacional de Transportes Públicos
- APINE - Associação Brasileira dos Produtores Independentes de Energia Elétrica
- APROBIO - Associação dos Produtores de Biodiesel do Brasil
- ArcelorMittal
- Avianca Brasil

- Azul Linhas Aéreas
- Banco Bradesco
- Banco Santander S.A
- Biofílica
- Braskem
- BYD Brasil
- CEBDS - Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável
- Cia Ultragás
- CNA - Confederação da Agricultura e Pecuária do Brasil
- CNI - Confederação Nacional da Indústria
- CNT - Confederação Nacional do Transporte
- COGEN - Associação da Indústria de Cogeração de Energia
- Enel S.A.
- Engie Ineo Brasil
- EQAO - Energia Renovável e Crédito de Carbono
- Febraban - Federação Brasileira de Bancos
- FENAVEG - Federação Nacional das Empresas de Navegação
- FIEMG - Federação das Indústrias do Estado de Minas Gerais
- FIEP - Federação das Indústrias do Estado do Paraná
- FIESP - Federação das Indústrias do Estado de São Paulo
- FIRJAN - Federação das Indústrias do Estado do Rio de Janeiro
- FMASE - Associação Fórum de Meio Ambiente do Setor Elétrico
- FNBF - Fórum Nacional das Atividades de Base Florestal
- Fórum Nacional Sucroenergético
- Fractal
- Fundo Key
- GBC Brasil - Green Building Council
- GOL Linhas Aéreas
- GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit
- Grupo Boticário
- Grupo CPFL Energia
- Grupo Libra
- IABR - Instituto Aço Brasil
- IBÁ - Indústria Brasileira de Árvores
- IBP - Instituto Brasileiro de Petróleo, Gás e Biocombustíveis
- IBRAM - Instituto Brasileiro de Mineração
- IEC - Iniciativa Empresarial em Clima
- Itaú Unibanco
- LATAM Airlines Brasil
- LLA - Ludovino Lopes Advogados
- MAN Latin America
- Matchmaking Brasil
- Mercedes-Benz
- NTU - Associação Nacional das Empresas de Transportes Urbanos
- OSC - One Shopping Center
- Scania Global
- Shell Global
- Siemens Global
- SNIC - Sindicato Nacional da Indústria do Cimento
- SRB - Sociedade Rural Brasileira
- Syndarma - Sindicato Nacional das Empresas de Navegação Marítima
- Ternium
- Tradener
- UBRABIO - União Brasileira do Biodiesel e Bioquerosene
- UBS Brasil
- UNICA - União da Indústria de Cana-de-Açúcar
- Vale S.A.
- Volvo Buses Global
- Votorantim Cimentos
- WayCarbon

Mitigation actions recommended by the FBMC for the implementation of Brazilian NDC, in 2030:

<table>
<tr><th>SECTOR</th><th>ACTION</th><th>MEASURE</th><th>MITIGATION POTENTIAL</th></tr>
<tr><td rowspan="6">FORESTS</td><td rowspan="4">1.1
Reducing deforestation</td><td>1.1.1 – Creation of new protected areas on undesignated public lands in the Amazon. (70 MtCO2eq, not included) [3]</td><td rowspan="4">Full potential for zero deforestation: 597.7 MtCO2eq

Balanced Scenario: 358 MtC02eq (60% of full potential)

AFOLU Scenario: 567.8 MtCO2eq (95% of full potential)</td></tr>
<tr><td>1.1.2 - Expansion of command & control actions against deforestation and the maintenance and preservation of protected areas</td></tr>
<tr><td>1.1.3 – Program of actions to minimize emissions from agriculture and forest fires</td></tr>
<tr><td>1.1.4 - Development of payment mechanisms for environmental services (PSA) rendered by forests</td></tr>
<tr><td colspan="2">1.2
Expansion of native forest restoration/planting</td><td>9,5 MtCO2eq</td></tr>
<tr><td colspan="2">1.3
Expansion of commercial forest cultivation</td><td>20,8 de MtC02eq</td></tr>
<tr><td colspan="2">1.4
Creation of a unique Registration system for forest carbon</td><td>-</td></tr>
<tr><td colspan="2">1.5
Tax awards for states and municipalities that reduce deforestation or increase forest cover</td><td>-</td></tr>
</table>

3. Although the inclusion of carbon sequestration by these newly protected areas would follow IPCCC guidelines we preferred not to include these estimated 70 MtCO2eq, at this time, to express a standpoint in favor of the revision of this kind of mechanism since it doesn't actually produce new carbon sequestration. However, the revision of this kind of criteria should not be done by one isolated country, it has to be collectively adopted at the UNFCCC and the IPCCC. Actually, the FBMC is proposing Brazil should employ three ways of calculating CO2 sequestration for net emissions: 1 – One limited to "active sequestration" counting only results from reforestation and afforestation 2 – The current method, used in the NDC, including designated and legally protected areas 3 – and, for comparison purposes, one including all monitored green areas as used by several OCDE nations. For internal policy assessment we should use the first

SECTOR	ACTION	MEASURE	MITIGATION POTENTIAL
AGRICULTURE AND LIVESTOCK	**2.1 Adoption of ABC techniques in the Safra Plan and expansion of the current ABC Program for the period 2020-2030**	**2.1.1 –** Pastures' recovery	**7,4 MtC02eq**
		2.1.2 - No-till plan planting and biological fertilization of nitrogen	**16,2 MtC02eq**
	2.2 Modernization of livestock management		**22,8 MtCO2eq**
TRANSPORT AND MOBILITY	**3.1 Expansion of public transport, active mobility and rationalization of individual motorized transport**		**12 MtCO2eq**
	3.2 Diversification of modes and optimization of cargo transportation		**3,8 MtCO2eq**
	3.3 Increased energy efficiency of the fossil and flex fuel fleet, including diesel in freight transport		**5,0 MtCO2eq**
	3.4 Expansion of the fleet of vehicles on biofuels, electric and hybrid		**12 MtCO2eq**
	3.5 Fostering aviation bio-kerosene and greater efficiency in air transport (no precise estimate at this time)		**-**
CITIES AND WASTE	**4.1 Expansion of capture and use of methane from dumps, landfills and effluents**		**8 MtCO2eq**
	4.2 Increased volume of composting		
	4.3 Degradation of landfill methane with flare		**20,8 MtCO2eq**
	4.4 Reverse logistics, reduction at source and selective waste collection (no precise estimate at this time)		**-**

SECTOR	ACTION	MEASURE	MITIGATION POTENTIAL
ELECTRICAL POWER	**5.1** Increase in energy efficiency levels on the consumption end (no precise estimate at this time)		-
	5.2 Expansion of the electrical generation from renewable sources, both centralized and distributed, in interconnected and in isolated systems. Development of energy storage capacity		47,1 MtCO2eq
	5.3 Repowering of hydroelectric plants		2,9 MtCO2eq
	5.4 Expansion of renewable energies in isolated locations		2 MtCO2eq
INDUSTRY	**6.1** Energy efficiency and process measures	**6.1.1 -** Efficiency of steam, heat, waste and effluents use	42,9 MtCO2eq
		6.1.2 - Exchange of solid fuels and inputs	7,3 MtCO2eq
		6.1.3 – Reduction of flare and steam recovery	22,3 MtCO2eq
	6.2 Finance for energy efficiency projects		-
ECONOMIC INSTRUMENTS	**7.1** The establishment of sectoral mitigation targets, activation of the Brazilian carbon market and the establishment of a reliable MVR system		-
	7.2 Decarbonizing criteria in taxation and subsidies	**7.2.1 -** Short term: improvement of CIDE	-
		7.2.2. Technical study for a review of subsidies in the light of a long-term decarbonization strategy	-
	7.3 Advances in the modalities of carbon pricing	**7.3.1 -** Guarantees Funds	-

ADAPTATION	
8.1 Transversal adaptation measures	**8.1.1 -** Incorporation of standards for adaptation in the PPI, where the new possibilities of investment in infrastructure are
	8.1.2 - Evaluate and assess risks and vulnerabilities in all sectors that require the downscaling of at least 10 GCMs (global climate models). We also need to consider that the climate change scenarios are just one of the elements considered in risk assessments. The whole question on values and perception of risk still requires a specific approach
	8.1.3 - Specific planning at federal level to support cities and municipalities in developing vulnerability maps, risk assessments and adaptation plans
	8.1.4 - Cross-cutting climate adaptation in sectoral planning and support to state and municipal governments for the same purpose
	8.1.5 - Implementation of PNA by defining sectoral targets with the use of indicators, identification of financing sources and prioritization of sectoral and regional level actions
	8.1.6 - Establishing the PNA's operational governance model, defining responsibilities, actions, decision-making, indicators as well as how the NAP should exchange with sectoral policies at each level of government
	8.1.7 - Develop studies evaluating adaptation costs over time and identification of funding mechanisms to share these costs equally
	8.1.8 - Develop management and environmental education programs to reduce greenhouse gas emissions for the sectoral measures of adaptation to be elaborated and implemented with the support of public universities, considering the local specificities
8.2 Energy and Industry	**8.2.1 -** Evaluation of future water availability of the main rivers and reservoirs, mainly in the regions of the North and Northeast, to enable planning future production in the electric and industrial sectors
	8.2.2 - Assess the increased demand for electricity resulting from the greater need for cooling to minimize the impact of heat waves and global warming. In this regard, distributed renewable energies are also a means of adapting to this increased demand, as well as the promotion of electric vehicles as a tool to reduce consumption at the chain's end (removing houses from the grid at peak times)
	8.2.3 - Identify new partnerships with the industrial sector to meet demands for new infrastructures or adapt existing ones to climate change
	8.2.4 - Training, standardization and dissemination of the concepts regarding adaptation to climate change for the entire value chain of finance and industry
	8.2.5 - Establish new standards to turn electric power transmission systems resilient to climate extremes (extremes of winds, rainfall, electric discharges, etc.)

ADAPTATION	
8.3 Forests and Biodiversity	**8.3.1 -** Quantify risks of Brazilian biodiversity loss and design adaptation strategies with risk assessment of accelerated extinction of species and analyze their viability. This is one of the hardest areas in the science of adaptation and touches its absolute limits
8.4 Agriculture and Livestock	**8.4.1 -** Genetic research to adapt agricultural species to the extreme climatic conditions projected for the different Brazilian biomes
	8.4.2 - Analyze irrigation demand as an adaptive measure, mainly in the basins that already face water scarcity, and suggest more efficient technologies for irrigation
	8.4.3 - Support the work of Embrapa and state institutes of agricultural research mapping climate risks and suggest new agricultural zoning in response to different climate scenarios
	8.4.4 - Inform and define strategies to support small producers to adapt to climate change
	8.4.5 - Define the role of ABC Plans and forest restoration also in the light of adapting the Brazilian agriculture to climate change
8.5 Transport and Logistics	**8.5.1 -** Vulnerability analysis of the main paved and unpaved roads in the face of projected extreme climate events, mainly intense rains and heat waves
	8.5.2 - Vulnerability analysis of the main ports in light of rising sea levels projections and related floods, undertows and other local conditions
	8.5.3 - Vulnerability analysis of the main waterways in the face of extreme weather events, mainly heavy rains and prolonged droughts
	8.5.4 - Air transport vulnerability analysis
	8.5.5 - Vulnerability analysis of information and communication technology systems
8.6 Cities and Waste	**8.6.1 -** Training states and municipalities in the management of climate risks, prepare vulnerability assessments and adaptation plans
	8.6.2 - Urbanization of favelas and poorer urban areas, improving infrastructure and services, including natural disaster warning systems in areas at risk, mainly slopes and lowlands
	8.6.3 - Protect structures in proximity of areas subject to landslides and restore native vegetation to stabilize soils and prevent flooding, recover riparian forests, and protect water supply, including quality and reduction erosion and sedimentation

ADAPTATION	
8.6 Cities and Waste	**8.6.4 -** Implement and improve natural disaster warning systems as well as civil defenses
	8.6.5 - Green sustainability initiatives - green/intelligent buildings, water reuse, rainwater harvesting, improvement/expansion of major urban drainage systems, permeable pavements, etc
	8.6.6 - Tree planting and implantation of sprinklers in the hottest areas of cities
	8.6.7 - Development of legal framework for the use of coastal areas taking into account sea level rise
	8.6.8 - Promotion of low emission zones in urban areas, considering the increase of pollutants concentration and the lower rainfall regime
8.7 Water Resourses	**8.7.1 -** River basin plans and water resources management in these territories should incorporate projections of climate change impacts on water availability and demand of uses, including decision making on water allocation
	8.7.2 - The water supply and irrigation sectors should incorporate projections of impacts on the outflow in their planning, projecting possible conflicts with other sectors (such as hydropower generation and industrial use) in the basins where water supply is expected to decrease
	8.7.3 - Coastal and lagoon regions, especially those with high population density, should anticipate fluctuations in water levels of these bodies as well as the potentially severe results and local impacts
	8.7.4 - The management of reservoirs and dams should include projections of hydrological fluctuations from climate change, both at federal (ANA) and state level (Water Resources Managing Bodies), as well as within the Basin Committees, considering vulnerabilities and impacts for the main users
	8.7.5 - Water use efficiency should be promoted through initiatives such as reducing wasted water and leakage (supply and distribution), recycling waste water and capturing rainwater, among others
	8.7.6 - Resilience to climate fluctuations should be encouraged through measures with multiple co-benefits such as water conservation and recovery, soil conservation, maintenance of ecological corridors, restoration of APPs, etc
	8.7.7 - The increasing degree of uncertainty in hydrological behavior in Brazilian river basins should be incorporated into water resource management tools so as to become more flexible and resilient
	8.7.8 - New arrangements and tools for the management of water resources, regarding their suitability for extreme hydrological events should be encouraged

Estimate of Brazilian emissions of greenhouse gases (GHG) in 2016 (last available year)

Source: SEEG - Greenhouse Gas Emission and Removal Estimation System.

1 - Gross Emissions 2016, in tons. Co2eq

Source: http://plataforma.seeg.eco.br/total_emission

ENERGY	**423.477.076**
FARMING	**499.347.537**
LAND USE	**1.167.484.337**
INDUSTRIAL PROCESSES	**95.574.731**
WASTE	**91.971.998**
TOTAL	**2.277.855.679**

2 - Net Brazilian emissions in 2016, in tons Co2eq

(Discounted from carbon sequestration by forests in protected areas and indigenous lands, according to the IPCC methodology used in the Brazilian Communications to the UNFCCC)

ENERGY	**423.477.076**
FARMING	**499.347.537**
LAND USE	**638.032.832**
INDUSTRIAL PROCESSES	**95.574.731**
WASTE	**91.971.998**
TOTAL	**1.748.404.174**

References

BID - Inter-American Development Bank. Base Document to support the structured dialogues on the elaboration of a strategy for the implementation and financing of Brazil's nationally determined contribution to the Paris Agreement. <http://www.mma.gov.br/images/arquivos/clima/ ndc/sumario_ executivo_2017.pdf>. Last accessed 02 April 2018.

COPPE - Alberto Luiz Coimbra Institute for Graduate Studies and Engineering Research / Federal University of Rio de Janeiro. Wills, W. and Grottera, C. (2015). Economic and Social Scenarios. In: LA ROVERE, E. L. et al. – Economic and Social Implications of Greenhouse Gases Mitigation Scenarios in Brazil until 2030: Project IES Brasil, Brazilian Forum on Climate Change – FBMC. COPPE/UFRJ, Rio de Janeiro, 2016.

MCTIC – Ministry of Science, Technology, Innovation and Communications. Mitigation trajectories and public policy instruments to reach the Brazilian targets in the Paris agreement. Régis Rathmann ... [et al.]. Brasília: Ministry of Science, Technology, Innovations and Communications, UN Environment, 2017. < http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/ clima/ opcoes_mitigacao/Opcoes_de_Mitigacao_de_Emissoes_de_Gases_de_ Efeito_ Estufa_GEE_em_SetoresChave_do_Brasil.html >. Last accessed 02 April 2018.

SAC/PR - Secretariat of Civil Aviation / Presidency of the Republic of Brazil. Plan of Action for the Reduction of Greenhouse Gas Emissions of Brazilian Civil Aviation - Base year 2013. <http://www.aviacao.gov.br/noticias/2016/03/acoes-sustentaveis-em-aeroportos-brasileiros-reduzem-uso-de- energia-e-danos-ao-meio-ambiente/plano_de_acao-1.pdf>. Last accessed 02 April 2018.

SAE/PR - Secretariat for Strategic Affairs / Presidency of the Republic. Project Brazil 2040: scenarios and alternatives for adaptation to climate change. Brasilia: 2015. < http://www.mma.gov.br/images/arquivo/80182/ BRASIL-2040- Resumo-Executivo.pdf> . Last accessed 02 April 2018.

SEEG - System of Greenhouse Gas Emission and Removal Estimates. Collection 5 (1970 a 2016). Climate Observatory. <http://seeg.eco.br> Last accessed 02 April 2018.

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