SECOND BIENNIAL UPDATE REPORT OF BRAZIL

TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Ministry of Foreign Affairs
Ministry of Science, Technology, Innovations and Communications

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FEDERATIVE REPUBLIC OF BRAZIL

MINISTRY OF FOREIGN AFFAIRS – *NATIONAL FOCAL POINT TO THE UNFCCC*
DEPARTMENT FOR ENVIRONMENTAL SUSTAINABILITY
DIVISION OF CLIMATE CHANGE

MINISTRY OF SCIENCE, TECHNOLOGY, INNOVATIONS AND COMMUNICATIONS
SECRETARIAT OF POLICIES AND PROGRAMS OF RESEARCH AND DEVELOPMENT
GENERAL COORDINATION ON CLIMATE

COLLABORATORS FOR THE SECOND BIENNIAL UPDATE REPORT

Ministry of Foreign Affairs – *MRE*
Ministry of Science, Technology, Innovations and Communications – *MCTIC*
Ministry of Environment – *MMA*
Ministry of Finance – *MF*
Ministry of Planning, Development and Management – *MP*
Ministry of Agriculture, Livestock and Supply – *MAPA*
Ministry of Mines and Energy – *MME*
Ministry of Industry, Foreign Trade and Services – *Mdic*
Brazilian Cooperation Agency – *ABC*

SUMMARY

1

NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1 NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENTS

1.1 NATIONAL CIRCUMSTANCES

Country Profile

Brazil is a developing country with continental dimensions (Table I) and a complex and dynamic economy. It is an urban-industrial country, with its agricultural sector playing a leading role in the world economy. Despite the evolution of economic and social indicators in recent years (Table II), it is worth recognizing that Brazil still is a developing country, with a growing population and several challenges related to poverty eradication, education, public health, employment, housing, infrastructure and access to energy.

TABLE I: RELEVANT INFORMATION ABOUT BRAZIL

Item	Characteristic
Territory	Total area of 8,515,767.049 km^2; divided in five political-administrative regions – North, Northeast, Midwest, South and Southeast; composed of 26 states and the Federal District.
Population	190.7 million people (IBGE, 2010[1]).
Climate	Five climatic regions: Equatorial (North), Tropical (most of the territory), Semi-arid (Northeast), Tropical of Altitude (Southeast), and Subtropical (South).
Biodiversity	Six biomes[2]: Amazon, Atlantic Forest, Cerrado, Caatinga, Pantanal and Pampa.
Water resources	12 river basins provide abundant water resources; however, they are unevenly distributed throughout the territory.
Energy mix	Over 41% of its supply comes from sources such as hydropower, biomass and ethanol, in addition to wind and solar energy (BEN, 2014[3]); hydroelectric power plants are responsible for over 79% of the electric energy generated in the country.

[1] 2010 census (Brazilian Institute of Geography and Statistics – IBGE). Available at: http://www.ibge.gov.br/home/estatistica/populacao/censo2010/.

[2] Biome is conceptualized in map as a set of life (plant and animal) composed by grouping types of contiguous and identifiable vegetation at a regional scale, with similar geo-climate conditions and a shared history of changes, resulting in a unique biological diversity. (IBGE, 2004)

[3] The Synthesis Report of the National Energy Balance – BEN 2014 presents data about the accounting of the supply, processing and final consumption of energy products in Brazil, based on the year 2013. Available at: <https://ben.epe.gov.br/downloads/S%C3%ADntese%20do%20Relat%C3%B3rio%20Final_2014_Web.pdf>.

TABLE II: SOCIOECONOMIC INDICATORS OF BRAZIL

Socioeconomic indicators	1990	1995	2000	2005	2010	2013 [2]
Gross Domestic Product (GDP) (in BRL billions)	774	854	1,199	2,170	3,885	5,316
GDP per capita (in BRL thousands)	17.24	18.71	18.81	20.32	23.87	24.70
Agriculture Gross Domestic Product (in % of GDP)	8.1	5.01	4.75	4.65	4.12	4.51
Industry Gross Domestic Product (in % of GDP)	38.7	23.38	23.01	24.17	23.27	21.22
Service Sector Gross Domestic Product (in % of GDP)	53.2	58.12	58.25	56.08	57.61	59.68
Human Development Index (HDI)	0.590	0.633	0.669	0.699	0.726	0.744
Gini Index	0.614	0.601	0.594 [1]	0.570	0.543 [1]	0.527
Percentage of the population living with less than USD 1.90 (PPP) per day	20.56	12.99	13.36 [1]	9.55	6.18 [1]	4.87

[1] *Data unavailable for the year; previous year data repeated.*
[2] *Most recent year with available data for all the indicators shown.*

Policy Dimensions

As mentioned in Brazil's first BUR, the Brazilian Government has created a series of regulatory frameworks and management instruments – which are still in force – aiming at implementing the United Nations Framework Convention on Climate Change (UNFCCC) in the country. With regard to institutional arrangements for the implementation of climate action in general, national governance remains as described in Brazil's first BUR and the Third National Communication. Notably, the National Policy on Climate Change (PNMC) is still the basis of the legal framework for actions against climate change in Brazil. Its main features are summarized in Table III.

TABLE III: NATIONAL POLICY ON CLIMATE CHANGE (PNMC)

PNMC	Details
Legal framework	Law Number 12,187, enacted in 2009
Objectives	Promoting sustainable development while protecting the climate system; reducing greenhouse gas emissions from relevant sources, as well as strengthening removals of these gases by sinks; implementing measures to adapt to climate change in order to reduce its adverse effects and the vulnerability of environmental, social and economic systems.
National voluntary commitment	Expected emissions reduction of between 36.1% and 38.9% below its projected emissions in 2020 (*business as usual*).
Instruments	National Plan on Climate Change; two action plans, one developed for the Amazon and the other for the Cerrado, to prevent and control deforestation; and plans for mitigation and adaptation in agriculture, energy and charcoal.
Regulation	Decree Number 7,390/2010, which indicates the projected emissions for 2020 and provides details on the national voluntary commitment.
Management and institutional arrangements	Coordination among federal agencies and entities of the Brazilian civil society. A governance structure was established for the implementation of this policy with specific mandates and assignments that are complimentary to each other. The main institutional instruments are: the Interministerial Committee on Climate Change (CIM); the Interministerial Commission on Global Climate Change (CIMGC); the Brazilian Forum on Climate Change (FBMC); and the Brazilian Research Network on Global Climate Change (Rede CLIMA). These bodies also assist in implementing the Convention and the Kyoto Protocol in Brazil.

1.2 **INSTITUTIONAL ARRANGEMENTS**

The Ministry of Science, Technology, Innovation and Communications (MCTIC) was responsible for coordinating the elaboration of the first, second and third National Communications of Brazil to the Convention, in its capacity as the Brazilian Government agency to conduct the National Communication project, through the work of its General Coordination on Climate (CGCL). Support for the development of these documents is provided by the Global Environment Facility (GEF), with the collaboration of the United Nations Development Programme (UNDP) and the consent of the Brazilian Cooperation Agency (ABC).

The preparation of BURs is conducted by a task-force coordinated by the Ministry of Foreign Affairs, in its capacity as the Brazilian National Focal Point to the UNFCCC, with the participation of different institutions and Ministries, such as: Ministry of Science, Technology, Innovation and Communication (MCTIC); Ministry of Environment (MMA); Ministry of Agriculture, Livestock and Supply (MAPA); Ministry of Mines and Energy (MME); Ministry of Industry, Foreign Trade and Services (Mdic); Ministry of Planning, Development and Management (MP); Ministry of Finance (MF); and the Brazilian Cooperation Agency (ABC).

The Technical Annex pursuant to decision 14/CP.19 was elaborated separately through the Working Group of Technical Experts on REDD+, created in February 2014 by the Ministry of Environment (MMA).

2

NATIONAL INVENTORY OF ANTHROPOGENIC EMISSIONS BY SOURCES AND REMOVALS BY SINKS OF GREENHOUSE GASES NOT CONTROLLED BY THE MONTREAL PROTOCOL

2 NATIONAL INVENTORY OF ANTHROPOGENIC EMISSIONS BY SOURCES AND REMOVALS BY SINKS OF GREENHOUSE GASES NOT CONTROLLED BY THE MONTREAL PROTOCOL

This section presents, in a summarized manner, the historical time series of emissions of the third National Inventory of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases Not Controlled by the Montreal Protocol[4], submitted to the UNFCCC in April 2016, and adds emission estimates for the years 2011 and 2012, by using the activity data publicly available, in an update of the information presented in the first BUR.

Preparation of the inventory involved significant participation of the Brazilian business and scientific communities, in addition to various government sectors. The Ministry of Science, Technology, Innovation and Communications (MCTIC) is the main coordinator for the elaboration of the national inventory of emissions and responsible for articulating different working groups that contribute to surveying sectoral information and conducting studies to obtain country-specific emission factors.

As part of the academic and research contributions to the elaboration of the national inventory of emissions, the participation of the Brazilian Research Network on Global Climate Change (Rede CLIMA) was significant in developing studies on national emission factors and surveying activity data. Rede CLIMA's mission is to generate and publicise knowledge on the causes and effects of global climate change by producing information for the preparation of climate change policies and for following up their implementation.

The following tables (Tables IV, V, VI and VII) show the greenhouse gas emissions for years 1994, 2000, 2010 and 2012, by type of gas and sector (Energy, Industrial Processes, Land Use, Land-Use Change and Forestry, Agriculture and Waste).

[4] *Ministry of Science, Technology and Innovation. (2016).* ***Third National Communication of Brazil to the United Nations Framework Convention on Climate Change – Volume III****. Brasília: MCTI, 333p. Available at: http://sirene.mcti.gov.br/. Last accessed on January 13, 2017.*

TABLE IV – GREENHOUSE GAS EMISSIONS BY SOURCES, YEAR 1994, IN GIGAGRAM (Gg)

Sector	Unit	CO_2	CH_4	N_2O	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a	HFC-152a	CF_4	C_2F_6	SF_6	NO_x	CO	NMVOC
Energy	Gg	193,669	494.7	14.53										1,870.0	9,632.1	1,120.9
Industrial processes		51,516	44.2	17.47	0.1566	-	-	0.0685	-	-	0.3231	0.0279	0.0140	52.9	834.3	370.8
Solvent and other product use																2,299.1
Agriculture			9,865.1	334.7										106.2	3,908.1	NE
Land Use, Land-Use Change and Forestry		821,387	1,213.8	48.7										593.1	21,286.6	NE
Waste		66	1,361.2	4.7												
TOTAL		**1,066,638**	**12,978.4**	**420.1**	**0.1566**	**0.0000**	**0.0000**	**0.0685**	**0.0000**	**0.0000**	**0.3231**	**0.0279**	**0.0140**	**2,622.2**	**35,661.1**	**3,790.8**
Bunker Fuels	Gg	**7,298**	**0.0**	**0.13**										**1.7**	**0.7**	**6.8**
Aviation		3,539	0.0	0.10										1.0	0.7	0.2
Navigation		3,759	0.0	0.3										0.7	0.0	6.6
Biofuel		**173,888**														

TABLE V – GREENHOUSE GAS EMISSIONS BY SOURCES, YEAR 2000, IN GIGAGRAM (Gg)

Sector	Unit	CO_2	CH_4	N_2O	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a	HFC-152a	CF_4	C_2F_6	SF_6	NO_x	CO	NMVOC
Energy	Gg	267,646	511.8	18.99										2,273.3	8,181.0	987.4
Industrial processes		65,991	43.7	21.14	-	-	0.0071	0.4988	0.0075	0.0001	0.1465	0.0117	0.0153	94.9	790.5	532.8
Solvent and other product use																3,154.0
Agriculture			10,382.3	355.9										97.2	3,576.4	NE
Land Use, Land-Use Change and Forestry		1,197,175.0	2,048.8	82.0										993.8	35,879.9	NE
Waste		95	1,754.2	82.0												
TOTAL		**1,530,907.0**	**14,740.8**	**483.7**	**0.00**	**0.00**	**0.0071**	**0.4988**	**0.0075**	**0.0001**	**0.1465**	**0.0117**	**0.0153**	**3,459.2**	**48,427.8**	**4,674.2**
Bunker Fuels	Gg	**13,639**	**0.1**	**0.20**										**3.2**	**0.9**	**14.9**
Aviation		4,626	0.0	0.13										1.4	0.9	0.2
Navigation		9,013	0.1	0.07										1.8	0.0	14.7
Biofuel		**166,435**														

TABLE VI – GREENHOUSE GAS EMISSIONS BY SOURCES, YEAR 2010, IN GIGAGRAM (Gg)

Sector	Unit	CO_2	CH_4	N_2O	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a	HFC-152a	CF_4	C_2F_6	SF_6	NO_x	CO	NMVOC
Energy	Gg	347,974	629.1	31.97										2,567.1	7,695.9	900.5
Industrial processes		80.786	45.3	2.15	-	0.1059	0.5012	2.7196	0.4671	-	0.0767	0.0059	0.0087	100.8	809.6	736.8
Solvent and other product use																4,749.9
Agriculture			12,415.6	472.1										171.6	6,313.5	NE
Land Use, Land-Use Change and Forestry		310,736	1,136	47.1										589.9	20,231.4	NE
Waste		175	2,462.7	7.2												
TOTAL		**739,671**	**16,688**	**560.5**	**0.1566**	**0.1059**	**0.5012**	**2.7196**	**0.4671**	**0.0000**	**0.0767**	**0.0059**	**0.0087**	**3,429**	**35,050**	**6,387.2**
Bunker Fuels	Gg	**18,550**	**0.2**	**0.27**										**4.3**	**1.1**	**21.4**
Aviation		5,784	0.0	0.17										1.8	1.1	0.2
Navigation		12,766	0.2	0.10										2.5	0.0	21.2
Biofuel		**303,170**														

TABLE VII – GREENHOUSE GAS EMISSIONS BY SOURCES, YEAR 2012, IN GIGAGRAM (Gg)

Sector	Unit	CO_2	CH_4	N_2O	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a	HFC-152a	CF_4	C_2F_6	SF_6	NO_x	CO	NMVOC
Energy	Gg	395,214	597.4	36.55										2,753.2	7,582.4	872.2
Industrial processes		88,182	43.3	1.86	-	0.1286	0.4795	0.3015	0.4767	-	0.0655	0.0050	0.0083	104.1	795.1	771.6
Solvent and other product use																5,477.6
Agriculture			12,492.3	491.1										152.6	5,616.9	NE
Land Use, Land-Use Change and Forestry		215,312	1.080	45.2										571.6	19,337.7	NE
Waste		227	2,595.4	7.5												
TOTAL		**698,935**	**16,808**	**582.2**	**0.0000**	**0.1286**	**0.4795**	**0.3015**	**0.4767**	**0.0000**	**0.0655**	**0.0050**	**0.0083**	**3,581.5**	**33,332.1**	**7,121.4**
Bunker Fuels	Gg	**19,049**	**0.1**	**0.29**										**4.5**	**1.3**	**21.3**
Aviation		6,896	0.0	0.20										2.1	1.3	0.2
Navigation		12,153	0.1	0.09										2.4	0.0	21.1
Biofuel		**292,178**														

Figure I shows the annual evolution of greenhouse gases in Brazil, per sector, from 1990 to 2012. The reduction of GHG emissions in Brazil is mainly due to the drop in deforestation rates in Brazilian biomes, especially in the Amazon.

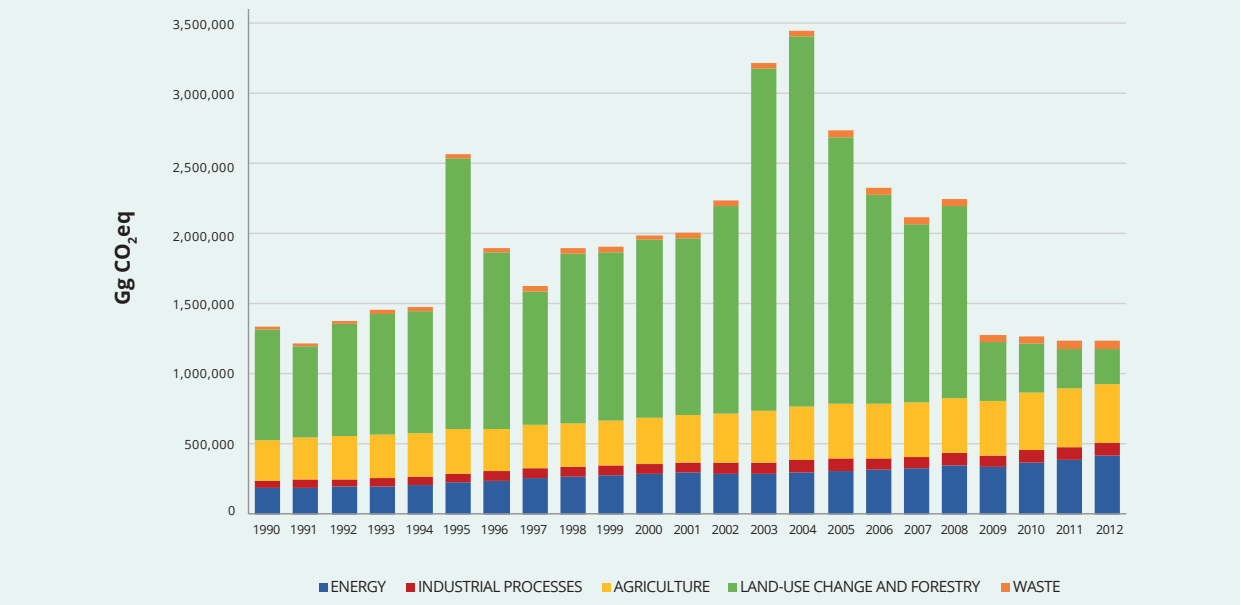

Figure I – GHG emissions in Brazil by sector, from 1990 to 2012, in CO_2eq (GWP-SAR)

Figure II compares emission levels in 1994, 2000, 2010 and 2012 with the national voluntary commitment for 2020, in GWP and GTP. In 2012, national emission levels were significantly below the *business as usual* projection for 2020 and the national voluntary commitment (based on Decree No. 7,390/2010).

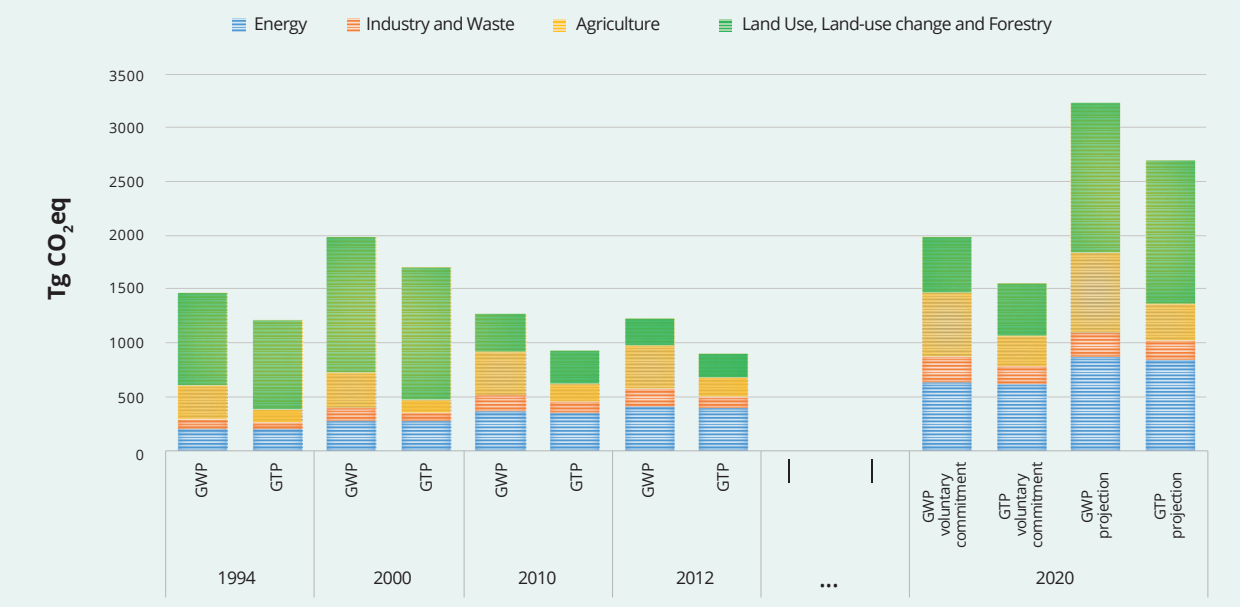

Figure II – GHG emissions in Brazil for 1994, 2000, 2010 and 2012, by sector, compared to the national voluntary commitment and projected emissions for 2020.

2.1 METHODOLOGICAL SUMMARY

The preparation of the National GHG Inventory is in accordance with the guidelines for the elaboration of the National Communications of Parties not included in Annex I to the Convention, established in decision 17/CP.8.

The methodological approaches and guidance used in the development of the National GHG Inventory were based on the "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories" (IPCC, 1997); "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" (GPG, 2000), and "Good Practice Guidance for Land Use, Land-Use Change and Forestry" (GPG LULUCF, 2003). Some of the estimates already take into account information published in the document "2006 IPCC Guidelines for National Greenhouse Gas Inventories".

In relevant sectors in Brazil, such as agriculture and land use, land-use change and forestry, no methodologies can be easily applied to the national characteristics, given that emission factors suggested by the IPCC largely reflect the conditions of developed countries with a temperate climate and are not necessarily adequate to the Brazilian reality. Therefore, under the third National Inventory of Emissions, a great effort was undertaken to obtain information corresponding to the domestic conditions, thus allowing for the use of more detailed IPCC methodologies and more accurate estimates.

Methodologies, activity data, emission factors and assumptions adopted for the preparation of this BUR were the same as those stated in the third National Communication of Brazil. Detailed information may be obtained in Volume III of the third National Communication, including on uncertainty of the estimates. In order to add estimates beyond the last year reported by the third National Communication, it was necessary to adopt some simplified assumptions for the years 2011 and 2012, using the best available information.

3

MITIGATION ACTIONS AND THEIR EFFECTS

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This section presents updated information in relation to the first BUR on Brazil's Nationally Appropriate Mitigation Actions (NAMA) communicated to the Convention. The timeframe varies according to the beginning of the implementation of each specific action, starting in 2004 and going up to 2015 and, where possible, the first half of 2016. At the national level, the government of Brazil established Sectoral Plans as instruments to support the implementation of its NAMAs, pursuant to its National Policy on Climate Change (PNMC).

TABLE VIII – MITIGATION ACTIONS IN BRAZIL

Name: National Plan for Low Carbon Emission in Agriculture (ABC Plan)	
Nature of the action: NAMA	
Sector: Agriculture	
Gas(es): CH_4, N_2O, CO_2	
Main objective: increase the area under sustainable agricultural production systems	
Description: Brazil has been investing in the sustainability of its agricultural sector. Through research and technology development, Brazil has achieved an important role in food production, by increasing productivity while maintaining almost constant the area under farming activity: in the last 35 years, Brazilian agricultural productivity has increased from 1.2 t/ha to 3.4t/ha. In this context, the ABC Plan was established in 2011, as one of the government's tools to promote the increase of area under sustainable agricultural practices. In order to promote the adoption by farmers of a set of technologies, developed within a conservationist agriculture framework, the Plan establishes a series of actions, involving training, technology transfer, establishment of Technological Reference Units, among others. The set of technologies promoted by the Plan (Recovery of Degraded Pasturelands, Integration Agriculture-Livestock-Forest and Agroforestry Systems, No-Tillage System, Biological Nitrogen Fixation, Planted Forests; Manure Management and Treatment) is a result of solid long time research, and have proven to increase agricultural productivity, integrating the concerns of soil and water conservation, as well as biodiversity, resulting in production systems that are more resilient to climate variability, adding to the efforts of maintaining the country's food production capacity in a context of global concern regarding food security. Further, the chosen set of technologies has also proven to reduce the GHG emissions originated from conventional farming activities, adding to the ongoing efforts by Brazil to reduce GHG emissions.	
Period considered: 2010 – 2015	
Specific objectives	**Progress achieved**
i. establishment of the Sectoral Plan for Mitigation and Adaptation to Climate Change for the Consolidation of an Economy of Low Carbon in Agriculture - ABC Plan	i. Sectoral Plan established in 2011
ii. transform 35,5 million hectares currently under poor agricultural practices into sustainable agricultural production systems by 2020	ii. Brazil has already invested, through credit lines, BRL 13.3 billion[5], covering around 30,000 contracts in private projects aiming at the improvement of agricultural production systems. A more detailed monitoring system is under development, in order to evaluate the effective area under transformation, which involves the mentioned projects added to a privately-financed project. Under the governance of the Plan, 31,813 professionals (70% technicians and 30% farmers) have been trained, and further training activities are being planned for both technicians and farmers. Technological reference units as well as further research are being developed throughout the country in order to improve the possible production systems design, considering its large ecological and social diversity.

[5] *Equivalent to almost USD 4 billion, considering conversion rate of USD 1.00 = BRL 3.38.*

Name: Action Plan for the Prevention and Control of Deforestation in the Legal Amazon – PPCDAm	
Nature of the action: NAMA	
Sector: Land use, land-use change and forestry (LULUCF)	
Gas(es): CO_2	
Description: The Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) was launched in 2004, as an effort of Federal Government to reduce deforestation rates in Legal Amazon. PPCDAm identified a number of measures, policies and actions to reverse the deforestation trend. Since then, the Federal Government has been working in coordination with the various stakeholders, including state and municipal governments as well as the civil society, to promote a sustainable model of forest resource use and agricultural practices. PPCDAm is structured in three thematic axes that direct government actions towards reducing deforestation: i) Land Tenure and Territorial Planning; ii) Environmental Monitoring and Control, and iii) Fostering Sustainable Production Activities. The Plan is periodically revised and it has already had three phases: 1st phase (2004 - 2008), 2nd phase (2009-2011) and 3rd phase (2012-2015). The 4th phase of PPCDAm was under development in 2016. The National Policy on Climate Change (Law 12,187) included PPCDAm as one of its instruments.	
Main objective: Promote the continuous and consistent reduction of deforestation in the Amazon Region. According with Decree 7,390, which regulates the National Policy on Climate Change, Brazil committed to reduce, by 2020, 80% of the annual rate of deforestation relative to the average annual gross deforestation in the period 1996 to 2005 (km^2), inclusive.	
Period considered: 2004 – 2015	
Specific objectives	**Progress achieved**
Promote the land tenure of public lands	Creation of more 50 million hectares of protected areas (federal and state ones) (2004 – 2015) 10 million hectares of indigenous lands approved (2004 – 2011) More than 10 million hectares of intended public lands (2012 – 2015)
Implement the instruments of spatial planning aiming at the conservation of the forest	Preparation of MacroZEE (Macro Ecological and Economic Zoning System) of the Legal Amazon (2004 – 2011) Support for the preparation of state and regional ZEEs (Ecological and Economic Zoning) (2012 – 2015) Implementation of protected areas (2004 – 2015) Resolution of land conflicts in protected areas and indigenous lands (2012 – 2015)
Increase the effectiveness of the monitoring and control	Establishment of satellites monitoring systems (DETER, Terraclass, DEGRAD) (2004 – 2011) Continuity of the historical series of DEGRAD (2012 – 2015) Continuity of the historical series of TerraClass (2012 – 2015) Creation of the Permanent Cabinet for Environmental Protection (2013) Development of DETER-B, improving the spatial resolution (2012 – 2015) 1,349 surveillance operations to combat deforestation (2012 – 2015) More than BRL 11 billion in fines, in addition to more than 1 million hectares of interdicted areas (2004 – 2015) Strengthening of the enforcement actions in federal conservation units and deployment of operational bases in the units (2012 – 2013) Dismantling of criminal groups which violated the system of forest control (2012 – 2015)
Promote the environmental responsibility of the main productive chains related to illegal deforestation	Institution of Sectoral Pacts with the business sector to reduce deforestation and the environmental responsibility of the productive chains (Soy Moratorium, Legal Timber) (2006 – 2013) Institution of the Rural Environmental Registry by Law No. 12,651 (2012) 540,271 properties registered in the Rural Environmental Registry (2012 - 2015)
Promote the viability of productive chains that are alternatives to deforestation	Incentives for the marketing of biodiversity products through the Minimum Prices Guarantee Policy Biodiversity Products - PGPM-Bio (2009 – 2015) Over 60,000 Green Grant beneficiary families (2012 – 2015)

Promote good agricultural practices, including the replacement of the use of fire	2,570 individuals trained in good agricultural practices (2012 – 2015) 67 Units, including Technological Reference Units and Test Demonstration Units deployed for the dissemination of agroforestry systems (2012-2015) 166 projects implemented to disseminate good agricultural practices without the use of fire (2012 – 2015) BRL 2,028 million to support family farming and low carbon practices (2013 – 2015)
Increase the production and marketing of wood through Sustainable Forest Management	Granting of 842,000 hectares of Public Forests for Sustainable Forest Management (2004 – 2015) Technical assistance for 3,200 families in Community and Family Forest Management (2012 – 2015)
Promote environmental adaptation and foster sustainable productive activities in settlements of agrarian reform and in Family Agriculture	Incentives for the marketing of products of family farming by means of institutional markets and subvention (2004 – 2015) 533 environmental permits filed for agrarian reform settlements in the Legal Amazon in their respective state environment organizations (2004 – 2011) 13,852 families assisted in projects for the management of natural resources in settlements, aiming at the recovery of Areas of Permanent Preservation and Legal Reserves, and adoption of sustainable production practices (2004 – 2011) Creation of the Green Settlements Program (2012 – 2013) BRL 130 million of Food Acquisition Program to buy products from extractivist and smallholder families (2012 – 2015) Technical assistance for 12,148 families in cocoa production (2012 – 2015)
Generate C, T & I on the Amazon in order to subsidize the sustainable development	BRL 8.3 million were invested to the development of products and processes in the Biotechnology Centre of the Amazon (2012 – 2015).

Name: Action Plan for the Prevention and Control of Deforestation and Forest Fires in the Cerrado biome - PPCerrado

Nature of the action: NAMA

Sector: Land use, land-use change and forestry

Gas(es): CO_2

Description: The Cerrado biome has been included as a priority area for actions of prevention and control of deforestation and fires in the National Policy on Climate Change - PNMC (Law No. 12,187/2009). Thus, the PPCerrado, created by Presidential Decree on September 15, 2010, was established as one of the main instruments of the PNMC. Developed from the successful experience of the PPCDAm, the PPCerrado also has 3 action axes: 1) Monitoring and Control; 2) Protected Areas and Land Use Planning; and 3) Fostering Sustainable Activities. The 3rd phase of PPCerrado was under development in 2016.

Main objective: The general objective of PPCerrado is to promote the continuous reduction of the rate of deforestation and forest degradation, as well as the incidence of forest fires in the Cerrado biome, through linkage of actions and partnerships between the Central Government, the States, Municipalities, civil society organizations, business sector and universities. In accordance with the Decree No. 7,390, which regulates the National Policy on Climate Change, Brazil committed domestically to reduce, by 2020, 40% of the annual rate relative to the annual average rate from 1999 and 2008, i.e., reduction of 15,701 km² to 9,420 km² per year.

Period considered: 2010 – 2015

Specific objectives	Progress achieved
Promote planted forests for charcoal production	1,032 people trained in planted forests/ agroforestry systems (2014 – 2015) 30 projects fostering planted forests production (2012 – 2015)
Promote sustainable forest management	Technical assistance for 2,400 families in Community and Family Forest Management (2014 – 2015) 89 projects of ethnical development and restoration of degraded areas for environmental protection and food security for 18,000 indigenous people (2014 – 2015)

Increase the adoption of sustainable practices and systems for agriculture in degraded or abandoned areas	Training of 7,686 technicians, 2,196 farmers and 1,098 students in low carbon agricultural practices (2014 – 2015) 48 projects fostering sustainable agricultural technologies (2012 – 2015) Training of 1,035 rural producers in the use of sustainable models of production (crop-livestock-forest, no tillage, organic agriculture and SAF) (2010 – 2011) Training of 161 rural producers in agricultural practices without the use of fire (2014 – 2015) Provision of technical assistance for sustainable activities (agroforestry, organic agriculture, crop-livestock and no-tillage) to 100,921 families (2010 – 2011)
Encourage the marketing and consumption of biodiversity products	Inclusion of 4 new products in the Policy of Minimum Prices Guarantee (baru, mangaba and umbu) and 1 in the National Policy of School Feeding – PNAE (2010 – 2015) Acquisition of 983 tons of products of Cerrado biodiversity by the PGPM-Bio (2014) Acquisition of 8,061 tons of products of agro-extractivism and biodiversity by the Food Purchase Program – PAA (2010 – 2011) Support 6 projects for the strengthening of the social and productive organization of traditional and extractive communities, and 15 projects to support sustainable production of indigenous peoples and the environmental management of their lands (2010 – 2011) 3 local production arrangements implemented (2014 – 2015) 17 projects fostering technologies for the sustainable use of native species (2012 – 2015)
Promote Rural Environmental Registry and recover degraded areas in Legal Reserves and Permanent Preservation Areas	Implementation of 7 Reference Centres in Recovery of Degraded Areas (CRADs) (2010 – 2011) Over 4,000 Green Grant beneficiary families (2014 – 2015) 12 projects fostering technologies for recovering degraded areas (2012 – 2015) 876,438 properties entered in the Rural Environmental Registry (2012 – 2015)
Enhance land-cover monitoring	2013 land use map of Cerrado biome – TerraClass Cerrado (2014 – 2015) More than 19,000 of embargoed areas identified by IBAMA
Strengthen the integrated surveillance of deforestation in special areas (Conservation Units and Indigenous Lands) and areas of priority for the conservation of biodiversity and water resources	Perform surveillance operations of the chain of the coal produced for the steel industries (2010 – 2015) BRL 75million in fines (2014 – 2015) 30 surveillance operations of the most vulnerable indigenous lands (2014 – 2015)
Enhance the National Environmental System for forest management	National System for Forest Products Origin Control developed and implemented in Cerrado states (2014 – 2015)
Implement Integrated and Adaptive Fire Management actions, considering its social, ecological and economic importance	Training of 630 and hiring of 490 fire fighters in Federal Conservation Units (2010 – 2011) Training and hiring of 1,293 fire fighters for the federal brigade program (2014 – 2015) Deployment of two Operational Bases for Preventing and Fighting Forest Fires (2010 – 2011) Training of 3,646 fire fighters in municipalities with a high occurrence of forest fires (2010 – 2011)
Create and consolidate protected areas (Conservation Units and Indigenous Lands) for the conservation of biodiversity and the sustainable use of natural resources	17,294,941 hectares of public forests registered (2010 – 2011) Declaration of the traditional possession of 5 Indigenous Lands (2010 – 2011) Completion of studies concerning the 3 areas for the creation of Conservation Units (2010 – 2011) Implementation of protected areas (2014 – 2015) Development of 14 Plans for the Territorial and Environmental Management of Indigenous Territories– PNGATI
Promote the territorial planning of the Cerrado biome	Conclusion of the proposals of Ecologic-Economic Zoning for the Parnaiba and Tocantins-Araguaia rivers basins, where the MacroZEE (Macro Ecological and Economic Zoning System) of the Cerrado biome is under preparation (2010 – 2011)

Name: Sustainable Charcoal for Iron and Steel production	
Nature of the action: NAMA	
Sector: Industrial processes; Energy	
Gas(es): CO_2; CH_4	
Description: The main objective of this mitigation action is to promote the sustainable production of charcoal used as an input in the production of iron and steel, aimed at reducing emissions and increasing the competitiveness of the sector. This transition to sustainability involves the development of solutions for the adequate supply of sustainable raw material (planted forests, forest management, wood residue for charcoal production), as well as development and dissemination of more efficient charcoal production technologies that increase efficiency in the conversion of wood into charcoal and ensure environmental quality improvement and GHG emissions monitoring.	
Main objective: To promote the sustainable production of charcoal used as an input in the production of pig iron.	
Period considered: 2010 – 2016	
Specific objectives	**Progress achieved**
Reduce 8 to 10 Million tons of CO_2eq by replacing the use of native forest for planted forest to produce charcoal used as a thermo-reducer in the production of pig-iron	Brazilian Government launched in 2010, specific Emission reduction Plan to support the achievement of this goal. The coordination of this Plan is shared by MMA and MDIC, the first being responsible for the forestry component of the Plan and the second by the industrial and technological components related to the carbonization process. The first phase of the Plan was implemented from 2010 to 2013 and the Plan underwent a revision process for adjustment of strategy and targets to acknowledge the impact of the international economic crisis of 2008 and update the Plan to new obligations under the Paris Agreement. MDIC commissioned a survey of the sector by leading experts with the participation of private sector representatives associations, released in December 2014, that makes recommendations of strategies for the second phase of the Plan. In the first period of the Plan, the main actions were the creation of specific lines of credit to finance planted forests and technology development – particularly more efficient kilns and environmental monitoring technology – from BNDES (Fundo Clima, BNDES Florestal, etc.) and FINEP (Inova-Energia) and the articulation and mobilization of public and private sectors that resulted in the adoption of voluntary measures by industry associations (IABr, Instituto Ethos) to increase the sustainability of the sector. The Government and the private sector also started the development of new sustainable production standards by the National Association of Technical Standards (ABNT). The enforcement of national legislation against deforestation and the intensification of policing actions reduced the supply of illegal charcoal and the voluntary initiatives from the private sector resulted in a reduction in the use of native forest in the charcoal production from 3.8 million tons in 2008 to 1.9 million tons in 2012, reducing the percentage of native forest in charcoal production from 51% to 33%.
Sustainable Steelmaking Plan	The Second phase of the Plan has as flagship initiative a pilot-project, funded by the Global Environmental Facility (GEF), to promote Sustainable Steelmaking in the state of Minas Gerais. This project will contribute to the dissemination of more efficient carbonization technologies by means of a result-based incentive mechanism and also contribute to the policy framework.

Name: Increase in the Supply of Energy by means of Hydroelectric Plants	
Nature of the action: NAMA	
Sector: Energy	
Gas(es): CO_2eq	
Description: Introduction of hydroelectric power plants to supply electricity to replace the implementation of thermoelectric plants	
Main objective: Increase the hydroelectric power in the National Energy Mix	
Period of evaluation: 2010 – 2015	
Specific objectives	**Progress achieved**
Granting of hydropower plants	In Brazil, the inclusion of low emission sources starts in the planning stage and includes projections for a 10-year horizon. Auctions to buy energy are carried out within 3 to 5 years in advance when new generation undertakings need to be acquired. This system provides the guarantee needed for these undertakings to be inserted in the energy-generating complex. Between 2010 and April 2015, new hydropower plants represented an increment of some 11,800 MW of supervised installed power capacity to the national interconnected system – a 15.6% increase in relation to the supervised power capacity in March 2010, which was of 75,727MW. The fact that the Teles Pires Hydropower Plant (1,800 MW), the Santo Antônio Hydropower Plant (3,750 MW) and the Jirau Hydropower Plant (3,750 MW) started to operate in this period is of note. *(Source: Information database of the Brazilian Electricity Regulatory Agency - ANEEL.)*

Name: Use of Alternative Energy Sources
Nature of the action: NAMA
Sector: Energia
Gas(es): CO_2eq
Description: Introduction of wind power plants, small hydroelectric power stations and electricity generation from biomass to supply electricity to replace the implementation of thermoelectric plants.
Main objective: Increase of alternative sources in the National Energy Mix
Period of evaluation: 2010 – 2015

Specific objectives	Progress achieved
Granting of Small Hydroelectric Power Plants, Biomass Thermal Power Plants and Wind Power Plants	Brazil instituted an important incentive that encouraged the implementation of alternative sources of energy generation: the Alternative Electrical Energy Sources Incentive Program (PROINFA, acronym in Portuguese), completed on December 30, 2011. This Program undertook 144 projects, consisting of 54 wind farms, 63 Small Hydroelectric Plants (SHPs) and 27 biomass thermal plants. Together, the 144 projects have installed capacity of 3,296.81 MW, comprising 1,422.92 MW in wind farms, 1,188 MW in SHPs and 685.24 MW in biomass plants. *(Updated on 03/08/2016 – Source: DDE/SPE/MME).* In addition to the PROINFA, specific auctions for renewable energy sources were carried out between 2010 and 2015. Thus, between 2010 and 2015, approximately 13,281 MW of supervised installed power started to operate, originated from Small Hydroelectric Power Plants (1,793 MW), Wind Power Plants (7,037 MW) and 27 Biomass Thermal Plants* (4,451 MW). *Obs: Considering biomass of sugarcane bagasse, firewood and rice hulls. *(Source: Information database of the Brazilian Electricity Regulatory Agency - ANEEL.)* According to the Monitoring of the Brazilian Electricity Sector Bulletin, in December 2010, Brazil had installed capacity of 927 MW for Wind Power Plants, 7,826 MW for Biomass Thermal Power Plants and 3,428 MW for SHP. In December 2015, these figures were 7,633 MW for Wind Power Plants, 13,257 MW for Biomass Power Plants and 4,886 MW for SHP. *(Source: December/2010 Bulletin and December/2015 Bulletin – Monitoring of the Brazilian Electric System. DMSE/SEE/MME)*

Name: Increased Use of Biofuels
Nature of the action: NAMA
Sector: Energy
Gas(es): CO_2eq
Description: Increase the supply of anhydrous and hydrated ethanol, as well as biodiesel to replace fossil fuels
Main objective: Increase the amount of Biofuel in the National Energy Mix
Period of evaluation: 2010 – 2015

Specific objectives	Progress achieved
Supply of anhydrous and hydrated ethanol and biodiesel	In 2010, total production of ethanol (both anhydrous and hydrated ethanol) reached 27.96 million m^3. In 2015, total production reached around 30 million m^3. Throughout the period from 2010 to 2015 the national supply of ethanol was around 160 million m^3. In addition to ethanol, Brazil provides biodiesel that is blended with diesel oil derived from petroleum. Several products are used for the production of biodiesel, such as soybeans and bovine tallow. In 2010, total biodiesel supply was 2.397 million m^3. In 2014, the total biodiesel supply was 3.42 million m^3. From 2010 to 2014, the national biodiesel supply was 14.1 million m^3. (SOURCE: BEN 2015 and BEN 2011). The percentage of mandatory blending of biodiesel into fossil diesel has been increasing steadily since 2005. In 2016, Law No. 13,263/2016, dated 23 March 2016, determined that the percentages of mandatory blending of biodiesel into diesel oil sold to the final consumer, in any part of the national territory, should be 8% (eight percent) by March 2017; 9% (nine percent) by March 2018; and 10% (ten percent) by March 2019. Law No. 13,263/16 also authorizes that, starting in 2019, the biodiesel blending may reach 15% after "tests and trials to validate the use of the biodiesel blend to the diesel oil sold to the final consumer". *(Source: Renewable Energy Monthly Bulletin SPG/MME with data from the REN21 and Law No. 13,263/2016)*

Name: Implementation of Energy Efficiency	
Nature of the action: NAMA	
Sector: Energy	
Gas(es): CO_2eq	
Description: Reducing the use of fossil fuels and electricity through the increase of energy efficiency in different sectors of the economy.	
Main objective: Reducing the consumption of fossil fuels and electric power	
Period of evaluation: 2010 – 2015	
Specific objectives	**Progress achieved**
Reduction of electric power consumption	The actions of the National Electrical Energy Conservation Program (Procel, acronym in Portuguese) resulted in energy savings of 6.164 billion kWh in 2010 and 11.68 billion kWh in 2015. Taking into consideration the accrued result of the period 2010 to 2015, around 64.415 billion kWh were saved. *(Source: Procel results in 2016, year base 2015 and Procel results 2011, year base 2010. Eletrobras/MME).*

Reducing the consumption of fossil fuels	Coordinated by the National Institute of Metrology, Quality and Technology (Inmetro, acronym in Portuguese), in partnership with the National Program for the Rational Use of Natural Gas and Oil Products (Conpet, acronym in Portuguese), the Brazilian Labeling Vehicle Program (PBEV, acronym in Portuguese) reached its eighth cycle in 2016, with record participation since its creation in 2008. Practically all automakers and importers that operate within the Brazilian territory have joined, which led to 90% of the cars marketed in the country bringing the information of consumption efficiency and emission of gases, both polluting and greenhouse gases (CO_2). Initially (April 2016), this ruling applied to 795 models and versions. Throughout the first semester of 2016, another 131 models and versions would have been included, ending the year 2016 with the expected number of 926 vehicles complying with the PBEV. *Source: National Institute of Metrology, Quality and Technology (Inmetro).*
Regulations of minimum rates for electrical equipment	Specific CGIEE Regulations (Managing Committee of Energy Efficiency Indicators): Ordinances regulated with minimum rates until 2015: • Three-phase Electric Engines - Decree 4,508 of 11 December 2002; • Compact Fluorescent Lamps - Interministerial Directive No. 132 of 12 June 2006; • Refrigerators and freezers - Interministerial Directive No. 362 of 24 December 2007; • Stoves and Gas Furnaces - Interministerial Directive No. 363 - December 24, 2007; • Gas Water Heaters - Interministerial Directive No. 298, 10 September 2008; • Reactors for Electromagnetic Sodium Vapor and Metal Halide Lamps, Interministerial Directive No. 959, December 09 2010; • Incandescent lamps - Interministerial Directive No. 10,077 of 31 December 2010. • Isolation Liquid Distribution Transformers – Interministerial Directive No. 104, 22 March 2013.

3.1 CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN BRAZIL: AN UPDATE

In December 2015, Brazil had 339 project activities registered with the CDM Executive Board (Figure III), which was equivalent to 4.4% of the world's total, occupying the 3rd position in number of projects registered. The total number of Certified Emissions Reductions issued by the CDM Executive Board for the Brazilian project activities was 107.5 million by December 2015, corresponding to 107.5 million tonnes of CO_2 equivalent (CO_2eq) in terms of GHG emissions reduction.

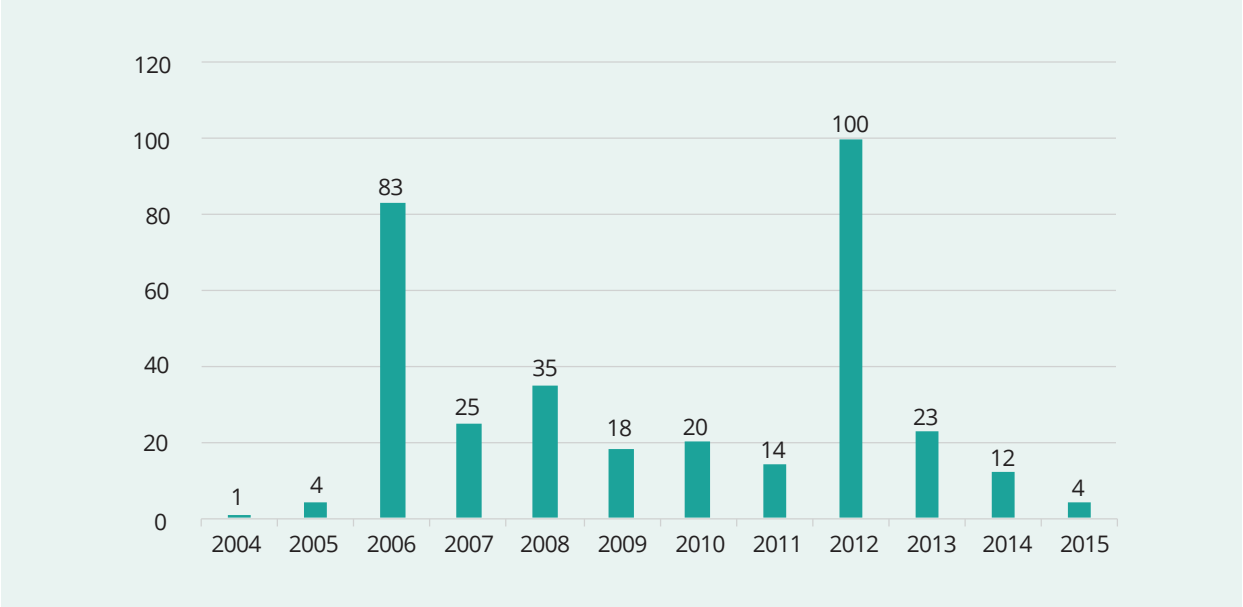

Figure III – Registered Brazilian project activities in the CDM Executive Board December 2015

As for the reduction of GHG emissions projected through the CDM, the Brazilian potential of registered projects by December 2015 was about 374 million tonnes of CO_2eq – for the first crediting period (maximum 10 years for fixed-period projects or 7 years for renewable period projects). That means that Brazilian CDM projects registered with the UNFCCC contribute to an average reduction of greenhouse gas emissions of approximately 48 million tons of CO_2eq per year.

Regarding the number of Brazilian project activities by project type registered by December 2015, Hydropower Plants led with 27.7%, followed by Biogas with 18.6%, Wind Power Plants with 16.6%, Landfill Gas with 14.8% and Biomass Energy 12.1%. The project types with the highest estimate of CO_2eq emission reduction were the Hydropower project, Landfill Gas, N_2O decomposition and Wind Power Plants, which totalled 83.6% of total GHG emissions reduction estimates. These four sectors had emissions reduction estimated at 313,085,007 t CO_2eq (Table IX).

TABLE IX – DISTRIBUTION OF CDM PROJECT ACTIVITIES IN BRAZIL, PER TYPE OF PROJECT, REGISTERED BY DECEMBER 2015.

Types of project	CDM project activities		Estimated GHG emissions reduction for the 1st crediting period	
	Quantity	% in relation to total	(tCO_2eq)	% in relation to total
Hydropower	94	27.7	138,473,415	37.0
Biogas	63	18.6	24,861,823	6.6
Wind power	56	16.6	42,670,329	11.4
Landfill gas	50	14.8	87,280,381	23.3
Biomass energy	41	12.1	16,091,394	4.3
Substitution of Fossil Fuel	09	2.6	2,664,006	0.7
Methane Avoided	09	2.6	8,627,473	2.3
Decomposition of N_2O	05	1.5	44,660,882	11.9
Utilization and heat recovery	04	1.2	2,986,000	0.8
Reforestation and Afforestation	03	0.8	2,408,842	0.6
Use of Materials	01	0.3	119,959	0.0
Photovoltaic Solar Energy	01	0.3	6,594	0.0
Energy Efficiency	01	0.3	382,214	0.1
Replacement SF_6	01	0.3	1,923,005	0.5
PFC reduction and Replacement	01	0.3	802,860	0.2
Total	**339**	**100.0**	**373,959,177**	**100.0**

In the official communication of its Nationally Appropriate Mitigation Actions to the UNFCCC, Brazil stated that the use of the clean development mechanism (CDM) established under the Kyoto Protocol would not be excluded.

4

CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS; INFORMATION ON SUPPORT RECEIVED

4 CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS; INFORMATION ON SUPPORT RECEIVED

4.1 CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS

As stated in the first BUR, due to the country's dimensions and diversity in terms of social, economic and environmental factors, the information presented in this item shall continue to be considered as provisional, partial and non-exhaustive. There are considerable challenges related to any in-depth consideration and identification of constraints and gaps, and related financial, technical and capacity needs at a comprehensive scale. In addition to the information presented in the first BUR, the table below summarizes technical, capacity building and financial support needs in some areas of interest for further international cooperation, without excluding other areas to be identified in the future.

TABLE X – INFORMATION ON TECHNICAL, CAPACITY BUILDING AND FINANCIAL SUPPORT NEEDED

Technical, capacity building and financial support needed by Brazil (Constraints and Gaps)				
Type	**Sector**	**Related NAMA**	**Activity**	**Information on supported needed**
Technical and technology	LULUCF	PPCDAm	Evaluation of contribution of public policies for reducing deforestation	Development of methodologies and tools
	LULUCF	PPCDAm and PPCerrado	Structuring of sustainable production and suply chains	Development of pilot projects
	LULUCF	PPCDAm and PPCerrado	Improvement of sustainable forest managment	Development of pilot projects
	LULUCF	PPCDAm and PPCerrado	Improve forest cover monitoring systems and disclosure	Development of automated mapping and data transmition methodologies for local public agents
	LULUCF	PPCDAm and PPCerrado	Disclosure and integration of state systems to authorize vegetation suppression to the federal system	Development of the technological component for integration and digitalization of paper-based processes, including image tracing
	LULUCF	PPCDAm and PPCerrado	Integration of state systems to control timber production and transport to the federal system	Development of the technological component for integration and digitalization of paper-based processes, including image tracing
	Energy	Alternative energy sources	Concentrated solar thermal	Technological, regulatory and economic development
	Energy	Alternative energy sources	Energy exploration of urban solid residues	Technological, regulatory and economic development
	Energy	Alternative energy sources	Energy storage	Technological, regulatory and economic development
	All sectors	All NAMAs presented	Measuring, reporting and verification of actions and financial resources received for implementation of actions	Development of methodologies and tools, implementation of an online platform
	Technology transfer	All NAMAs presented	Support for conducting technology capacities and needs assessment (TNA)	Develop Technology roadmaps and a technology Action Plan

Technical, capacity building and financial support needed by Brazil (Constraints and Gaps)				
Type	**Sector**	**Related NAMA**	**Activity**	**Information on supported needed**
Capacity building	LULUCF	PPCDAm	Integration of state and federal level initiatives	Seminars, workshops, exchange of experiences
	LULUCF	PPCDAm	Monitoring and evaluation of public policies in the federal and state levels	Seminars, workshops, exchange of experiences
	LULUCF	PPCDAm and PPCerrado	Support for CAR (Rural Environmental Registry) validation	Improvement of technology tools to assess and build capacity for state agents
	LULUCF	PPCDAm and PPCerrado	Disseminate Integrated Fire Management	Brigade and public managers training
	LULUCF	PPCDAm and PPCerrado	Stregthen social organization of local communities towards carrying out sustainable productive activites	Seminars, workshops, exchange of experiences
	Energy	Alternative energy sources	Concentrated solar thermal	Seminars, workshops, exchange of experiences
	Energy	Alternative energy sources	Energy exploration of urban solid residues	Seminars, workshops, exchange of experiences
	Energy	Alternative energy sources	Energy storage	Seminars, workshops, exchange of experiences
	All sectors	All NAMAs presented	Measuring, reporting and verification of actions and financial resources received for implementation of actions	Capacity-building for public managers, exchange of experiences
	All sectors	All NAMAs presented	Implementation of measuring, reporting and verification obligations under the UNFCCC, including the drafting of reports and other documents to be submitted to the Convention and its Paris Agremeent	Capacity-building on a regular basis in order to consolidate results and actions in tackling climate change and drafting of reports and other documents to be submitted to the UNFCCC
Financial	All sectors	All NAMAs presented	Implementation of measuring, reporting and verification obligations under the UNFCCC, including the drafting of reports and other documents to be submitted to the Convention and its Paris Agremeent	International financial support in a regular and proper basis is pivotal to ensure quality, scope and frequency of works related to the fulfilment of commitments concerning measuring, reporting and verification under the UNFCCC and the Paris Agreement, such as drafting of BURs and NCs, as well as Brazil's participation in the "Enhanced Transparency Framework".
	LULUCF	PPCDAm and PPCerrado	Improve conservation units management	Infrastructure, studies, capacitation
	LULUCF	PPCDAm and PPCerrado	Maintenance of forest cover monitoring systems and deforestation detection	Image acquisition or access
	LULUCF	PPCDAm and PPCerrado	Acknowledge efforts in fighting deforestation	Payment for measured, reported and verified results under the Convention (Decision 1/CP.16 and others)
	All sectors	All NAMAs presented	Measuring, reporting and verification of actions and financial resources received for implementation of actions	Implementation of an online platform

4.2 **INFORMATION ON SUPPORT RECEIVED**

Climate finance from external multilateral and bilateral sources plays a key role in advancing climate action in Brazil. It has contributed to the implementation of budget-funded public policies and programs, leveraged private resources to low-carbon and climate-resilient investments and supported initiatives from civil society organizations. Having a better understanding of these flows is crucial to assess past results and enhance future climate policy-making, by optimizing the use of the available resources. In this context, Brazil sees the Biennial Update Reports and the Biennial Reports as an important source of information.

Building upon the information on support received presented in Brazil's first Biennial Update Report, this section provides information on public resources committed to Brazilian entities through multilateral institutions and through bilateral channels (Parties included in Annex II to the Convention) in the years of 2014 and 2015. In spite of the difficulties and constraints inherent to this exercise, the section attempts to provide, in a table format, the most disaggregated possible information.

Given the difficulty to access project-level information on the disbursement of funds, it was decided to use the date of the commitment of the resources as a reference for the inclusion on the listing. Therefore, projects that are currently under implementation and that were approved or had their resources committed by the relevant institutions before the 2014-2015 period were not included. The exception to this criterion is the donations to the Amazon Fund, which were included based on the date of the receipt of the resources by the Fund's manager.

In collecting the data for this section, information from multilateral institutions proved to be much more transparent, accessible, complete and comparable than the information available from bilateral flows. It is difficult, for instance, to identify and access information on climate finance flows directed from a bilateral donor to a civil society organization when there is no Federal government involvement. Because of these constraints, the information on the bilateral channels only includes resources that were internalized through a public entity or implemented under the coordination of a public entity (be it of the Federal, state or municipal levels). On the other hand, the information on multilateral channels also includes resources directed to private enterprises.

All values are in US dollars. When data was available only in a currency other than US dollars, the conversion rate used was based on the OECD annual exchange rate for the year of the project commitment. In terms of the climate-relevance of individual projects, the percentage of the climate component for the multilateral resources was based on the criteria of the institution providing the finance. For most bilateral resources there was no assessment on the climate specific component readily available. In order to avoid double counting, projects whose main objective was not mitigation or adaptation were considered to have less than 100% of their foreign resources accounted for as climate finance. Likewise, for projects with a stated principal objective in both mitigation and biodiversity, as per the OECD Rio Markers attribution given by the donor, 50% of the resources received were accounted for as the climate specific component.

TABLE XI – INFORMATION ON THE SUPPORT RECEIVED

FINANCIAL SUPPORT RECEIVED THROUGH MULTILATERAL CHANNELS IN 2014								
Institution	**Type of support (mitigation, adaptation, cross-cutting, other)**	**Sector (energy, transport, industry, agriculture, forestry, water and sanitation, cross-cutting, other, not applicable)**	**Project name**	**Total funding (USD)**	**Climate-specific component (%)**	**Climate-specific funding (USD)**	**Financial instrument (grant/ concessional loan)**	**Date of commitment/ receipt**
CAF	Cross-cutting	Transport / other (sustainable cities)	Programa de Mejoría de la Movilidad Urbana y Socio Ambiental de Taubaté	$60,000,000.00	100.00%	$60,000,000.00	Loan	Approved in December/2014
CAF	Mitigation	Transport	Programa Ambiental y de Optimización Vial	$70,000,000.00	100.00%	$70,000,000.00	Loan	Approved in October/2014
CAF	Cross-cutting	Transport	Programa de Desarrollo de la Infraestructura y de los Servicios Basicos	$50,000,000.00	100.00%	$50,000,000.00	Loan	Approved in November/2014
CAF	Adaptation	Water / Other	Programa de Región Oceánica Sustentable	$100,000,000.00	100.00%	$100,000,000.00	Loan	Approved in November/2014
CAF	Adaptation	Other	Programa de Valorización y Ampliación de la Infraestructura y la Actividad Turística de Fortaleza - PROVATUR	$250,000,000.00	100.00%	$250,000,000.00	Loan	Approved in November/2014
CAF	Cross-cutting	Cross-cutting	Niterói Sostenible	$130,000.00	100.00%	$130,000.00	Grant	Approved in 2014
CAF	Mitigation	Energy / forestry	Estudio sobre sinergias positivas entre el sector electrico y forestal em la región del Tapajós, Amazônia	$100,000.00	100.00%	$100,000.00	Grant	Approved in 2014
CAF	Cross-cutting	Other	Capacitación de administradores públicos y sociedad civil para ciudades sostenibles	$80,000.00	100.00%	$80,000.00	Grant	Approved in 2014
IBRD	Cross-cutting	Agriculture / water and sanitation	Brazil Bahia Sustainable Rural Development Project	$150,000,000.00	70.00%	$105,000,000.00	Loan	Approved in June/2014
IDB	Mitigation	Other (financial markets)	Banco Pine Green Line Partnership	$125,000,000.00	60.00%	$75,000,000.00	Loan	Approved in January/2014
IDB	Mitigation	Other (financial markets)	Banco Pine Green Line Partnership	$125,000,000.00	60.00%	$75,000,000.00	Loan	Approved in January/2014
IDB	Mitigation	Water and sanitation	Program of Environmental Sanitation of CAESB	$286,310,000.00	1.42%	$4,070,000.00	Loan	Approved in May/2014

FINANCIAL SUPPORT RECEIVED THROUGH MULTILATERAL CHANNELS IN 2014								
Institution	**Type of support (mitigation, adaptation, cross-cutting, other)**	**Sector (energy, transport, industry, agriculture, forestry, water and sanitation, cross-cutting, other, not applicable)**	**Project name**	**Total funding (USD)**	**Climate-specific component (%)**	**Climate-specific funding (USD)**	**Financial instrument (grant/ concessional loan)**	**Date of commitment/ receipt**
IDB	Mitigation	Other (financial markets)	Banco ABC Brasil Green Financing Partnership	$150,000,000.00	50.00%	$75,000,000.00	Loan	Approved in September/2014
IDB	Mitigation	Other (financial markets)	Banco ABC Brasil Green Financing Partnership	$150,000,000.00	16.67%	$25,010,000.00	Loan	Approved in September/2014
IDB	Mitigation	Transport	Fortaleza Urban Transportation Program II	$115,820,000.00	42.88%	$49,660,000.00	Loan	Approved in October/2014
IDB	Mitigation	Forestry	Klabin - Puma Project	$300,000,000.00	36.67%	$110,010,000.00	Loan	Approved in October/2014
IDB	Mitigation	Forestry	Klabin - Puma Project	$300,000,000.00	36.67%	$110,010,000.00	Loan	Approved in October/2014
IDB	Cross-cutting	Cross-cuting	Londrina Sustainable Urban Development Program	$42,900,000.00	27.85%	$11,950,000.00	Loan	Approved in October/2014
IDB	Adaptation	Cross-cuting	System to Reduce Drought Vulnerability and Enable to Adapt to Climate Change	$1,000,000.00	100.00%	$1,000,000.00	Grant	Approved in September/2014
IDB	Adaptation	Cross-cuting	Proadapta Sertão	$3,050,000.00	41.14%	$1,250,000.00	Grant	Approved in March/2014
IDB	Cross-cutting	Forestry	Recovery and Protection of Climate and Biodiversity Services in Brazil's Southeast	$75,950,000.00	41.48%	$31,500,000.00	Grant	Approved in July/2014
IDB	Mitigation	Transport	Low Carbon Urban Mobility for Large Cities	$6,000,000.00	100.00%	$6,000,000.00	Grant	Approved in October/2014
IFC	Mitigation	Energy	BCG Brasil SEF	$30,100,000.00	100.00%	$30,100,000.00	Loan	Approved in 2014
IFC	Cross-cutting	Agriculture	Biosev	$50,000,000.00	42.00%	$21,000,000.00	Equity	Approved in 2014
IFC	Mitigation	Energy	Enel Wind Brasil	$200,000,000.00	100.00%	$200,000,000.00	Loan	Approved in 2014
IFC	Mitigation	Energy	Itau Clim. Smart	$100,000,000.00	100.00%	$100,000,000.00	Loan	Approved in 2014
PMR	Mitigation	Cross-cutting	Brazil Market Readiness Proposal	$3,000,000.00	100%	$3,000,000.00	Grant	Approved in August/2014
Total						**$1,034,560,000.00**		

FINANCIAL SUPPORT RECEIVED THROUGH BILATERAL CHANNELS IN 2014								
Institution	**Type of support (mitigation, adaptation, cross-cutting, other)**	**Sector (energy, transport, industry, agriculture, forestry, water and sanitation, cross-cutting, other, not applicable)**	**Project name**	**Total funding (USD)**	**Climate-specific component (%)**	**Climate-specific funding (USD)**	**Financial instrument (grant/ concessional loan)**	**Date of commitment/ receipt**
European Union (EIB)	Mitigation	Transport	São Paulo Rolling Stock	$265,357,569.32	50%	$132,678,784.66	Loan	Signed in October/2014
France (AFD)	Mitigation	Transport	Linha 13 da CPTM	$398,036,353.98	50%	$199,018,176.99	Loan	Signed in July/2014
France (AFD)	Mitigation	Energy	Apoio e acompanhamento de políticas públicas brasileiras de desenvolvimento das energias renováveis e promoção da eficiência energética	$206,000,000.00	50%	$103,000,000.00	Loan	Signed in November/2014
Germany (KfW)	Mitigation	Energy	Programa Eólica BNDES II (KfW UEE II)	$335,000,000.00	100%	$335,000,000.00	Loan	Signed in July/2014
Germany (KfW)	Cross-cutting	Forestry	Biodiversidade e mudanças climáticas na mata atlântica	$10,435,183.41	50%	$5,217,591.77	Grant	Signed in December/2014
Germany (KfW)	Mitigation	Forestry	Contribution to the Amazon Fund	11,120,181.53	100%	$11,120,181.53	Grant	Received in January/2014
Germany (KfW)	Mitigation	Forestry	Contribution to the Amazon Fund	$5,385,692.98	100%	$5,385,692.98	Grant	Received in July/2014
Japan (JBIC)	Cross-cutting	Energy	JBIC Green II	$300,000,000.00	100%	$300,000,000.00	Loan	Signed in March/2014
Norway	Mitigation	Forestry	Contribution to the Amazon Fund	$108,839,740.46	100%	$108,839,740.46	Grant	Received in December/2014
Total						**$1,200,260,168.39**		
Total 2014 (multilateral and bilateral)						**$2,234,820,168.39**		

FINANCIAL SUPPORT RECEIVED THROUGH MULTILATERAL CHANNELS IN 2015							
Institution	**Type of support (mitigation, adaptation, cross-cutting, other)**	**Sector (energy, transport, industry, agriculture, forestry, water and sanitation, cross-cutting, other, not applicable)**	**Project name**	**Climate-specific component (%)**	**Climate-specific funding (USD)**	**Financial instrument (grant/ concessional loan)**	**Date of commitment/ receipt**
CAF	Cross-cutting	Transport / other	Programa de Organicidad y Recalificación del Espacio Urbano, del Entretenimiento, del Acceso y Movilidad de Porto Alegre	100.00%	$92,000,000.00	Loan	Approved in June/2015
CAF	Cross-cutting	Transport / other	PIMD - Programa de Integración, Mobilidad y Desarrollo de la Ciudad de Manaus	100.00%	$100,000,000.00	Loan	Approved in June/2015
CAF	Mitigation	Other	Línea de Cédito Rotativa No Comprometida para Desenvolve S.P.	100.00%	$30,000,000.00	Loan	Approved in 2015
CAF	Adaptation	Forestry	Reunión de áreas protegidas de la OTCA	100.00%	$20,000.00	Grant	Approved in 2015
CAF	Adaptation	Cross-cutting	Identificar las medidas de adaptación al cambio climático en el área metropolitana de la región de Sao Paulo - CIOESTE -	100.00%	$100,000.00	Grant	Approved in 2015
CIF	Cross-cutting	Agriculture / forestry	BR DGM for Indigenous People and Traditional Communities	80%	$5,200,000.00	Grant	Approved in March/2015
IDB	Mitigation	Agriculture / other (financial markets)	Banco Coorporativo Sicredi Financing for Rural Credit and Low-Carbon Agriculture	71.43%	$50,000,000.00	Loan	Approved in August/2015
IDB	Mitigation	Other	Sucden: Corporate Finance Loan	13.00%	$6,500,000.00	Loan	Approved in October/2015
IDB	Mitigation	Cross-cutting	Program for Integrated Urban Development of the Municipality of Campo Grande	25.00%	$28,000,000.00	Loan	Approved in December/2015
IDB	Mitigation	Cross-cutting	Strengthening Funding for Mitigation in Brazil based on Results-oriented Management	80.00%	$480,000.00	Grant	Approved in January/2015
IDB	Mitigation	Cross-cutting	Instituto Inhotim: Strengthening Regional Development, Climate Change and Biodiversity	10.00%	$88,000.00	Grant	Approved in September/2015
IFC	Cross-cutting	Forestry	CVA	77.69%	$17,090,000.00	Loan (debt investment)	Approved in 2015
IFC	Cross-cutting	Agriculture / energy	Usina Delta	30.89%	$12,360,000.00	Loan	Approved in 2015
Total					**$119,718,000.00**		

FINANCIAL SUPPORT RECEIVED THROUGH BILATERAL CHANNELS IN 2015							
Institution	**Type of support (mitigation, adaptation, cross-cutting, other)**	**Sector (energy, transport, industry, agriculture, forestry, water and sanitation, cross-cutting, other, not applicable)**	**Project name**	**Climate-specific component (%)**	**Climate-specific funding (USD)**	**Financial instrument (grant/ concessional loan)**	**Date of commitment/ receipt**
Germany (KfW)	Cross-cutting	Forestry	ARPA - Fundo de transição ARPA para a vida	50%	$17,584,026.50	Grant	Signed in August/2015
Germany (KfW)	Cross-cutting	Forestry / agriculture	Projeto CAR	50%	$12,756,516.92	Grant	Signed in August/2015
Germany (KfW)	Mitigation	Transport	Desenvolvimento urbano sustentável - mobilidade urbana	100%	$294,150,000.00	Loan	Signed in August/2015
Germany	Adaptation	Other	Integrated Coastal Zone Management and Marine Biodiversity - TerraMar	100%	$6,655,574.04	Grant	Project implementation started in July/2015
Germany	Cross-cutting	Cross-cutting	Adapting public investment to climate change in Latin America (IPACC II)	100%	$1,109,262.34	Grant	Project implementation started in 2015
Germany	Mitigation	Energy	Energy Systems of the Future	100%	$4,991,680.53	Grant	Project implementation started in 2015
Germany	Mitigation	Energy	Energy Propulsion Systems	100%	$5,546,311.70	Grant	Project implementation started in 2015
Germany	Mitigation	Cross-cutting	Energy efficiency for sustainable urban development	100%	$4,437,049.36	Grant	Signed in 2015
Japan (JBIC)	Mitigation	Energy	JBIC Green III	100%	$150,000,000.00	Loan	Signed in March/2015
Japan (JBIC)	Mitigation	Energy	JBIC Green IV	100%	$100,000,000.00	Loan	Signed in December/2015
Norway	Mitigation	Forestry	Contribution to the Amazon Fund	100%	$14,893,881.10	Grant	Received in March/2015
Norway	Mitigation	Forestry	Contribution to the Amazon Fund	100%	$120,000,000.00	Grant	Received in December/2015
Total					**$732,124,302.49**		
Total 2015 (multilateral and bilateral)					**$851,842,302.49**		

5

FUNDS RECEIVED FOR THE PREPARATION OF THE BUR

5 FUNDS RECEIVED FOR THE PREPARATION OF THE BUR

Brazil received financial support from the Global Environment Facility (GEF) to prepare this report, which was crucial to ensure the provision of updated information and without which transparency and data collection would be impaired. GEF's financial support amounted to USD 500,000 and was made possible by a joint project for the preparation of the Fourth National Communication of Brazil.

TABELA XII – CAPACITY BUILDING AND FINANCIAL SUPPORT RECEIVED FOR THE PREPARATION OF THE BUR

Type	Activity	Period	Source	Information on supported received
Capacity building	Technical workshops	2013, 2014 and 2016	CGE/UNFCCC	Technical instructions for the preparation of the report
Financial support	Hiring of consultants and services for the preparation of BUR2	2016-2017	GEF	Funds received from a trilateral project (GEF/MCTIC/PNUD)

6

INFORMATION ON THE DESCRIPTION OF DOMESTIC MEASUREMENT, REPORTING AND VERIFICATION ARRANGEMENTS (MRV)

6 INFORMATION ON THE DESCRIPTION OF DOMESTIC MEASUREMENT, REPORTING AND VERIFICATION ARRANGEMENTS (MRV)

6.1 SMMARE AND MRV OF ACTIONS

The Paris Agreement, as well as Brazil's Nationally Determined Contribution (NDC), are an opportunity to review the arrangements for implementation of the transparency system of action and support, including institutional aspects. The MRV strategy presented in the first Brazilian BUR is currently under revision in light of this new context and the advances obtained so far.

In 2013, in cooperation with Ministries that coordinate Sectoral Plans on Climate Change Mitigation and Adaptation, the Ministry of Environment outlined a proposal to monitor and follow-up greenhouse gas emissions reductions associated with the actions of those Plans. This proposal led to the Modular System for Monitoring Actions and GHG Emissions Reductions (SMMARE), for which, in 2014, guidelines and methodological bases were established. In addition to specific plans for the Amazon and the Cerrado, the following sectors were also part of the plans: Energy, Agriculture, Iron and Steel, Transport, Mining, Industry and Health.

Since the Sectoral Plans are in different stages of implementation and are considerably different in terms of mitigation actions, each Plan would have a "Monitoring Module" within SMMARE. Once established, SMMARE would support managers responsible for Sectoral Plans in setting up and following up key monitoring indicators. Although the System has its theoretical framework outlined, it will need to be revised in light of the NDC and the Paris Agreement. One of the objectives of this review is to optimize financial and human resources, thus avoiding duplication of efforts.

The MRV strategy needs to be reassessed, considering that the Brazilian contribution to the Paris Agreement is of economy-wide nature. SMMARE, in turn, was designed for monitoring sectoral plans, within the context of a national voluntary commitment based on a business as usual projection.

Much of what has been done to fulfil Brazil's voluntary national commitment, towards 2020, will be used to plan, organize, implement, measure, report and verify the actions that will lead to the reductions indicated in Brazil's NDC. Lessons learned, as well as gaps identified, will reorient the implementation of the new MRV system, now based on the new national and international contexts brought by the NDC and the Paris Agreement. Such arrangements may be improved or expanded to encompass the additional measures present in the Brazilian NDC.

The SMMARE project will be revised in 2017, so that it can monitor the main climate change mitigation and adaptation actions associated with NDC, as well as facilitate public access to available information. Monitoring will occur in a comprehensive manner, with action-specific indicators, not necessarily in terms of emission reductions, although this approach will be considered where applicable.

Although different from what had been planned for the previous context, monitoring and reporting of government action to the Brazilian society is still needed – for both the pre-2020 and post-2020 actions. However, the pre-2020 approach should already be reoriented based on MRV needs coupled with the new national and international contexts brought by NDC and the Paris Agreement.

6.2 **NATIONAL EMISSIONS REGISTRY SYSTEM – SIRENE**

In May 2016, the Brazilian Government launched the National Emissions Registry System (SIRENE), an important tool to support the development and disclosure of national greenhouse gases emissions estimates. This system was developed by the Ministry of Science, Technology, Innovation and Communications (MCTIC), aiming at maintaining continuity and accessibility to the results of the National Inventory of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases Not Controlled by the Montreal Protocol.

SIRENE's mission is to support decision-making in the scope of policies, plans, programs and projects in climate change, particularly in the adoption of mitigation actions. This platform optimizes not only the management processes of calculations results, but also the disclosure of such information through graphics and tables generated by the management system, available on the Internet. Such initiative aims at contributing to the continuity of the work directed to the quantification of greenhouse gas emissions, as well as management of information related to GHG emissions in Brazil.

In addition, efforts are being made to disaggregate, at a sub-national level, the country's emission estimates, in order to more accurately convey emission profiles of states, strengthening SIRENE as a tool to monitor the evolution of emissions and the fulfilment of the objectives to be achieved through the implementation of public policies by the states.

The Brazilian Government categorizes SIRENE as an MRV (measuring, reporting and verification) system for emissions at an aggregated level, of the inventory sectors, including:

- Type of gas (carbon dioxide – CO_2; methane – CH_4; nitrous oxide – N_2O; hydrofluorocarbons – HFCs; perfluorocarbons – PFCs; sulfur hexafluoride – SF_6; nitrogen oxides – NO_x; carbon monoxide – CO and other non-methane volatile organic compounds – NMVOC);

- Emissions by sources and removals by sinks - for the Energy, Industrial Processes, Use of Solvents and Other Products, Agriculture, Land Use, Land-Use Change and Forestry, and Waste; and,

- The historical series of emissions published in the national inventory, as part of its National Communications, of the Biennial Update Reports, as well as of the Annual Emissions Estimates reports, whose elaboration complies with the established by the National Policy on Climate Change.

MCTIC is responsible for the coordination, management and maintenance of SIRENE, which also relies on the collaboration of numerous specialists in sectoral greenhouse gas emissions from partner institutions, both public and private, and representatives of state governments. These different stakeholders contribute by making available activity data, promoting studies of emission factors and participating in the process of quality control of information.

7

TECHNICAL ANNEX PURSUANT TO DECISION 14/CP.19

Results achieved by Brazil from Reducing Emissions from Deforestation in the Amazon biome for REDD+ results-based payments

1 INTRODUCTION

Brazil welcomes the opportunity to submit a Technical Annex to its Second Biennial Update Report (BUR) in the context of results-based payments for reducing emissions from deforestation and forest degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks in developing countries (REDD+), under the United Nations Framework on Climate Change (UNFCCC).

Brazil notes that the submission of this Technical Annex with REDD+ results is voluntary and exclusively for the purpose of obtaining and receiving results-based payments for its REDD+ actions, pursuant to decisions 13/CP.19, paragraph 2, and 14/CP.19, paragraphs 7 and 8.

This submission, therefore, does not modify, revise or adjust in any way the Nationally Appropriate Mitigation Actions (NAMA) voluntarily submitted by Brazil under the Bali Action Plan (FCCC/AWGLCA/2011/INF.1), neither its Nationally Determined Contribution (NDC) under the Paris Agreement under the UNFCCC.

This submission was developed by the Brazilian government with the technical support from the Technical Working Group of Experts on REDD+ (GTT REDD+, for its acronym in Portuguese) created in February 2014 by the Ministry of Environment (MMA) through the Ministerial Ordinance No. 41. It represents a second step in Brazil's voluntary commitment to provide information on REDD+ results under the UNFCCC, building upon the experience of submitting Brazil's *First Technical Annex*, which contained the results of reducing emissions from deforestation in the Amazon biome from 2006 to 2010.

Technical Annex submissions undergo the International Consultation and Analysis (ICA) process, which aims at strengthening the transparency of mitigation actions and their outcomes. The technical analysis of Brazil's *First Technical Annex*, carried out by a Team of Technical Experts (TTE), concluded that the submission met all the requirements set by decision 14/ CP. 19[1]. In addition, it recognized Brazil's "strong commitment to continuous improvement of its data and information used for producing results" and identified areas for further technical improvement, as the country makes progress towards a national forest monitoring system. **Section 5** of this Technical Annex presents Brazil's advances in addressing these areas.

The *Second Technical Annex* for REDD+ presents not only the results achieved in reducing emissions from deforestation in the 2011-2015 period, but also the progress made in producing data and information to continuously improve Brazil's submissions.

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[1] *Decision 4/ CP.15, paragraph 1, "requests developing country Parties, on the basis of work conducted on the methodological issues set out in decision 2/CP.13, paragraphs 7 and 11, to take the following guidance into account for activities relating to decision 2/CP.13, and without prejudging any further relevant decisions of the Conference of the Parties, in particular those relating to measurement and reporting: (c) To use the most recent Intergovernmental Panel on Climate Change guidance and guidelines, as adopted or encouraged by the Conference of the Parties, as appropriate, as a basis for estimating anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes; (d) To establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of national monitoring systems that: (i) Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes; (ii) Provide estimates that are transparent, consistent, as far possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities; (iii) Are transparent and their results are available and suitable for review as agreed by the Conference of the Parties."*

2 SUMMARY INFORMATION FROM THE ASSESSED FOREST REFERENCE EMISSION LEVEL FOR REDUCING EMISSIONS FROM DEFORESTATION IN THE AMAZON BIOME

Brazil´s forest reference emission level for reducing emissions from deforestation in the Amazon biome, henceforth referred to as FREL Amazonia, was submitted on a voluntary basis for a technical assessment in the context of results-based payments and covers the activity "reducing emissions from deforestation" in the Amazon biome, the most significant of the five activities included in paragraph 70 of decision 1/CP.16.

Brazil applied a step-wise approach to develop a national FREL, in accordance with decision 12/CP.17, paragraph 10, and has presented the subnational FREL Amazonia with the aim of transitioning to a national FREL, incorporating other biomes and activities as soon as all the relevant data and information are available. The step-wise approach enables Parties to continuously improve their data and submissions, by incorporating better data, improved methodologies and, where appropriate, additional carbon pools.

The construction of the assessed FREL Amazonia followed the guidelines set out in the IPCC Good Practice Guidance for Land Use, Land-use Change and Forestry[2] (IPCC, 2003) to estimate the changes in carbon stocks in areas of natural forest converted to other land-use categories.

The emissions from deforestation for the 1996-2005 period were estimated through the combination of activity data (i.e. the area of annual gross deforestation per forest type considered) with the appropriate emission factor (i.e. carbon stocks in the biomass associated with the forest types considered). The FREL Amazonia considers the following carbon pools: aboveground biomass, belowground biomass and litter. Dead wood and soil organic carbon (for mineral and organic soils) were not included, as they are not considered to be significant sources, following the Second National Greenhouse Gas Inventory, the most recent inventory at the time of the FREL Amazonia submission. As per the gases included in the submission, only CO_2 was considered.

The activity data used in the construction of the FREL Amazonia were those from the historical time series from the National Institute for Space Research (Inpe for the acronym in Portuguese) of the Ministry of Science, Technology, Innovations and Communications (MCTIC for the acronym in Portuguese), adjusted to conform to the geographical limits of the **Amazon biome**. INPE, by means of the Amazon Deforestation Monitoring Project – PRODES generates annual estimates of gross deforestation in the **Legal Amazon**[3] since 1988, using satellite data of the Landsat class to make a complete assessment of the region, with a minimum mapping area of 6.25 hectares. Since PRODES covers an area greater than that of the Amazonia biome, it was necessary to exclude data from the geographical area which exceeded the geographical boundaries of the biome. The historical time series data are available in analogical format until 1997 and in digital format since 1998 (in an aggregated file for the period 1998-2000 and annually since 2001).

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[2] Henceforth referred to as IPCC good practice guidance for LULUCF.

[3] Legal Amazon covers the totality of the following States: Acre (AC), Amapá (AP), Amazonas (AM), Pará (PA), Rondônia (RO), Roraima (RR), Tocantins (TO) and Mato Grosso (MT), in addition to parts of the state of Maranhão (MA), totaling about 5,217,423 km² (521,742,300 ha).

Regarding the emission factors, the carbon stock in aboveground biomass was estimated for the different forest typologies considered using a country-specific allometric equation (tier 3) and data collected in sampled points from the RADAMBRASIL Project (circunference at breast height - CBH). The estimates were adjusted to include carbon in belowground biomass, litter, biomass in palms and lianas, as well as in the biomass of trees with CBH below 100 cm[4] and were extrapolated to the entire territory of the biome following defined rules. Hence, a Carbon Map for the Amazonia biome was created, including 22 types of forest physiognomies[5]. Brazil assumed that the biomass immediately after the conversion to other land-use category was zero and did not consider any CO_2 removals after the conversion (that is, only gross emissions from deforestation were considered).

The annual emissions from gross deforestation were estimated from the annual deforestation increments[6], adjusted to include potential deforested areas under clouds, as detailed in **Section 4** and in the assessed FREL Amazonia. The areas of the deforestation polygons for a given forest typology were multiplied by the corresponding emission factors (total carbon[7], in tonnes of carbon per unit of area (tC ha^{-1}) and subsequently by 44/12, to convert tonnes of carbon to tonnes of CO_2 (tCO_2 ha^{-1})). Then, for each year considered, the CO_2 estimates associated with each polygon were summed up (see tab ***2100_2015_FULL_DATA***[8] in the ***Worksheet-Planilha-Calculo*** available at http://redd.mma.gov.br/en/infohub.

The FREL Amazonia is a dynamic mean of the CO_2 emissions from deforestation since 1996, updated every five years, using the most recent data from the historical time series and with the most recent National GHG Inventory submitted by Brazil to the UNFCCC at the time of the construction of the FREL.

This base year was chosen by the GTT REDD+ so as to leave out the peak year of deforestation, 1995, and also maintain consistency with the main policies and initiatives for REDD+ in Brazil, including the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm for the acronym in Portuguese)[9], the National Policy on Climate Change[10] and the Amazon Fund[11], all of which have 1996 as the reference year.

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[4] RADAMBRASIL project collected data on trees with circumference at breast height (CHB) greater than 100 cm.

[5] Details about the Carbon Map are included in section b (Transparent, complete, consistent and accurate information used in the construction of the Forest Reference Emission Level) of the original FREL submission.

[6] Increment of deforestation refers to the sum of the area of all observed deforestation polygons within a certain geographic area. In the FREL submission and also in this Technical Annex, increment of deforestation refers to the sum of observed deforested area in each Landsat scene that covers the biome. The increment of deforestation may underestimate the total area deforested (and corresponding emissions), since it does not include potential deforestation in cloud covered areas.

[7] Total carbon refers to the sum of the carbon in aboveground biomass, belowground biomass and litter.

[8] This tab includes the list of all observed deforestation polygons from 2011 a 2015, identified by year and, when applicable, the starting year the area was not observed due to the presence of clouds.

[9] For more details about policies and plans for the Amazon biome, see http://redd.mma.gov.br/en/legal-and-public-policy-framework/ppcdam (accessed the last time on July 20, 2016).

[10] For more information regarding the Presidential Decree nº 7.390, of December 9, 2010, see: http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm (accessed las time on July 20, 2016).

[11] For more information related to the Amazon Fund, see: http://www.amazonfund.gov.br/FundoAmazonia/fam/site_en (accessed last time on July 20, 2016).

The dynamic nature the FREL Amazonia seeks to reflect the national circumstances, including the effect of policies and plans implemented to reduce deforestation in the Amazon biome, as well as improvements in data quality and availability.

Brazil's FREL does not include projections on how the future may develop. It is solely based on the historical deforestation time series.

In summary, the following applies for REDD+ results-based payments for the periods 2006-2010, 2011-2015 and 2016-2020 (as illustrated in **Figure 1** and in **Table 1**):

- **Emission reduction results from 2006 to 2010 (inclusive)**: the FREL is equal to the mean annual CO_2 emissions associated with gross deforestation (calculated from the adjusted deforestation increments) from the period 1996 to 2005, inclusive (refer to **Figure 1** and **Table 1**).

  Note: *the emission reduction results for this period were covered in Brazil's First Technical Annex.*

- **Emission reduction results from 2011 to 2015 (inclusive)**: the FREL is equal to the mean annual CO_2 emissions associated with gross deforestation (calculated from the adjusted deforestation increments) from 1996 to 2010, inclusive (refer to **Figure 1** and **Table 1**).

  Note*: the emission reduction results for this period are presented in this Second Technical Annex.*

- **Emission reduction results from 2016 a 2020 (inclusive)**: the FREL is equal to the mean annual CO_2 emissions associated with gross deforestation (calculated from the adjusted deforestation increments) from 1996 to 2015, inclusive.

The FREL Amazonia was constructed using adjusted deforestation increments. However, there were areas under persistent cloud cover that were not observed by the time the FREL Amazonia was constructed. The more recent data (2011-2015) allowed for the observation of several of these areas.

In principle, this could lead to an update in the FREL Amazonia (in particular for the results of the 2011-2015 period, used in this Technical Annex). However, as presented in **Section 4**, the estimate of an updated FREL, incorporating these areas, resulted in an increase of the CO_2 emissions of only 0.23% relative to the original. **Box 2** ***(Approaches to estimate the gross deforestation in the Amazon biome)*** in **section 4** presents a detailed explanation about how the adjusted deforestation increment is calculated, consistent with the principle of transparency. Additionally, tab ***Final_Table_Cloud_Adjust in Worksheet-Planilha-Calculo***, available at http://redd.mma.gov.br/en/infohub, provides detailed calculations that justify maintaining the FREL Amazonia as originally proposed.

Brazil currently has a complete set of data on gross deforestation in the Amazon biome until the year 2015. These data allow for the estimation of CO_2 emissions from gross deforestation from 1996 to 2015. The FREL for assessing REDD+ results achieved in the 2016-2020 period, presented below, relies on the most up-to-date data, as demonstrated below:

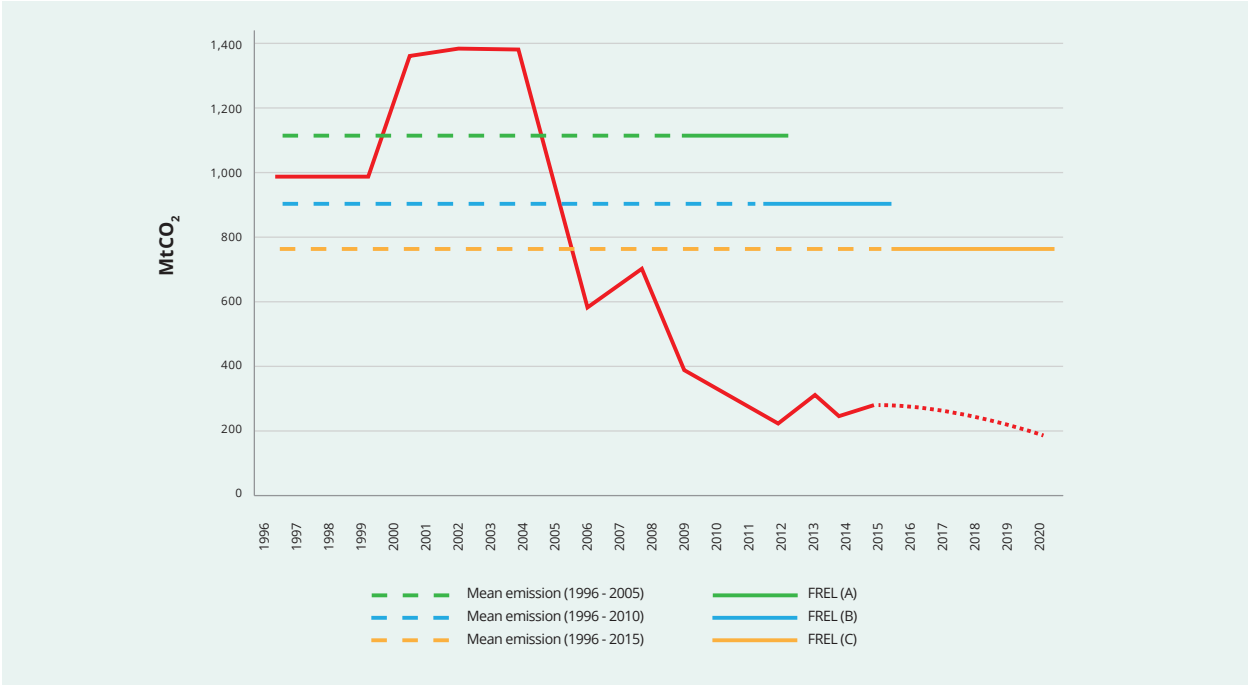

Figure 1 – Pictorial representation of FREL Amazonia, where (A) refers to the mean annual gross CO_2 emissions in the 1996-2005 (inclusive) period (1,106,027,616.63 tCO_2); (B) refers to the mean annual gross CO_2 emissions in the 1996-2010 (inclusive) period (907,959,466.33 tCO_2); and (C) refers to the mean annual gross CO_2 emissions in the 1996-2015 (inclusive) period (750.234.379,99 tCO_2)

TABLE 1 – ADJUSTED DEFORESTATION INCREMENT, EMISSIONS FROM GROSS DEFORESTATION (in tC) AND CO_2 EMISSIONS FROM GROSS DEFORESTATION (tCO_2) IN THE AMAZON BIOME, IN THE PERIOD FROM 1996 TO 2015. THE LINES HIGHLIGHTED IN GREEN PRESENT THE DATA FOR THE PERIOD FROM 2011 TO 2015

Year	ANNUAL ADJUSTED DEFORESTATION INCREMENT (ha/yr)	ANNUAL EMISSIONS FROM GROSS DEFORESTATION (tC/yr)	ANNUAL CO2 EMISSIONS FROM GROSS DEFORESTATION (tCO_2/yr)
1996	1,874,013.00	267,142,749.24	979,523,413.88
1997	1,874,013.00	267,142,749.24	979,523,413.88
1998	1,874,013.00	267,142,749.24	979,523,413.88
1999	1,874,013.00	267,142,749.24	979,523,413.88
2000	1,874,013.00	267,142,749.24	979,523,413.88
2001	1,949,331.35	247,899,310.88	908,964,139.89
2002	2,466,603.88	363,942,942.80	1,334,457,456.93
2003	2,558,846.30	375,060,876.74	1,375,223,214.70
2004	2,479,429.81	376,402,076.09	1,380,140,945.68
2005	2,176,226.17	317,420,001.73	1,163,873,339.68

2006	1,033,634.15	157,117,398.10	576,097,126.38
2007	1,087,468.65	165,890,835.62	608,266,397.26
2008	1,233,037.68	181,637,813.29	666,005,315.39
2009	596,373.64	103,706,497.78	364,340,477.19
2010	583,147.53	99,063,434.93	344,406,512.43
2011	501,406.41	77,823,777.98	285,507,794.61
2012	425,499.51	64,550,223.35	236,684,154.44
2013	537,857.10	82,322,140.41	301,847,850.91
2014	490,851.45	74,615,890.39	273,591,600.59
2015	524,057.09	78,453,873.19	287,664,204.33
Mean 1996-2005	**2,100,050.25**	**301,643,895.40**	**1,106,027,616.63**
Mean 1996-2010	**1,702,277.61**	**247,625,309.00**	**907,959,466.33**
Mean 1996-2015	**1,400,691.79**	**204,607,277.19**	**750,234,379.99**

3 RESULTS IN TONNES OF CO_2 PER YEAR, CONSISTENT WITH THE ASSESSED FOREST REFERENCE EMISSION LEVEL FOR THE AMAZON BIOME

Decision 14/ CP.19, paragraph 3, "decides that the data and information used by Parties in the estimation of anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes, as appropriate to the activities referred to in decision 1/CP.16, paragraph 70, undertaken by Parties, should be transparent, **and consistent over time and with the established forest reference emission levels** and/or forest reference levels in accordance with decision 1/CP.16, paragraph 71(b) and (c) and section II of decision 12/CP.17".

CO_2 emissions from gross deforestation in the Amazon biome in the period from 1996 to 2010, used in the construction of the FREL, were estimated using the methodology presented in the previous section. For this Technical Annex, the results for the period from 2011 to 2015 were calculated by subtracting the mean annual CO_2 emissions (calculated from the adjusted deforestation increments) from the forest reference emission level for the period from 1996 to 2010 (see FREL (B) in **Figure 1** = 907,959,466.33 tCO_2).

Hence, for year t in the period from 2011 to 2015, the emission reduction from deforestation was estimated as follows:

REDD+ (t) = FREL (1996-2010) – Gross emissions from deforestation at year t (tCO_2)

For example, the emission reduction from deforestation for year 2012 is equal to:

907,959,466,33 tCO_2 – 236,684,154,44 tCO_2 = 671,275,311,89 tCO_2

The total emission reduction from gross deforestation in the Amazon biome, from 2011 to 2015, was equal to the sum of the emission reduction results achieved for each year in the period, i.e., **3,154,501,728 tCO_2 (Figure 2 and Table 2)**.

Figure 2 – REDD+ results from 2011 to 2015 calculated based on the FREL submitted to the UNFCCC in June 2014 and assessed by technical experts

TABLE 2 – ANNUAL EMISSIONS FROM DEFORESTATION (tCO_2/yr) FROM 1996 TO 2015; FOREST REFERENCE EMISSION LEVEL USED TO ESTIMATE THE EMISSION REDUCTION RESULTS IN THE PERIODS OF 2006-2010 AND 2011-2015 (tCO_2/yr) AND REDD+ RESULTS ACHIEVED ON THESE PERIODS (tCO_2)

Note: *The information for the period 2011 to 2015, object of this Technical Annex, is highlighted below.*

Year	Annual emissions from deforestation (tCO_2/yr)	FREL (tCO_2)	Annual REDD+ results 2011-2015 (tCO_2/yr)
1996	979,523,413.88		
1997	979,523,413.88		
1998	979,523,413.88		
1999	979,523,413.88		
2000	979,523,413.88		
2001	908,964,139.89		
2002	1,334,457,456.93		
2003	1,375,223,214.70		
2004	1,380,140,945.68		
2005	1,163,873,339.68		
2006	576,097,126.38	1,106,027,616.63	529,930,490.25
2007	608,266,397.26	1,106,027,616.63	497,761,219.37
2008	666,005,315.39	1,106,027,616.63	440,022,301.24
2009	364,340,477.19	1,106,027,616.63	741,687,139.44
2010	344,406,512.43	1,106,027,616.63	761,621,104.20
2011	285,507,794.61	907,959,466.33	622,451,671.72
2012	236,684,154.44	907,959,466.33	671,275,311.89
2013	301,847,850.91	907,959,466.33	606,111,615.42
2014	273,591,600.59	907,959,466.33	634,367,865.74
2015	287,664,204.33	907,959,466.33	620,295,262.00
Total emission reductions result (2011-2015)			**3,154,501,726.77**

4 DEMONSTRATION THAT THE METHODOLOGIES USED TO PRODUCE THE RESULTS ARE CONSISTENT WITH THOSE USED TO ESTABLISH THE ASSESSED FOREST REFERENCE EMISSION LEVEL

The methodology, data sets and information used for calculating the results presented in this Technical Annex are the same as the ones used in Brazil's FREL Amazonia, as demonstrated in the following items: (1) activity data; (2) emission factors; (3) carbon pools; (4) gases (CO_2 and non-CO_2); and (5) REDD+ activities.

4.1 ACTIVITY DATA

The area of each deforestation polygon with a certain forest physiognomy is the data needed to estimate the emissions from deforestation[12], following the IPCC good practice guidance for LULUCF (IPCC, 2003).

Similar to the way the FREL Amazonia was calculated, the activity data used here to generate the results are derived from the PRODES, adapted to include only deforestation within the geographic limits of the Amazon biome. The minimum mapping area of 6.25 hectares was maintained (see **Box 1**).

BOX 1 – PRODES MINIMUM MAPPING AREA

PRODES was set in 1988 to map deforestation over hardcopy prints of Landsat images at the 1:250,000 scale. Consistent annual data for gross deforestation are available since 1988. The minimum mapping area was defined as 1 mm^2, which is equivalent to 6.25 ha in the surface.

Since 2008, deforestation polygons with areas larger than 1 ha and under are retrieved in a separate dataset and registered as PRODES deforestation as they coalesce to a size larger than 6.25 ha.

The consistency of the PRODES time series is ensured by using the same deforestation definition, same minimum mapping area, similar satellite spatial resolution[13], same forest/non-forest vegetation boundaries, and same methodological approach to analyze the remotely sensed data at every new assessment.

[12] In most first order approximations, the "activity data" are in terms of area of land use or land use change. The generic guidance is to multiply the activity data by a carbon stock coefficient or "emission factor" to provide the source/or sink estimates. (IPCC, 2003, section 3.1.4, page 3.15).

[13] Spatial resolution is the pixel size of an image associated with the size of the surface area being assessed on the ground. In the case of the Landsat satellite, the spatial resolution is 30 meters.

In the construction of the FREL, the increments of deforestation were adjusted to avoid over or under-estimating the emissions from deforestation, due to the non-observation of potential deforestation polygons in areas covered by clouds (see **Box 2** for details). The same Vegetation Map used to identify the forest physiognomies associated with the deforestation polygons, available at http://redd.mma.gov.br/en/infohub, was used to identify the forest physiognomies affected by deforestation in the results presented in this Technical Annex.

BOX 2 – APPROACHES TO ESTIMATE THE GROSS DEFORESTATION IN THE AMAZON BIOME

There are several approaches to estimate the area deforested and different results may be obtained depending on the approach adopted. For example, the annual deforestation area can be estimated from the annual increments of deforestation; from the annual rate of deforestation; or from the adjusted deforestation increment (the list is not exhaustive). This box reproduces parts of the original FREL submission, to ensure transparency in the calculation of the adjusted increments of deforestation. In that submission, there are information about methodologies that could be applied. The use of the adjusted increment to estimate the gross deforestation area is considered to be appropriate for the purposes of REDD+, since it can be verified.

(1) **Deforestation Polygons** (at year t): refer to new deforestation events identified from the analysis of remotely sensed data (satellite images) at year t as compared to the accumulated deforestation mapped up to year t-1. Each deforestation polygon is spatially identified (geocoded), has accurate shape and area representations, and has an associated date of detection (the date of the satellite image from which it was mapped). For each year, a map containing all deforestation polygons (deforestation map) is made available in shapefile format for PRODES (and hence, for the Amazonia biome, after exclusion of the areas associated with the Cerrado and Pantanal biomes) at (http://www.obt.inpe.br/prodesdigital/cadastro.php). This map does not include deforestation polygons under cloud covered areas. However, the deforestation map also renders spatially explicit distribution of the cloud covered areas.

(2) **Deforestation Increment or Increments of Deforestation** (at year t): refers to the sum of the areas of all observed deforestation polygons within a given geographical extent. This geographical extent may be defined as the boundaries of a satellite scene which has the same date as the deforestation polygons mapped on that scene; or the entire Amazonia biome, for which the deforestation increment is calculated as the sum of the individual deforestation increment calculated for each scene that covers the biome. The deforestation increment **may underestimate** the total area deforested (and associated emissions), since it does not account for the area of deforestation polygons under clouds.

(3) **Adjusted Deforestation Increment or Adjusted Increments of Deforestation** (at year t): this adjustment is made to the deforestation increment at year t-1 (or years t-1 and t-2, etc., as applicable) to account for deforestation polygons in areas affected by cloud cover and that are observable at time t. It is calculated according with ***Equation 1***:

$$Inc_{adj(t)} = Inc_{(t)} - \sum_{\Delta=1} A_{CC(t-\Delta),(t)} + \sum_{\Delta=1} \frac{A_{CC(t-\Delta),(t)}}{\Delta+1} + \sum_{\Omega-1} \frac{A_{CC(t+\Omega),(t)}}{\Omega+1} \qquad \textit{Equation 1}$$

WHERE:

$Inc_{adj(t)}$ = adjusted deforestation increment at year **t**; km²

$Inc_{(t)}$ = deforestation increment at year **t**; km²

$A_{CC(t-\Delta),(t)}$ = area of the deforestation polygons observed (cloud-free) at year ***t*** over cloud-covered areas at year t-Δ ; km². Note that when $\Delta = 1$, $A_{CC(t-1),(t)}$ equals the area of the deforestation polygons observed at year **t** over cloud-covered areas at year *t-1* (but which were under cloud-free at year *t-2*); for $\Delta = 2$, $A_{CC(t-2),(t)}$ equals the area of the deforestation polygons observed at year ***t*** over an area that was cloud-covered at both years *t-1* **and** *t-2*.

$A_{CC(t+\Omega),(t)}$ = area of the deforestation polygons observed at year t+Ω over cloud-covered areas at year *t*; km². Note that when $\Omega = 1$, the term $A_{CC(t+\Omega),(t)}$ provides the area of the deforestation polygons observed at year *t+1* over the area that was cloud-covered at year *t* ; when $\Omega = 2$, the term $A_{CC(t+2),(t)}$ provides the area of the deforestation polygons observed at year *t+2* over the area that was cloud-covered at years *t* **and** *t+1*.

Δ = number of years that a given area was persistently affected by cloud cover prior to year t but was observed at year *t* ; Δ **= 1, 2, ...**

Ω **=** number of years until a given area affected by cloud cover at year t is observed in subsequent years (i.e., is free of clouds); Ω **= 1,2, ...**

As an example, suppose that the area of the deforestation increment observed at year *t* , $Inc_{(t)}$, is 200 km² and that 20 km² of this occurred over primary forest areas that were cloud covered at year *t-1* (but are cloud-free at year *t*). Since these 20 km² may accumulate the area of the deforestation polygons under clouds at year *t-1* and the area of the deforestation polygons that occurred at year *t* , the deforestation increment **may overestimate** the total area deforested area (and associated emissions) at year *t* .

The adjusted deforestation increment $Inc_{adj(t)}$ at year t evenly distributes the total area of the deforestation polygons observed at year t under the cloud-covered area at year **t-1** (or before, if the same area was also cloud covered at year *t-2* , for instance) among years *t-1* and **t**. Hence, the adjusted deforestation increment at year *t* is 190 km² (200 – 20/2) and not 200 km², assuming that there were no cloud-covered areas at year t (in which case the adjusted deforestation increment at year t would be adjusted by $\sum_{\Omega=1} \frac{A_{CC(t+\Omega)(t)}}{\Omega+1}$ where $A_{CC(t+\Omega),(t)}$ = area of the deforestation polygons observed at year *t+*Ω over cloud-covered areas at year *t*; and Ω is the number of years that a given area affected by cloud cover at year t is observed (i.e., is free of clouds).

The rationale behind **Equation 1** is to remove from the deforestation increment the area to be distributed among the years ($-\sum_{\Delta=1} A_{CC(t-\Delta),(t)}$) and then add back the portion allocated to year t $\left(\sum_{\Delta=1} \frac{A_{CC(t-\Delta),(t)}}{\Delta+1}\right)$. The last term of the equation refers to the area distributed from subsequent years (or year) over cloud covered areas at year t.

(4) **Deforestation Rate** (at year t): was introduced in PRODES to sequentially address the effect of **cloud cover**; and, if necessary, the effect of **time lapse** between consecutive images. The deforestation rate aims at reducing the potential under or over-estimation of the deforested area at year t. The presence of cloud-covered areas in an image at year t impairs the observation of deforestation polygons under clouds, and may lead to an **underestimation** of the area deforested; while the presence of clouds in previous years (e.g., at year *t-1*) may lead to an **overestimation** of the area deforested if all deforestation under clouds at year *t-1* is attributed to year t.

This **over** or **under-estimation** may also occur if the dates of the satellite images used in subsequent years are not adjusted. To normalize for a one-year period (365 days) the time lapse between the images used at years t and t+1, the rate considers a reference date of August 1st and projects the cloud corrected increment to that date, based on a model that assumes that the deforestation pace is constant during the dry season and zero during the wet season. Refer to **Annex I, Part I** for more information on PRODES methodology for calculating the deforestation rate.

As an example of cloud correction, suppose that the primary forest area in an image is 20,000 km² and that 2,000 km² of this occurred over primary forest areas that were cloud covered. Suppose also that the observed **deforestation increment** is 180 km². As part of the calculation of the rate, it is assumed that the proportion of deforestation measured in the cloud-free forest area (18,000 km²) is the same as that in the area of forest under cloud (2,000 km²). Therefore, the proportion 180/18,000 = 0.01 is applied to the 2,000 km², generating an extra 20 km² that is added to the observed deforestation increment. In this case, the **adjusted increment of deforestation** is 200 km².

Important note: an implication of this approach is the need to regularly revise the activity data, since at each new year areas under persistent cloud cover in previous years may be observed. The procedure is expected to result in increased accuracy of the deforestation data. **Box 2** presents the revised mean annual emissions according with this approach and its impact on the assessed FREL, for the calculation of the results presented in this submission.

As mentioned, the annual increments of deforestation in the period from 2011 to 2015 were adjusted, consistent with the method adopted in the construction of the FREL Amazonia.

An example of the adjusted increment for year 2011 is provided, to enhance transparency of this submission. In 2011, the deforestation area under clouds was 68,533.99 ha. This total was distributed among previous years, as detailed in tab NUVEM in **Worksheet-Planilha-Calculo** available at http://redd.mma.gov.br/pt/infohub. The value 21,903.38 ha in line 13 column R (see also line 6823, column J in tab ANO2011-NUVEM2009), indicates the deforestation area observed in 2011 and that had been under clouds in 2009 and 2010. Hence, this total was distributed among three years (2009, 2010 and 2011), with individual areas equal to 7,301.13 ha (line 13, columns O, P e Q).

The emissions associated with the adjusted deforestation polygons were also presented in **Worksheet-Planilha-Calculo**. For year 2011, an emission of 15,917,617.89 tCO_2 was estimated for the observed deforested areas in 2011 that were under clouds in 2009 and 2010 (see line 25, column

R – see also line 6823, column K, tab ANO2011-NUVEM2009). Hence, this total was distributed among years 2009, 2010 and 2011, totaling 5,305,872.63 tCO_2 year-1 (see line 25, columns O, P and Q in tab NUVEM).

The total CO_2 emissions distributed was equal to 171,929,099.44 tCO_2 (see tab ***NUVEM_2***, line 11 to 15, column V, for the emissions distributed in years 2011, 2012, 2013, 2014 and 2015, respectivelly. The total CO_2 emissions is provided in line 16, column V. More details on these emissions can be found in tab ***NUVEM***: for 2011, line 27 column R; for 2012, line 52, column S; for 2013, line 27, column AM; for 2014, line 55, column AN; and for 2015, line 86, column V).

The total increment of deforestation for the period 2011 a 2015 was equal to 2,524,232.50 ha (**see Worksheet-Planilha-Calculo**, tab ***NUVEM_2***, lines 47 to 51, with total in line 52, column J, for the observed increments for 2011, 2012, 2013, 2014 and 2015, respectivelly). The adjusted increments are presented in lines 47 to 51, with total in line 52, column K, equal to 2,479,671.56 ha. The value 259,487.46 ha refers to the total area observed in the period 2011-2015 that was distributed since 1996 to 2014 (see tab ***NUVEM_2***, lines 3 to 7, total in line 8, column V, for the totals distributed in each year of the period. For instance, 68,533.99 ha of deforestation was observed in 2011, in areas that have been previously under clouds.The distribution of this area among the years of cloud cover are shown in line 3, columns B to P. Of the 259,487.46 ha distributed, 214,926.51 ha was allocated to years 2011-2015. The observed and adjusted deforestation increments in the period 2011-2015 are presented in lines 47 to 51, totals in line 52, columns J and K, respectively. The difference of 44,560.94 ha between the observed and the adjusted increments corresponds to a percent difference of 1.76%. The emissions calculated on the basis of the observed increments totalled 1,416,217,030.49 t CO_2 (see details in tab ***NUVEM_2***, lines 47 to 51, total in line 52, column N) and the emissions calculated from the adjusted increments, 1,385,295,604.87 t CO_2 (see details in lines 47 to 51, total in line 52, column O), the percent difference being equal to 2.18%.

Table 3 (columns 1 and 2) presents the annual emissions used to calculated the **FREL Amazonia** submitted to the UNFCCC (***EMISSION***) for the period from 1996 to 2010 (for results-based payments for the period 2011 to 2015) and the annual emissions recalculated using the adjusted increments with the most recent data (***EMISSION_ADJUST***). Columns 3 and 4 present the annual emissions for the period 1996 to 2015, with and without adjustment of the data from 1996 to 2010. The average of these annual emissions constitute the **FREL Amazonia** to be used for results-based payments for the period 2016 to 2020. The difference between the two values (1,546,071.28 tCO_2) corresponds to a percent difference of 0.21%. Hence, the **FREL Amazonia** to be used for results-based payments for the period 2016 to 2020 is **750,234,379.99 tCO_2**. This value is conservative.

TABLE 3 – DIFFERENCE BETWEEN THE EMISSIONS CALCULATED FROM THE OBSERVED INCREMENTS OF DEFORESTATION (EMISSION) AND FROM THE ADJUSTED INCREMENTS OF DEFORESTATION (ADJUSTED EMISSION) FOR THE PERIODS 1996-2010 AND 1996-2015

	FREL (B) - MEAN 1996 - 2010			FREL (C) - MEAN 1996 - 2015	
	EMISSION (tCO_2)	ADJUSTED EMISSION (tCO_2)		EMISSION (tCO_2)	AJUSTED EMISSION (tCO_2)
1996	979,523,413.88	979,523,618.48	1996	979,523,413.88	979,523,618.48
1997	979,523,413.88	979,523,618.48	1997	979,523,413.88	979,523,618.48
1998	979,523,413.88	979,523,618.48	1998	979,523,413,88	979,523,618.48
1999	979,523,413.88	979,523,618.48	1999	979,523,413.88	979,523,618.48
2000	979,523,413.88	979,523,849.37	2000	979,523,413.88	979,523,849.37
2001	908,964,139.89	908,964,575.38	2001	908,964,139.89	908,964,575.38
2002	1,334,457,456.93	1,334,458,298.72	2002	1,334,457,456.93	1,334,458,298.72
2003	1,375,223,214.70	1,375,224,078.19	2003	1,375,223,214.70	1,375,224,078.19
2004	1,380,140,945.68	1,380,142,199.34	2004	1,380,140,945.68	1,380,142,199.34
2005	1,163,873,339.68	1,163,879,134.73	2005	1,163,873,339.68	1,163,879,134.73
2006	576,097,126.38	576,136,731.11	2006	576,097,126.38	576,136,731.11
2007	608,266,397.26	609,101,478.18	2007	608,266,397.26	609,101,478.18
2008	666,005,315.39	669,215,058.08	2008	666,005,315.39	669,215,058.08
2009	364,340,477.19	373,066,456.69	2009	364,340,477.19	373,066,456.69
2010	344,406,512.43	362,507,086.87	2010	344,406,512.43	362,507,086.87
TOTAL 1996 - 2010	**13,619,391,994.9**	**13,650,313,420.55**	2011	285,353,855.18	285,353,855.18
MEAN	**907,959,466.33**	**910,020,894.70**	2012	236,684,154.44	236,684,154.44
	DIFFERENCE	**2,061,428.37**	2013	301,847,850.91	301,847,850.91
	% DIFFERENCE	**0.227039692**	2014	273,591,600.59	273,591,600.59
			2015	287,664,204.33	287,664,204.33
			TOTAL 1996-2015	**15,004,533,660.3**	**15,035,455,086.00**
			MEAN	**750,226,683.02**	**751,772,754.30**
			DIFFERENCE		**1,546,071.28**
			% DIFFERENCE		**0.206080551**

Note: *The first column in Table 3 presents, for the period 1996-2010, the annual CO_2 emissions used in the construction of the FREL Amazonia (see FREL (B) in* ***Figure 1*** *= 907,959,466.33 tCO_2). The second column presents, for each year of the period, the adjusted emissions calculated from the adjusted increments of deforestation. The values presented in this column result from the sum of the values presented in the first column and the values in lines 24 to 38, column Q, from tab* ***NUVEM_2 in Worksheet-Planilha-Calculo*** *available at http://redd.mma.gov.br/en/infohub. For example, for year 2010, the value in the second column (362,507,086.87 tCO_2) is equal to the sum of the corresponding value in the first column (344,406,512.43 tCO_2) and the emission value distributed for year 2010, equal a 18,100,574.44 tCO_2 (see line 38, column Q, in* ***Worksheet-Planilha-Calculo****).*

4.2 EMISSION FACTORS

Although Brazil has submitted to the UNFCCC, in March 2016, its Third National Greenhouse Gas Inventory, with a new Carbon Map for the Amazon biome, the results here presented were calculated using the same Carbon Map included in Second National Greenhouse Gas Inventory to ensure consistency between the **FREL Amazonia** and the results.

4.3 CARBON POOLS

The FREL Amazonia includes the following carbon pools: above and below-ground biomass and litter. The Carbon Map of the Second National GHG Inventory mentioned in **section 4.2** includes the carbon in the biomass of these three pools. The results presented in this Technical Annex maintain the same pools. Considerations regarding the dead wood pool are presented on **Box 3** below.

BOX 3 – CONSIDERATION REGARDING THE DEAD WOOD POOL

Paragraph 28 of the technical evaluation of the **FREL Amazonia** submitted by Brazil to the UNFCCC (FCCC/TAR/2014/BRA) indicated the treatment of the emissions from dead wood as an area for future improvement of the FREL. The results presented in this Technical Annex do not include emissions from this pool, to ensure consistency with the assessed **FREL Amazonia**.

The Third National GHG Inventory however includes this pool in the new Carbon Map for the Amazon biome, which could be the reference for revising the FREL Amazonia as part of the construction of the national FREL.

The carbon estimates for the dead wood pool were discriminated for dense and non-dense forests by applying ratios of the carbon in dead wood to the carbon in dry biomass, equal to 7.1 and 8.6%, respectively.

4.4 NON-CO_2 GASES

The **FREL Amazonia** includes only CO_2 emissions from gross deforestation in the Amazon biome. The results presented in this Technical Annex do not incorporate other gases, maintaining the consistency with the assessed FREL. **Box 4** provides some information on how the inclusion of non-CO_2 gases is being considered, for possible inclusion in a future submission, if deemed significant.

BOX 4 – CONSIDERATIONS REGARDING THE INCLUSION OF NON-CO_2 GASES

Paragraph 29 of the technical evaluation report of the FREL Amazonia submitted by Brazil to the UNFCCC (FCCC/TAR/2014/BRA) indicated the treatment of emissions of non-CO_2 gases as an area for future technical improvement of the FREL.

The results presented in this Technical Annex exclude emissions from non-CO_2 gases, to ensure consistency with the assessed **FREL Amazonia**. However, the Third National GHG Inventory provides estimates for these gases, resulting from fire associated with deforestation. For year 2010, the emissions of carbon monoxide (CO), methane (CH_4), nitrous oxide (N_2O) and NOx were approximately 8.400 Gg; 549 Gg; 16 Gg e 129 Gg, respectively. Data on emissions from biomass burning are expected to be improved in the next national inventories, to allow the possible incorporation of these emissions in a future submission of FREL to the UNFCCC, if deemed significant.

4.5 REDD+ ACTIVITIES

The FREL Amazonia was constructed targeting emissions from gross deforestation and, hence, does not include emissions resulting from other REDD+ activities (including *reducing emissions from forest degradation*).

The results presented in this Technical Annex are consistent with the assessed FREL Amazonia.

Brazil is carrying out internal discussions through the GTT REDD+ regarding the treatment of forest degradation and how its associated emissions can be included in future submissions. **Box 5** presents some considerations regarding the treatment of forest degradation.

BOX 5 – CONSIDERATIONS RELATED TO THE TREATMENT OF FOREST DEGRADATION

Paragraph 31 of the technical evaluation report of the FREL Amazonia considered the information provided by Brazil regarding forest degradation as a good start to understand its dynamics.

Brazil continues to map and monitor alterations in forest cover resulting from selective logging and biomass burning, and has also advanced, in the context of the GTT REDD+, in the development of a definition of forest degradation applicable to the Amazon biome.

The GTT REDD+ decided to promote, in 2017, a specific workshop to discuss with the academic community questions related to forest degradation. Brazil is aware of the importance of this discussion and will seek to include these emissions in a future submission of a FREL, when more adequate data and information are available.

5 DESCRIPTION OF THE NATIONAL FOREST MONITORING SYSTEM AND THE ROLE AND INSTITUTIONAL ROLES AND RESPONSIBILITIES FOR MEASURING, REPORTING AND VERIFYING THE RESULTS

5.1 THE AMAZONIA DEFORESTATION SATELLITE MONITORING PROJECT - PRODES

Brazil has a consistent, reliable, credible, accurate, transparent and verifiable historical time series for annual gross deforestation in the Legal Amazon (and, consequently, for the Amazon biome). PRODES is part of a larger program (Amazonia Program) developed at the National Institute for Space Research (INPE) to monitor gross deforestation in areas of primary (natural) forest in the Legal Amazon through use of satellite imagery.

Deforestation is associated with clear-cut activities, normally related to the conversion of forest areas to other land-use categories. Gross deforestation is annually estimated, through a complete,

wall-to-wall analysis, that involves approximately 215 Landsat scenes, with minimum mapping area equal to 6.25 hectares. It uses satellite imagery to identify new deforestation polygons every year in areas of primary forest, aided by additional Landsat class data (CBERS/CCD, Resourcesat/LISS3 and DMC) to reduce areas that are not observed due to the presence of cloud cover.

The method adopted by PRODES to estimate potential deforestation under cloud covered areas is different from that adopted for the FREL Amazonia.

Primary forest areas affected by forest degradation that do not show in the satellite imagery as clear-cut are not included in PRODES but in a separate project, named DEGRAD. This Project is also carried out by INPE and discriminates degraded forest from areas under sustainable forest management. This ensures the consistency of the PRODES deforestation time series over time.

At the start of PRODES, deforestation polygons were identified by means of visual interpretation using false color composites of Landsat imagery at the scale of 1:250,000 and mapped manually in overlays that contained the aggregated deforestation up to the previous year. Subsequently, these deforestation polygons were manually digitized in a Geographic Information System (GIS) developed by INPE. This analogical approach to estimate deforestation (Analog PRODES) was employed from 1988 until 2002.

Due to the increased computing advances and improved technical capability at INPE, it was possible to transition from analogical (Analogical PRODES) to digital annual assessments of deforestation (Digital PRODES), which was carried out in year 2000. A digital reference map containing the aggregated deforestation until 1997 was created and allowed the development of the first digital estimate of deforestation, for the period 1998 to 2000. After year 2000, annual mappings of deforestation were carried out, in a single archive. Hence, the geographical expansion of deforestation, as well as its spatial pattern could be evaluated and monitored.

Digital PRODES maintains total consistency with the Analogical PRODES data. This includes consistent delimitation of forest/non-forest and the aggregated deforestation polygons from Analogical PRODES. Despite the evolution of the digital assessment, the identification of the deforestation polygons continues to be carried out through visual interpretation in the screen and not by means of digital classification methods[14].

In summary, the digital database does not contain specific information on deforestation occurring prior to 1997; it contains aggregated deforestation information for the period 1998-2000, and annual information from 2001 onward.

Since 2003, INPE began to publish the annual rate of deforestation online, together with all the satellite imagery used and the maps with the observed deforestation polygons, ensuring complete transparency of the deforestation estimates and access by the general public (http://www.obt.inpe.br/prodes/index.php). Approximately 215 Landsat 5/7/8 scenes (or similar data, as for instance, from CBERS/CCD, Resourcesat/LISS3 and DMC) are annually available and each scene is accompanied by the respective mapping of the observed deforestation in that year and previous ones.

INPE continuously improves its tools to better manage large-scale projects such as PRODES. Its latest development, the TerraAmazon, is a system that manages the entire workflow of PRODES,

[14] *INPE has developed alternative methods to identify the increments of deforestation in satellite imagery (for instance, the linear mix models, Shimabukuro et al. (2004). However, the visual interpretation is considered to be simple and more accurate.*

annually storing approximately 600 images (e.g., Landsat, CBERS, DMC, Resourcesat). It performs geo-referencing, pre-processing and enhancement of images for subsequent analysis in a multi-task, multi-processing environment. The database stores and manages approximately 4 million polygons.

PRODES, which for decades has generated reliable deforestation data for Amazonia, is key in the context of expanding land cover monitoring to the other Brazilian biomes. The Project, open coded and evaluated by national and international experts, ensures the quality of the data used by Brazil on its REDD+ submissions.

5.2 BRAZILIAN BIOMES ENVIRONMENTAL MONITORING PROGRAM (PMABB)

The Ministry of the Environment has established the Brazilian Biomes Environmental Monitoring Program for the monitoring of deforestation, land cover and land use, selective logging, forest fires and recovery of native vegetation, through MMA Ordinance no. 365, of November 27, 2015.

Historically, with the development of geoprocessing and remote sensing technologies, Brazil has become a benchmark in the development and deployment of land cover and land-use monitoring systems. The resulting knowledge on the dynamics of land-use change has been a key element for curbing deforestation in the Amazon.

Since the 1970's, INPE, the Brazilian Agricultural Research Corporation (EMBRAPA, for the acronym in Portuguese) and the Brazilian Institute of Geography and Statistics (IBGE, for the acronym in Portuguese) have established and strengthened strategic partnerships to develop technologies and methodologies to monitor the Brazilian territory through, for example, the monitoring of forests and wildfires. This enabled an ongoing flow of qualified data to inform firefighting activities, as well as the integrated management of species, territories, ecosystems and fire.

Mapping and monitoring initiatives have been undertaken to provide the government with official data regarding the remaining vegetation cover of Brazilian biomes. The MMA, through the Project for the Conservation and Sustainable Use of Brazilian Biological Diversity (PROBIO), conducted significant mappings based on satellite imagery, which were later refined under the Project of Satellite Deforestation Monitoring of the Brazilian Biomes (PMDBBS). This project was developed through a cooperation agreement between the MMA, the IBAMA and the United Nations Development Program (UNDP), which carried out a series of assessments between 2008 and 2011 on the Cerrado, the Caatinga, the Pampa, the Pantanal and the Atlantic Forest biomes, taking the PROBIO map as a basis.

Research and innovation in the field of remote sensing have helped in the mapping of land cover and land-use change dynamics at local, regional, and national levels. This has been essential for better understanding the spatial aspects related to the expansion, retraction, transition, intensification, conversion and diversification of Brazilian agricultural production. Understanding the dynamics of land-use is important not only for assessing the condition of different ecosystems, but also for estimating the impacts caused by different human activities on biodiversity and climate change.

Through these monitoring initiatives Brazil tracks its progress in achieving its targets to reduce greenhouse gas emissions by 37% by 2025 and by 43% by 2030, relative to the GHG emissions in 2005, as stated on its NDC under the UNFCCC Paris Agreement. Furthermore, information on deforestation and forest degradation will be fundamental for the implementation of Brazil's National REDD+ Strategy.

The scope of these monitoring activities represents a major challenge. Brazil has an extensive territory of over 8.5 million square kilometers - with approximately 60-70% of the surface covered

by natural vegetation. Brazil currently has five systems in place to monitor deforestation and forest degradation in the Amazon: PRODES, DETER, QUEIMADAS, DEGRAD/DETEX and TerraClass. TerraClass Cerrado, launched in 2013, is the first Land Use and Land Cover Mapping of the Cerrado biome.

For the Amazon and the Cerrado biomes, the Program provides assessments of prior deforestation, allowing the development of reliable and consistent time series that are essential for the construction of Forest Reference Emission Levels for REDD+.

The Program also envisages the gradual expansion of forest monitoring to cover all Brazilian biomes. In addition, the monitoring of forest fires outbreaks in the entire national territory is being upgraded, in order to produce reliable data on the area affected by fires. Monitoring selective logging in the Amazon will also be strengthened. Monitoring of native vegetation restoration will be devised and implemented for the Amazon, Cerrado and the Atlantic Forest biomes.

This information will support decision-making processes to foster the conservation of Brazilian biodiversity and will also be instrumental for the development of a strategy for territorial management that reconciles diverse interests in the occupation of the land and thus enable Brazil to develop on a more sustainable basis.

The Program coordinates the efforts carried out by a diverse number of Federal institutions engaged on monitoring and mapping activities using satellite data (such as EMBRAPA, IBGE, IBAMA, INPE and research institutions), thus ensuring greater efficiency in the use of resources and better harmonization between the products.

The complexity of the Program is reflected in the number of deliverables planned (**Figure 3**). A prioritization of the activities has been established in the MMA Ordinance no. 365/2015, in view of the large number of products to be delivered by 2020: I) Amazon and Cerrado (2016-2017); II) Atlantic Forest (2016-2017) and III) Caatinga, Pampa and Pantanal (2017-2018).

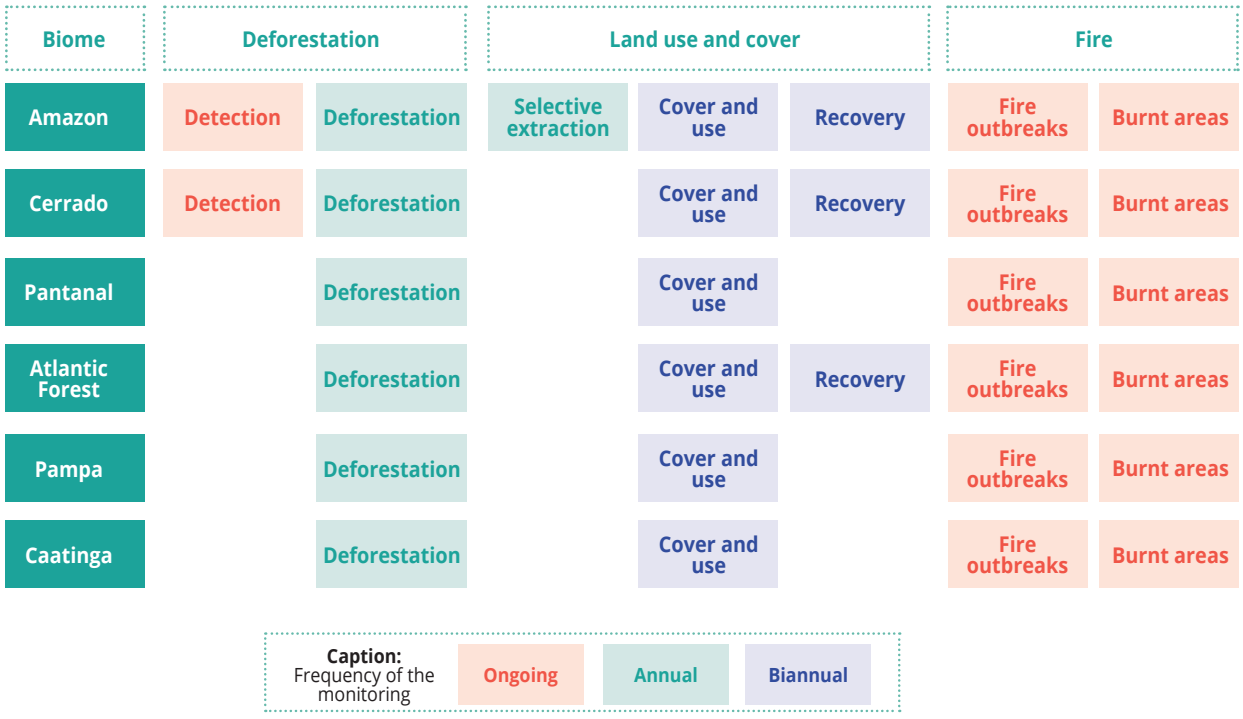

Figure 3 – Monitoring types and frequency for Brazilian biomes

As part of the first phase of the Program, support for the construction of historical time series of nearly three decades for the Amazon biome is assured, as well as almost all of the financial resources needed to support activities in upcoming years.

In the next phases of the Program, the priority will be to generate a historical time series of deforestation in the Atlantic Forest and the Caatinga biome, schedule to be finalized by the middle 2018. The Pampa and Pantanal biomes will follow.

5.3 **NATIONAL FOREST INVENTORY**

Brazil occupies approximately 8.5 million squared kilometers (or 850,000,000 hectares), of which 62% are covered by forests. Those forests have enormous importance for the country, due to environmental and socio economic importance, as well as for their global contribution by delivering forest services, such as biodiversity conservation and carbon sequestration.

At national level, the use and conservation of natural resources is of strategic importance for the country. The National Forest Inventory (NFI) is a key tool to produce reliable and regular information on forest resources.

The main purpose of the NFI is to generate information on forest resources, both natural and plantations, based on a 5-year measurement cycle, to support the formulation of public policies aiming at forest resources use and conservation. The NFI will produce information on forest stocks, composition, health and vitality, as well as the patterns of change in time by comparing estimates from successive inventory cycles. The NFI includes also the development of allometric equations to estimate wood volume and biomass for different forest physiognomies, in partnership with universities and research institutes. These estimates may serve to support the design and implementation of regional and national policies based on updated and reliable data, to identify strategies and opportunities for sustainable use of the forest resources by the forestry sector, and also to keep society and policymakers informed on the status of national forest resources. Further, NFI information can be used to address the increasing demand by international organizations and agreements for forest information.

The NFI is based on a systematic sampling design, with a national grid of sample point at 20 km x 20 km. At each sample point a cluster sample unit of four sub sampling units of 20 m x 50 m is measured every five years. Field data collection comprises biophysical variables for forest and environment condition assessment, as well as socioeconomic variables (interviews) for characterization of how people living nearby forest use and perceive the forest resources. An additional component for assessment at landscape level, is the interpretation of higher resolution satellite images in 10 x 10 km sample units, instead of field measurement. Among the landscape variables to be analyzed are forest fragmentation, changes in forest cover and land use, and the condition of permanent protected areas along rivers and water bodies as required by law.

Data collection for NFI is already in course in 14 Brazilian States, where around 5,500 conglomerates have already been measured. In the Amazon, the work started in 2014 and data has already been collected in the states of Rondonia, west of Para, northeast of Mato Grosso, reaching 1,100 conglomerates. It is expected that by 2018, at least 5,000 conglomerates will have been measured for the nine states in the Amazon, corresponding to 20,000 ground parcels (subunits of the conglomerates).

5.4 ROLES AND RESPONSIBILITIES FOR MEASURING, REPORTING AND VERIFYING (MRV) REDD+ RESULTS

The measuring, reporting and verifying process for REDD+ results in Brazil is presented on **Figure 4** below.

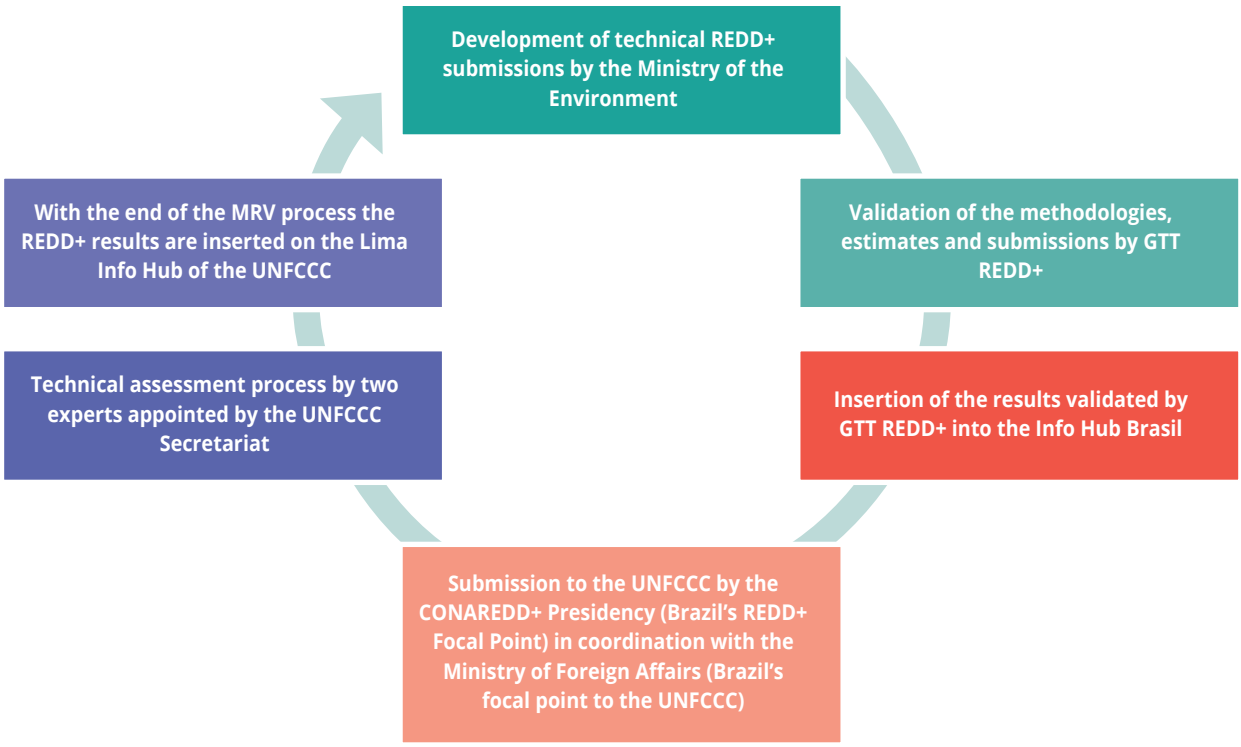

Figure 4 – MRV for REDD+ in Brazil

Table 4 presents the mapping of the institutions responsible for measuring, reporting and verifying (MRV) REDD+ results.

TABLE 4 – ROLE AND INSTITUTIONAL RESPONSIBILITIES FOR REDD+ MRV IN BRAZIL

MRV	Instrument	Responsible Institution	Role	Additional Information
Measuring	GTT REDD+	Institution hired to do the mapping and generating the results estimates	Map the deforestation polygons in the Amazon biome, consistent with the methodologies used in the assessed FREL Amazonia; estimate the annual emissions, ensure consistency with the Second National GHG Inventory	http://www.funcate.org.br
		Inpe/MCTI	Carry out the quality control and quality assurance of the products generated by the contracted institution.	http://www.obt.inpe.br/prodes/index.php
	Executive Secretariat of the National REDD+ Committee (CONAREDD+)	MMA	Carry out quality control of the emission estimates produced by the contracted institution. Develop the submissions to the UNFCCC under the guidance of the GTT REDD+. Verify consistency with the FREL.	http://redd.mma.gov.br/en/the-national-redd-committee
Reporting	Presidency of CONAREDD+ Focal point to the UNFCCC	MMA MRE	Forward the REDD+ submission to the UNFCCC.	http://redd.mma.gov.br/en/the-national-redd-committee
	Info Hub Brasil	MMA	Compile and make available documentation needed for the recognition of the REDD+ results until its verification by the ICA and insertion in the Lima REDD+ Information Hub.	http://redd.mma.gov.br/en/infohub
Verifying	International Consultation and Analysis	UNFCCC	Verify the submission by Parties, indicating experts in Land use and Forestry (LULUCF) to evaluate the FREL submissions and technical annexes.	http://unfccc.int/methods/redd/redd_web_platform/items/4531.php
		MMA	Provide the clarification information requested by the experts in charge of the technical evaluation and verification of the consistency of results. Exchange with the experts indicated by the UNFCCC for the technical evaluation of the submission of the FREL and results.	

6 NECESSARY INFORMATION THAT ALLOWS FOR THE RECONSTRUCTION OF THE RESULTS

For REDD+ purposes, **complete** information means the provision of data that allows for the reconstruction of the FREL and the REDD+ results. The list of elements considered relevant to this end is provided below and made available at: http://redd.mma.gov.br/en/infohub.

The links to the database and the information that allows for the reconstruction of the results are listed in **Section b.1** of the FREL Amazonia and can also be accessed at: http://redd.mma.gov.br/en/infohub.

1. **Satellite imagery** used in the identification of deforestation polygons in the Amazon biome, from 1996 to 2015. The images (approximately 220 per year) are made publicly available by INPE.

2. **Accumulated deforestation polygons until 1997 (inclusive)** presented in a map hereinafter referred to as the *digital base map (for more details, see Part I of Annex I of the FREL Amazonia)*.

3. **Accumulated deforestation polygons** for years 1998, 1999 and 2000 are presented in the digital base map.

4. **Annual deforestation polygons** (annual maps) for the period from 2000 to 2005.

5. **Annual deforestation polygons** (annual maps) for the period 2006-2010.

6. **Annual deforestation polygons** for the period 2011 a 2015.

7. **Information regarding deforestation under cloud cover and calculation of the adjusted deforestation increment.**

8. **Map with the carbon stocks for the different types of forest in the Amazon biome** (Carbon Map), consistent with that used in the Second National GHG Inventory, the most recent at the time of the FREL Amazonia was constructed.

***IMPORTANT NOTE 1**: All the maps listed under (2), (3) and (4) above are available in shapefile format (.shp), ready to be incorporated in a Geographical Information System for analysis. All the satellite images cited in (1) above are available in full resolution in format GeoTIFF at INPE's site. Any specific deforestation polygon can be verified using the corresponding satellite image.*

***IMPORTANT NOTE 2**: The maps cited in (2), (3) and (4) above are a subset of the maps produced by INPE for PRODES (for more information access http://www.obt.inpe.br/prodes/index.php) and refer only to the Amazon biome, object of this submission. The information in (2) and (3) above is available as a single file.*

9. **Information that allows the calculation of the adjusted deforestation increment for years 2011, 2012, 2013, 2014 and 2015.**

7 DESCRIPTION OF HOW THE ELEMENTS CONTAINED IN DECISION 4/ CP.15, PARAGRAPH 1(C) AND (D), HAVE BEEN TAKEN INTO ACCOUNT

7.1 USE OF THE MOST RECENT IPCC GUIDANCE AND GUIDELINES

The FREL Amazonia and the respective Technical Annexes use the methodologies described in the IPCC Good Practice Guidance for LULUCF (IPCC, 2003) as a basis for estimating the changes in carbon stock in forested areas converted to other land uses. For any conversion occurring at a given year, the IPCC considers the carbon stock in the biomass immediately before and immediately after the conversion. Brazil only considers the loss of the carbon stock in the biomass present immediately before the conversion (gross emissions). Brazil applies the basic method for estimating emissions suggested by IPCC, i.e., emissions estimated as the product of activity data and emission factor.

7.2 ESTABLISH, ACCORDING TO NATIONAL CIRCUMSTANCES AND CAPABILITIES, ROBUST AND TRANSPARENT NATIONAL FOREST MONITORING SYSTEMS

The activity data used in the construction of the FREL Amazonia and for the calculation of the results presented on both the First and Second Technical Annexes originated from PRODES historical time series (for more details, see **Section 5.1**). However, in a near future, the harmonization of land use/cover monitoring initiatives, through the Brazilian Biomes Environmental Monitoring Program will allow the regular production of emission data from deforestation in the remaining biomes (Caatinga, Atlantic Forest, Pantanal and Pampas) (described in detail in **Section 5.2**). Field data will also be available through the National Forest Inventory (see **Section 5.3**) that will certainty enhance the quality of the forest carbon estimates. Both initiatives are of great importance to the advancement of the forest agenda in Brazil and are instrumental for the establishment of robust and transparent forest monitoring systems at the national level.

The definition of forest adopted by PRODES includes all types of evergreen forest formations in the Legal Amazon and other forest physiognomies associated with savanna and steppe formations that are normally classified as “Other Wooded Land” according to the FAO classification system. The presence of these phytophysiognomies in the Amazon biome is not significant. However, when deforestation takes place in some of these formations, the corresponding emissions are calculated on the basis of the corresponding carbon stock, following the Carbon Map.

When PRODES was initiated, in 1988, a map discriminating forest/non-forest areas was created, based on the existing vegetation maps and spectral characteristics of the forest, as per the Landsat satellite imagery. In 1987, all the areas previously deforested were aggregated in a single map (including **deforestation** occurring in areas that, in 1987, were secondary forests) and classified as deforestation. Thereafter, this served as the base map for the annual assessment of deforestation in the Amazonia biome.

For the purposes of PRODES, the non-forested areas are not monitored (regardless of being managed or not, following the IPCC definition of managed land[15]). Deforestation occurring in forest land (managed or not) is annually assessed and monitored, and the corresponding CO_2 emissions calculated under the assumption of instantaneous oxidation at the year of the deforestation event. Hence, under no circumstances, a reduction in the accumulated deforestation in the Brazilian Amazonia is possible.

PRODES historical time series refers only to deforestation in natural forests (primary forests) that may or may not have resulted from human activities or natural events, but that have never presented a clear cut pattern in the satellite imagery. Hence, the areas where selective logging may have previously occurred are included in PRODES only when identified as areas of clear cut in the images. The deforestation definition adopted by PRODES and maintained in the FREL construction (i.e., clear cut), jointly with a detailed evaluation of deforestation using satellite imagery of high spatial resolution (less than 30 x 30 meters) allow that the deforestation polygons be identified and mapped with high accuracy.

Ground verification is not necessary, once the deforestation mapping is carried out annually and there is unequivocal association of the land cover being forest in one year and bare soil in the next. Only the observed increments of deforestation at year ***t*** (new polygons) are included in the map containing the aggregated deforestation, i.e., deforestation occurring before year ***t***.

All deforestation polygons mapped for the Amazon biome (i.e., aggregated until 2007; aggregated for years 1998, 1999 and 2000; and annual from 2001 until 2010) are available at http://redd.mma.gov.br/en/infohub.

Note that this information is a subset of that made available since 2003 by INPE for PRODES at www.obt.inpe.br/prodes. At this site, for each satellite image, a vector map in shapefile format is generated and made available, along with all the previous deforestation polygons, the areas not deforested, the hydrology network and the area of non-forest.

The experts appointed by the UNFCCC Secretariat noted on their report of the technical assessment of Brazil's FREL that the transparency and completeness of information significantly improved in the final submission and commended Brazil for the efforts taken. According to their report, the information provided in the final FREL submission, including through the data made available in websites and the examples of how estimates of deforestation were calculated, increased the reproducibility of FREL numbers.

[15] *Managed land is land where human interventions and practices have been applied to perform production, ecological or social functions (IPCC, 2006).*

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