



Center for Sustainable Development  
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# **On the Characterization of Data Quality of the 1<sup>st</sup> Brazilian GHG Inventory**

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# Objectives

- **To assess Brazilian 1<sup>st</sup> Inventory of Anthropogenic Greenhouse Gases (GHG) emissions, focusing on:**
  - **Data availability within Brazilian data bases;**
  - **Results: direct / indirect measurements, mathematical treatments;**
  - **Data quality, regarding their technological, temporal and geographical scales.**



# Brazilian Regional Characteristics

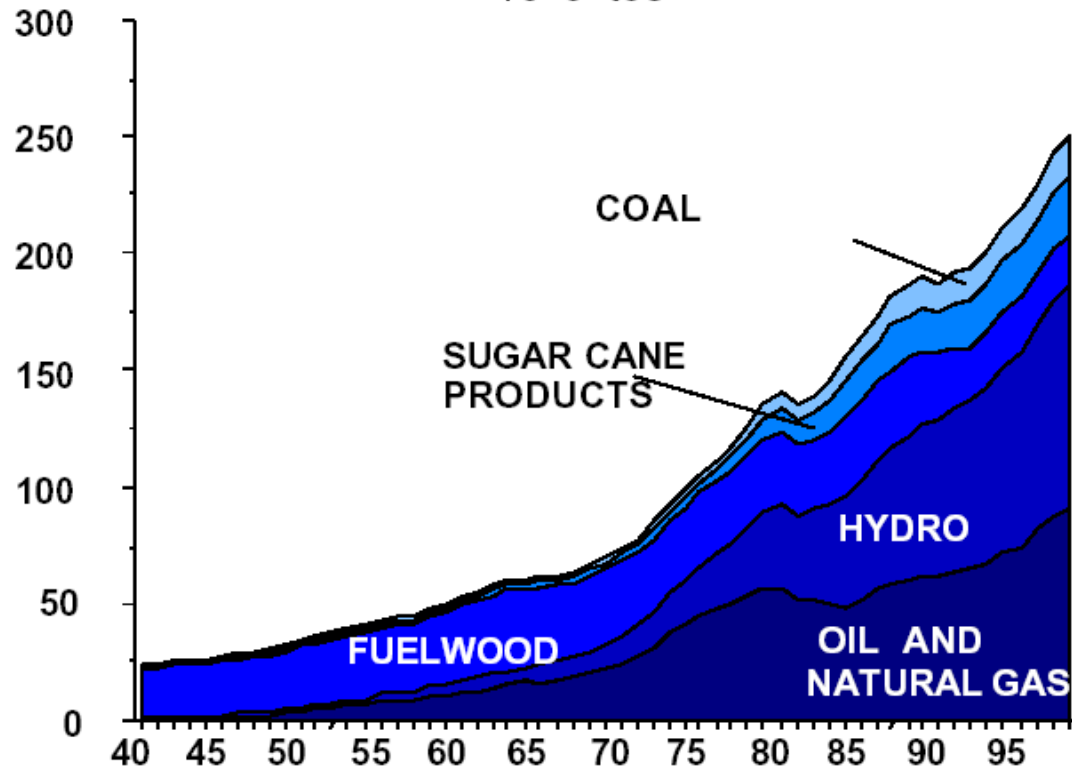
- **5<sup>th</sup> largest country in the world, 8,500,000 km<sup>2</sup>, 26 states and one Federal District (Brasília, the capital).**
- **5 geographical regions:**
  - **North: % area, 4.9% population, % GNP;**
  - **Northeast: % area, 29.3% population , % GNP;**
  - **Center West: % area, 6.3% population , % GNP;**
  - **Southeast: % area, 43.5% population , % GNP;**
  - **South: % area, 16% population , % GNP.**
- **regional diversities + increasing social, cultural and economic contrasts.**
- **very complex and dynamic economy: a large agricultural producer, producer of pig iron and steel, cement, aluminum, chemical and biochemical products, petrochemical feedstock and petroleum.**



# Brazilian Energy Systems

DOMESTIC ENERGY SUPPLY - 1940-98

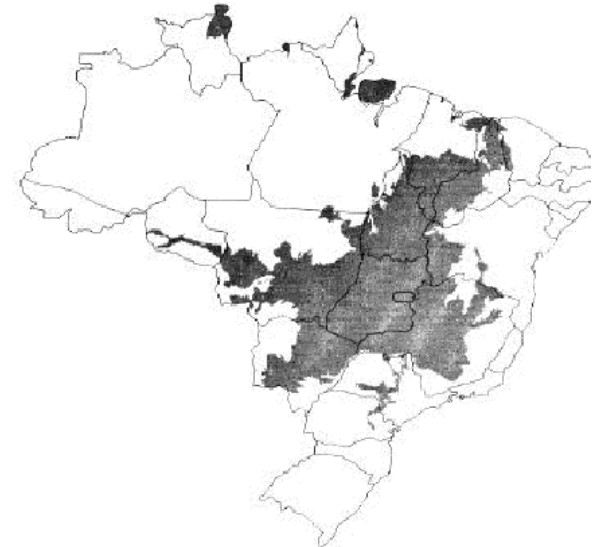
$10^6$  toe





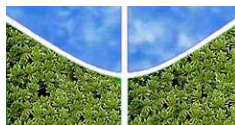
# Reports on Brazilian Anthropogenic GHG

- **14 reports prepared by Brazilian Minister of Science and Technology, under Brazilian IPCC commitment**
- **13 studies on anthropogenic sources of GHG:**
  - Carbon dioxide and methane emissions from Brazilian hydroelectric reservoirs
  - Emissions and removals of carbon dioxide by soils from land use change and liming
  - Carbon dioxide emissions and removals from changes in the stocks of planted forests
  - Emissions of greenhouse gases from burning of agricultural residues
  - Methane emissions from livestock
  - Methane emissions from rice cultivation
  - Nitrous oxide (N<sub>2</sub>O) emissions from agricultural soils
  - Greenhouse gas emissions from fuel combustion: bottom-up approach
  - Carbon dioxide emissions from fuel burning: top-down approach
  - Fugitive emissions from coal mining and handling
  - Greenhouse gas emissions from movable sources in the energy sector
  - Greenhouse gas emissions from industrial processes and use of solvents
  - Methane emissions from waste treatment and disposal
- **A fourteenth report on nonanthropogenic GHG emissions from biomass burning in Cerrado using orbital data**
- **Methodology suggested by the IPCC , OECD and IEA**

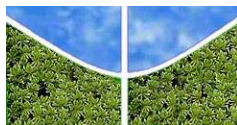




	Source / Sink	Data Availability
1	<b>Soils from land use change and liming</b>	Statistical data from the <a href="#">Agricultural census</a> for 1970, 1975, 1980, 1985 and 1995-1996; from map of Brazilian soils and map of vegetation; and data on agricultural lime sales.
2	<b>Changes in the stocks of planted forests</b>	Obtained from two major <a href="#">Brazilian agencies in the forest sector</a> , the National Pulp and Paper Manufacturers Association - ANFPC, and the Brazilian Association of Renewable Forests – ABRACAVE.
3	<b>Rice cultivation</b>	Data obtained with <a href="#">research institutes and specialists</a> in rice cultivation.
4	<b>Burning of agricultural residues</b>	Data obtained with <a href="#">research institutes and specialists</a> in sugar cane and cotton growing.
5	<b>Agricultural soils</b>	Data about agricultural and animal production from <a href="#">IBGE (Brazilian Institute for Geography and Statistics) official statistics</a> .
6	<b>Biomass burning in Cerrado</b>	<a href="#">Statistical orbital sampling strategy</a> for estimating the area burnt in the non-anthropogenic cerrado, according to area and degree of human intervention.
7	<b>Livestock</b>	<a href="#">Official data</a> for livestock from IBGE.
8	<b>Hydroelectric reservoirs</b>	There were <a href="#">no reports of in loco scientific studies</a> . Total emissions of GHG, through a program of systematic sampling. Emissions in the Miranda, Barra Bonita, Segredo, Três Marias, Xingó, Samuel and Tucuruí reservoirs were assessed by <a href="#">sampling, with extrapolation of results to the complete reservoir</a> .
9	<b>Fuel combustion and burning</b>	<a href="#">Analysis based on Brazilian energy matrix</a> , namely renewable energy sources such as firewood, water energy, charcoal, and sugar cane bagasse and alcohol.
10	<b>Coal mining and handling</b>	<a href="#">Industrial data</a> for two types of coal: steam coal used industrially in the generation of steam and energy, and coking coal, used in the steel industry.
11	<b>Movable sources in the energy sector</b>	Light and heavy vehicles data was supplied by several <a href="#">Governmental and research institutions</a> , aircraft fuel information provided by <a href="#">Brazil's Civil Aviation Institute (IAC)</a> .
12	<b>Industrial processes and use of solvents</b>	Cement, lime and barilla-related emissions were estimated based on <a href="#">data provided by the respective industrial association</a> .
13	<b>Waste treatment and disposal</b>	Sanitation data from the <a href="#">National Survey on Basic Sanitation</a> .



Source / Sink	Related to (1994)	CO2-Eq	CO2	CH4	N2O	NOx	CO	NMVOC
1 Soils from land use change and liming	emissions from changes in carbon stocks in mineral soils and from liming;	64800	64800					
2 Changes in the stocks of planted forests	6.9 million hectares, with 93% of the total area planted with Eucalyptus and 7% with Pinus;	-11000	-11000					
3 Rice cultivation	approximately 1,468 thousand hectares of flooded rice fields in Brazil, accounting for 33% of all rice growing area in the country (4,452 thousand hectares);	5943		283				
4 Burning of agricultural residues	from burning of sugar cane and cotton, produced by 262,674,150 tonnes of sugar cane on a harvested area of 4,287,630 ha, as well as 1,783,175 tonnes of cotton on a harvested area of 1,391,880 ha;	90832	2790	130	7	260		
5 Agricultural soils	manure from grazing animals (56%), crop residues (34%) and biological nitrogen fixation (21%);	152320			476			
6 Biomass burning in Cerrado	Brazilian Cerrado area of 2,0 x 10 <sup>6</sup> km <sup>2</sup> , TM-Landsat scenes from the June/July period;	52938		306	8	137	8	
7 Livestock	224 million heads: 67% of cattle, 15% of swine, 9% of sheep and 5% of goats;	205800		9800				
8 Hydroelectric reservoirs	Seven lakes: Miranda-50.6km <sup>2</sup> , 3Marias-1040km <sup>2</sup> , Barra Bonita-312km <sup>2</sup> , Segredo-82km <sup>2</sup> , Xingu-60km <sup>2</sup> , Samuel-559km <sup>2</sup> , Tucuruí-2430km <sup>2</sup> ;	5920	2785	149				
9 Fuel combustion and burning	total end use energy consumption of 190,858,000 Toe;	780704	231408	293	9	1601	12266	1169
10 Coal mining and handling	total production of run-of-mine coal of 9.7 million tons, 59% from underground mines and 41% from open pit mines;	1113		53				
11 Movable sources in the energy sector	11.745 million of light vehicles, 35% fueled by ethyl alcohol; 1.497 million heavy vehicles, 60% trucks, 28% light vehicles and 13% buses; 1.443 million m <sup>3</sup> of aviation kerosene in domestic routes, 43% in 547,000 operations of landing and takeoff;	703850	83710	10	2	1888	5898	1180
12 Industrial processes and use of solvents	cement, lime and barilla production;	13676	13676					
13 Waste treatment and disposal	municipal solid waste of 54 thousand metric tons per day, namely 0.4 to 0.7 kg/inhab.day.	14217		677				
<b>Total</b>	-----	<b>2081113</b>	<b>Gg</b>					



# Data Quality

	Source / Sink	Data Quality
1	Soils from land use change and liming	<ul style="list-style-type: none"><li>• Estimates are still <b>scarce</b>.</li><li>• In the <b>absence</b> of specific data, factors used were suggested by IPCC.</li></ul>
2	Changes in stocks of planted forests	<ul style="list-style-type: none"><li>• Accuracy is hard to quantify, because of the <b>variance</b> in figures.</li><li>• Estimating methods are well developed, accuracy of 85%.</li></ul>
3	Rice cultivation	<ul style="list-style-type: none"><li>• Size of the country and its <b>different</b> ecosystems and climatic conditions should influence the estimates.</li></ul>
5	Agricultural soils	<ul style="list-style-type: none"><li>• Data required by IPCC is not available in Brazil, some factors used obtained in <b>other countries</b>.</li></ul>
6	Biomass burning in Cerrado	<ul style="list-style-type: none"><li>• There are not, for each orbit/point, <b>complete</b> sets of images to cover the entire burning season.</li></ul>
7	Livestock	<ul style="list-style-type: none"><li>• <b>Lack of data</b> for characterizing cattle populations, food supply season and climatic fluctuations.</li><li>• Animal wastes information obtained in consultation with <b>specialists</b>.</li></ul>
8	Hydroelectric reservoirs	<ul style="list-style-type: none"><li>• Intensity of <b>emissions dependent</b> on measurement site, time of flooding, temperature, depth, wind, sunlight, water physical-chemistry, biosphere composition and reservoir operational regime.</li></ul>
9	Fuel combustion and burning	<ul style="list-style-type: none"><li>• Validation relied on the <b>values recommended</b> by the IPCC do not accurately reflect the conditions of production and use of energy in Brazil.</li></ul>
13	Waste treatment and disposal	<ul style="list-style-type: none"><li>• <b>National-related literature</b> should be used.</li></ul>



# Data Quality

- **Scarcity of data.**
- **Completeness of data.**
- **Complexity of conditions: size of the country, ecosystems and climatic conditions diversity.**
- **Inaccuracy of validation relied on foreign values.**
- **Information obtained with specialists.**
- **Inexistence of regular basis inventory statistics.**



# Further Topics

- **Brazilian 1<sup>st</sup> Inventory of GHG is a valuable collection of information, although less detailed than LCI.**
- **Data describes aggregated mass flux crossing Brazilian economy.**
- **National statistics available do not always allow an adequate evaluation of emissions. In many cases, indicators were estimated.**
- **Part of the analysis relied on values recommended by the IPCC.**
- **These questions emphasize the importance of region-specific conditions in environmental evaluation.**
- **LCA force tasks must take into account regional specificity, namely social, economic, geographical, technological and industrial characteristics.**
- **It should be recognized that the development of a national life cycle inventory is a resource-intensive undertaking. Priorities should be established for carrying out research and studies of impacts for social and economic sectors.**