

*GOVERNANCE FOR THE TRANSITION TO A SUSTAINABLE
ENERGY SECTOR IN BRAZIL: INTEGRATING ENERGY AND
CLIMATE CHANGE POLICIES*

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Main points to be addressed

- The recent changing profile of GHG emissions in Brazil: Main aspects of the energy sector and recent evolution of the electricity sector
- Projected emissions in the light of the Paris Accord
- Overall assessment: Is Brazil heading for a sustainable energy sector in the sense of stabilising GHG emissions? Could it be better?

Brazilian GHG Emissions Profile is Changing

- Following the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006) the Brazilian Ministry of Science, Technology and Innovation (MCTI) publishes information on national GHG emissions divided into main sectors grouped according to processes, sources and sinks: energy, industrial processes and product use, waste; and agriculture, forestry, and other land use, land-use change and forestry (LULUCF).
- The most recent GHG emissions estimates for the five broad sectors show that the bulk of Brazilian recent GHG emissions growth has come from energy, with a value of 24% for the 2005-2011 period. This result expresses two interdependent factors.
- The first is related to the fact that the key driver of climate change in Brazil used to be LULUCF activities (up to 2005), so policies to control emissions focused on controlling those activities. In this context, and because of the historically low-carbon content of main energy sources, there has been limited pressure on Brazil to explore energy efficiency and renewable energy (beyond hydropower and bioenergy)

Brazilian GHG Emissions by Sector, 1990-2011

MTCO₂EQ

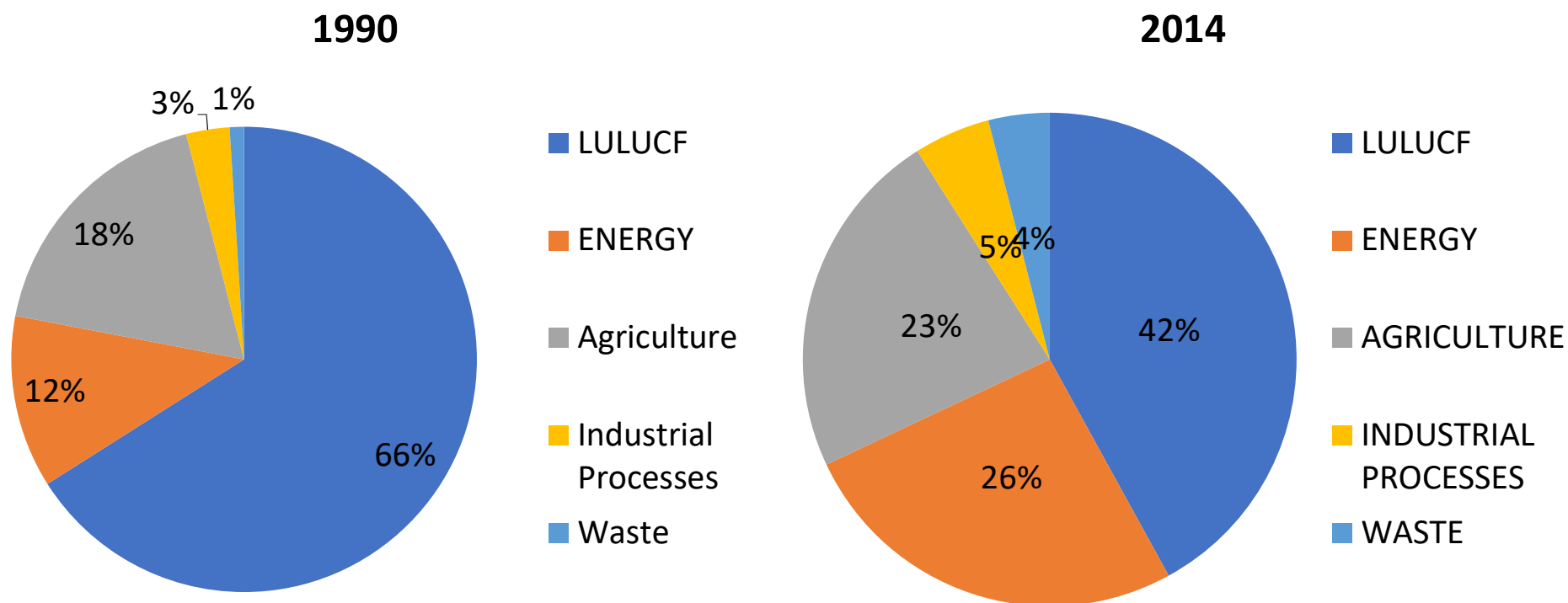
Sectors	1990	1995	2000	2005	2011	1995-2005 (%)	2005-2011 (%)
Energy	188	228	299	328	408	44	24
Industrial processes	53	63	72	78	86	24	11
Agriculture	304	336	348	416	450	24	8
LULUCF	816	1940	1343	1179	310	-39	-74
Waste	29	33	38	42	48	24	15
TOTAL	1389	2601	2100	2043	1302	-21	-36

Source: MCTI, 2014

Brazilian Energy Matrix Getting Dirtier.....

- More recent estimates provided by independent data collection systems (SEEG, 2014) the situation outlined before has experienced important changes: in 2012, fossil-energy emissions for the first time exceeded those originating from agriculture and they are expected to surpass those from LULUCF in the medium term.
- The point to be highlighted is that although renewables account for 39.4 % of Brazil's total energy supply in 2014 (EPE, 2015), therefore assessed as being essentially clean, its share of the total energy mix is on the decline, with the faster growth of non-renewable compared to the growth of renewable energy. Estimates by the WRI point out that around 80% of the energy investments in Brazil for the period 2013-2022 will be allocated to fossil fuels, implying that the country is heading for a carbon intensive lock-in.
- Brazilian power generation sector is undergoing important changes. Historically dominated by hydropower, an increasing share of power is now generated from thermal electricity processes, including from fossil fuels (coal, natural gas, fuel, oil and diesel) biomass (sugarcane bagasse in particular) and, to a lesser extent, uranium. The PDE 2023 projects significant growth in Brazil's electricity demand over the next decade, resulting in the need for about 6 GW of additional installed capacity per year through 2023 (EPE, 2014).
- These two trends combined tend to result in a significant increase in GHG emissions. However, this possible result is far from being an inexorable one since Brazil has a very expressive renewable potential that could and should be better exploited with appropriate policies and institutions designed for the specific purpose of greening the power generation sector. The final purpose of this research is exactly to discuss the options for it, trying to identify the main factors limiting a more widespread implementation of renewables.

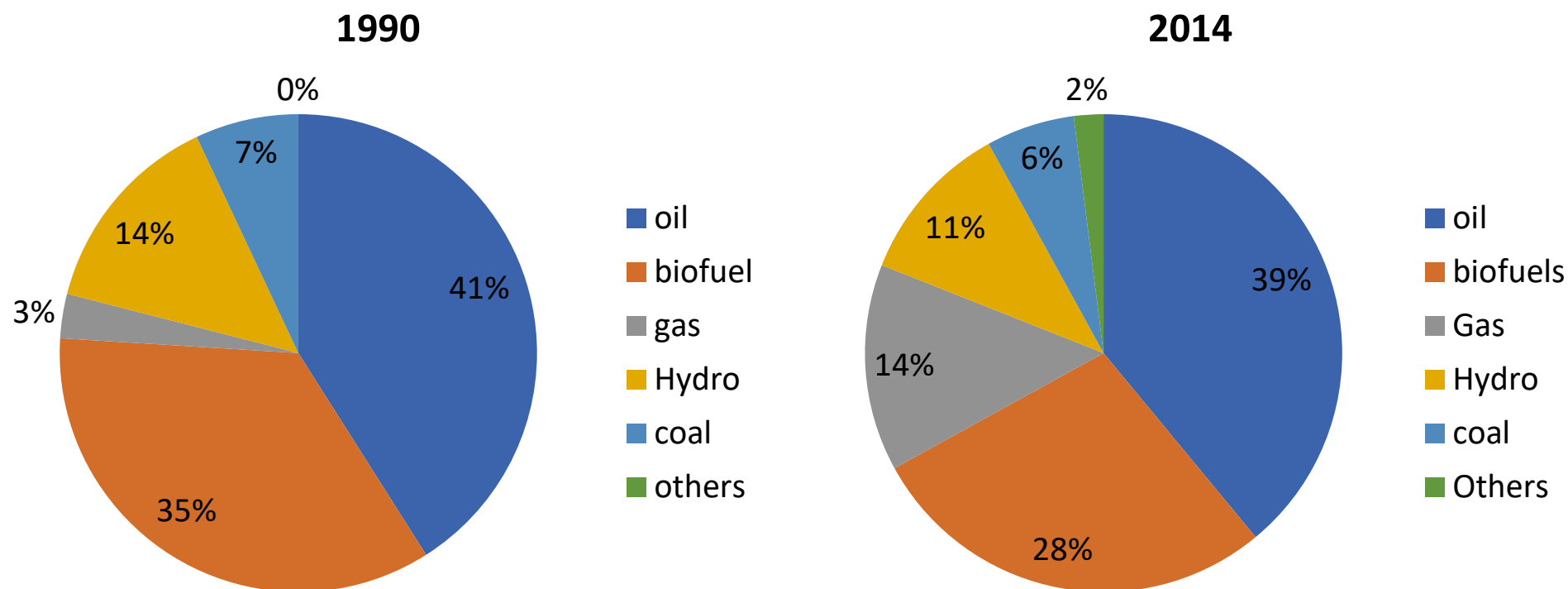
GHG Changing Profile:1990-2014



Comments

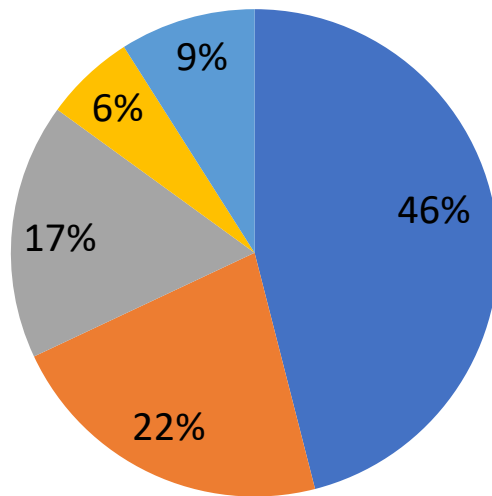
- It is worth stressing the significant increase in the share of emissions generated in the energy sector
- GHG emissions in the energy sector from a value of 189,7 MCO₂T in 1990 reached 479,1 MCO₂T according to SEEG (2016), a rate of growth of 3,9% per year
- Therefore, to grasp the main trends in GHG emission trends, we need to understand what is happening in the energy matrix
- SEEG provides updated information on what is happening in the energy sector using official data This has been used as main data source

Internal Supply of energy by primary source



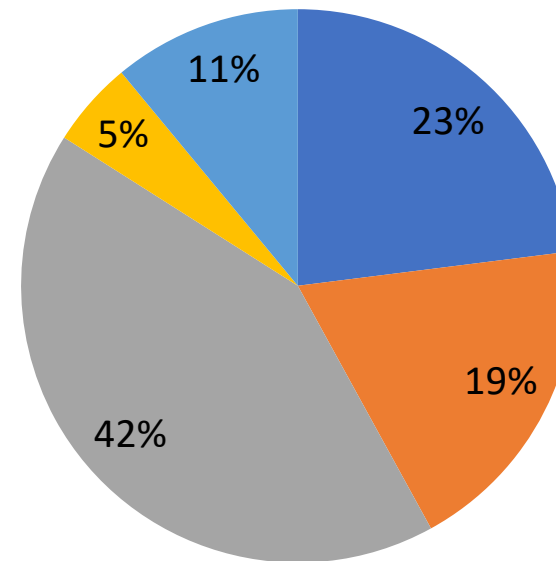
Energy sector: Emissions by activity sector in Brazil and in the world

Brazil 2013



- transport
- Industry
- Electricity generation
- fuel production
- others

World 1013



- Transport
- Industry
- Electricity generation
- Fuel Production
- Others

Comments

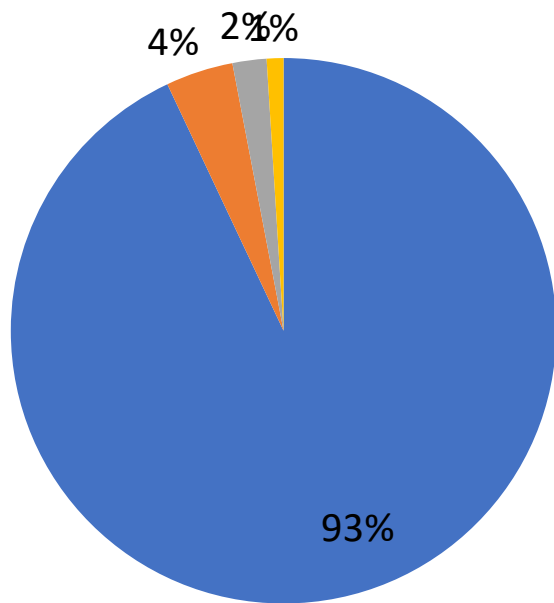
- In Brazil, most of the emissions are originated from oil, responsible for 71% of total emissions in 2014, in contrast with the rest of the world (coal)
- Worth remarking the growth of gas as primary source, from 3% in 1990 to 17% of emissions in 2014
- The most important sectors by activity sector are transport (40,1%), industrial sector (19,5%), electricity generation (17,4%), and fuel production (6,8%)
- Transport sector accounts for significant share of emissions from the energy sector (45% in 1990 and 46% in 2014)
- Brazil is a high emitter in the transport sector and low emitter in electricity generation compared to the world
- Electricity sector growing participation in emissions, from 5% to 17%
- SEEG Monitor Elétrico shows that 57% of additional emissions in 2014 were from electricity generation compared to 2013
- This fact calls for a more detailed analysis of the electricity sector

Electricity sector

- Electricity demand more than doubled in the period 1990-2014
- Largest consumer industry sector (41% in 2014) followed by the residential sector (24%)
- Although hydroelectricity is dominant, thermal sources have been increasingly used, as shown on next figures
- Oil, gas and coal accounted for 66% of electricity generation other than from hydro, followed by biofuels 21,3%, nuclear (7,1%) and wind (5,6%)

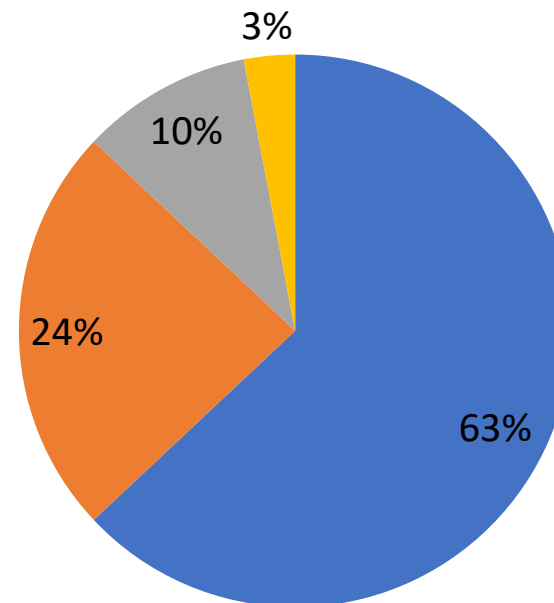
Electricity Generation in Brazil- Primary Sources

1990



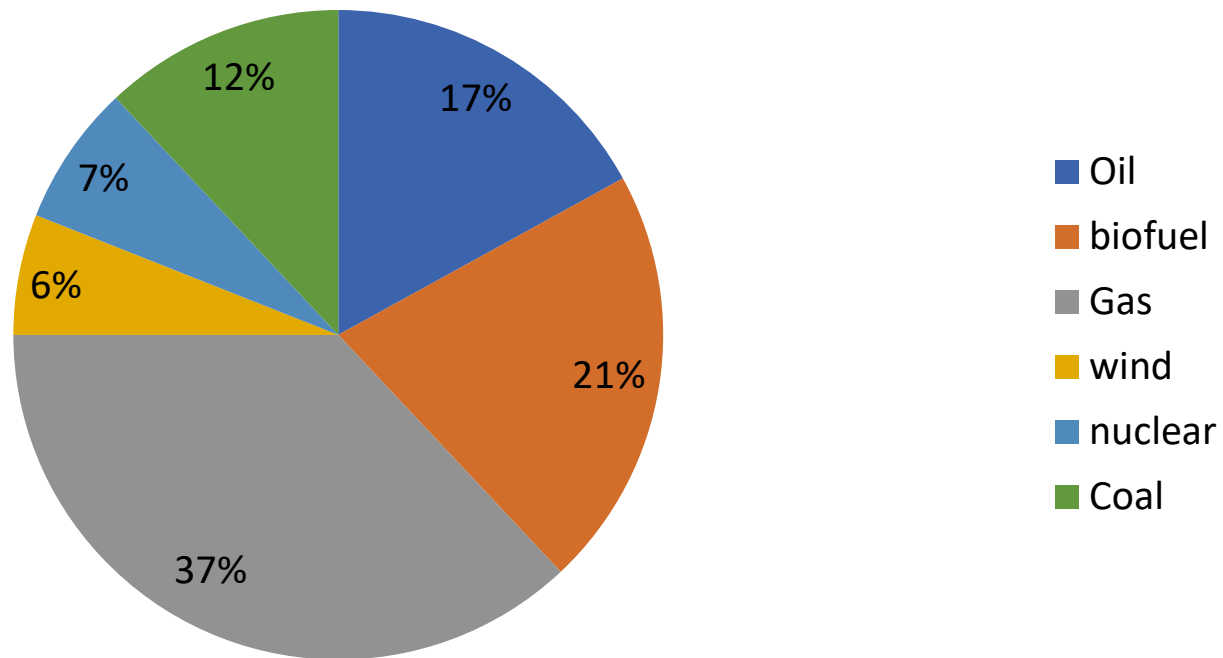
- Hydro
- Fossil
- renewables
- Nuclear

2014



- Hydro
- Fossil
- Renewable
- Nuclear

Elect. Generation other than from hydro 2014



Comments

- Brazil could be heading for a significant increase in GHG emissions if a new pattern is not designed for the power generation sector growth. Emissions factors for the electricity sector have increased substantially and are expected to remain higher
- To reverse this result above, it would be necessary to increase renewables share
- Brazil has significant renewable energy potential, with many opportunities to green this sector in particular increasing the share of wind and solar in the electricity mix as well promoting grid interconnection of renewables.
- Moreover, a very important research topic, often neglected, refers to the improvement of the governance in which energy decisions are taken, in an attempt to point out the possibilities to improve integration between climate and energy policies in Brazil.