Energy and Climate Change: Towards a Greener Energy Sector for Brazil

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1) **Overview: brief presentation of the topic including its background and potential significance**

Brazilian power generation sector has recently undergone important changes. Historically dominated by hydropower, an increasing share has been generated from thermal electricity processes, mainly from fossil fuels (coal, natural gas, fuel, oil and diesel). Although there is an official commitment to increase the share of wind and solar in the Brazilian energy matrix, there has been modest support for those forms of energy. In fact, the National Energy Plan (PNE, 2050), elaborated by the governmental Energy Research Company (EPE), estimates a relative increase from thermal power plants fuelled by natural gas and coal, even if it is acknowledged the importance and relevance of investing in modern renewables energies such as wind and solar.

As a consequence of those developments, the projected GHG energy related emissions for Brazil has shown an increasing participation in the Brazilian GHG total emissions, with a concomitant change in its profile. This is because LULUCF related emissions (land use, land-use change and forestry) , in general responsible for the bulk of GHG Brazilian emissions in the past, has been put under control, what has not happened to the emissions from energy because Brazil has had to rely more on thermal sources of energy, due to the adverse hydrological conditions prevailing in recent years.

In the context outlined above, it matters to exploit possible future scenarios for the energy related emissions for Brazil conditional on different energy mixes in order to identify paths conducive to decarbonize the Brazilian energy sector.

2) **Methodology: how the matter was addressed what techniques were used**

As part of UNFCCC agreements, 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, in particular wind and solar energy.

Two sets of information will be used : the projected energy mix provided by the PDE 2024 with the projected emissions estimated through the Brazilian National GHG Inventory to assess how the GHG profile might be changing over time as a consequence of changes in energy mixes. Following it, using simulation techniques, we proceed to estimate what would be the necessary shares of wind and solar energy in order to stabilize emissions from the Brazilian energy sector for sector for the period 2020-2030.

3) Expected results: key findings

It is expected that there will be an important increase in GHG emissions from the energy sector, if Brazil does not devise a new pattern for the energy sector growth, as highlighted by La Rovere et al (2013). 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. Once the necessary shares of wind and solar energy for stabilising the GHG emissions are estimated, a discussion on the policy and institutional options for increasing their participation in the energy sector is done, in an attempt to identify the main factors limiting a more widespread implementation of renewables (wind and solar).

4) Conclusions: lessons learned and implications

Both forms of energy, wind and solar, show a remarkable potential power in Brazil. But because of the high costs involved and the logistics associated, they still contribute in an insignificant way to power generation in Brazil. This is really an unsatisfactory situation because of the many benefits associated with those forms of energy sources. As Pao and Fu (2013) highlight, investing in wind and solar power generation can enhance energy security, reduce GHG emissions and create more jobs in Brazil.

On the supply side, it is imperative to reduce capital, operational and maintenance costs, through appropriate policies, promoting research and development, adequate funding and standards/ regulatory norms to reach uniformity among regions and a stable regulatory framework. On the demand side, policy making is required from public agents to create incentives to agents to switch to solar energy, including feed in tariffs (FIT), and net metering schemes, as well as simplified procedures for grid access. It would be extremely relevant that Brazil is in a position to assess lessons from international experience so far, to identify which measures and policies have proved most effective towards the aim of disseminating the use of solar and wind energy. Equally important would it be to improve the governance of energy policies in Brazil towards a greener energy matrix.

5) References

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