

## **Monitoring System of Greenhouse Gases Emissions Project in Rio de Janeiro Municipality**

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### **ABSTRACT**

The Rio de Janeiro municipal government has set Climate Change as a priority. The aim is the consideration of global warming issues in the context of urban planning for defining actions and measures to reduce greenhouse gases (GHGs) emissions in the city.

In 2011 the Climate Change and Sustainable Development Municipal Policy has been implemented by the Municipal Environmental Secretariat (SMAC), which has required every four years updates of the municipal GHG emissions Inventory (2005 has been the monitoring base year) and the definition of emissions reduction targets.

After performing three gas emission inventories, Rio de Janeiro municipal government has developed a project with the support of the World Bank, for designing and operating a Web System on GHG Emission Monitoring and executing the 4th Inventory based on data collected in 2016.

The project also aims at capacity-building and staff training in order to maintain and update inventories of GHG emission, implement measures to reduce them, and elaborate mitigation, adaption and resilience measures on climate change effects.

This paper presents the fundamentals that helped devising the monitoring system framework and the possible system outputs. It also shows the benefits that other cities could obtain by implementing this type solution to help their countries to reach the Paris Agreement reducing targets.

### **INTRODUCTION**

The first urban climate initiatives started in the early 1990s when a number of cities, mainly in Europe and North America adopted climate change policies in their agendas, focusing on measure to reduce GHG emissions. (BULKELEY, BROTO, EDWARDS G, 2012)

BULKELEY (2010) mentions that during the 1990s and 2000s the number of cities concerns about climate change grew significantly, mainly after the Rio United Nations Conference on Environment and Development of 1992. Then, important local organizations were formed in order to address climate change issues, including ICLEI'S (Local Governments for Sustainability).

The increase of extreme climate events frequency and intensity observed in recent years had its connection with climate change confirmed in 2011 by the IPCC (Intergovernmental Panel on Climate Change) (IPCC, 2012), attracting world attention to this theme.

In 2010, Brazilian government established its National Policy on Climate Change (PNMC - Law N°. 12,187/2009 and Decree N°. 7,390/2010). Although not included in the list of countries required to reduce their emissions (Annex 1 of the Kyoto Protocol), PNMC defined mitigation actions to reduce 36.1% to 38.9% GHG emissions by the year 2020 as a voluntary national commitment this is equivalent to 1,168 million to 1,259 million tonCO<sub>2</sub>eq (Decree 7,390 / 2010). To achieve these goals, the PNMC has established the developed sectoral mitigation and adaptation plans at the local, regional and national levels.

Brazil ratified the Paris Agreement on Climate Change on September 12 of 2016, confirming the Intended Nationally Determined Contribution (INDC) goals to reduce GHG emissions by 37% below 2005 levels in 2025 and by 43% below 2005 levels in 2030 (INDC, 2015). On 4 November 2016 the Paris Agreement entered in force, after the minimum conditions was achieved (UNFCCC, 2016).

The achieved of these goals will require a strengthening of local government actions. Stern N. (2006) and IEA (2008) (apud Bulkeley, 2010. 230p) stated that the cities may be responsible for up to 75% of the carbon dioxide anthropogenic emissions. Such rate should raise once two-thirds of the global population are expected to live in urban areas until 2050 (GHGP-GPC, 2014).

Against this backdrop, municipalities should be more actively involved in combating climate change by drawing up their inventories of greenhouse gas emissions and efficient public policies to define and achieve their emissions reduction targets.

For GHGP-GPC (2014) an inventory of emissions is the first step in the creation of a local action plan to reduce their emissions, monitor progress, and take effective action on mitigating climate change.

Despite the importance of urban centers for reducing GHG emissions, Brazil still has a lack of mandatory elements to ensure municipalities actions towards the compliance of these reduction targets. The Brazilian Climate Change Policy (PNMC – Política Nacional de Mudanças Climáticas) has as one of its guidelines the encouragement and support for regional and local governments, productive sectors, academia and NGOs in the development and execution of policies, plans, programs and actions related to climate change (Brazil – PNMC, 2009). However, there is no obligation for these federative entities to carry out their inventories.

## METHODS

In 2007, Dubeux and Rovere discussed the importance of controlling GHG Emissions in Rio de Janeiro, concluding that *“planning activities at the municipal level can incorporate the greenhouse effect problem in their variables (...). This new attitude can contribute to the climate issue and raise resources under the clean development mechanism. This additional income from GHG emissions reduction projects can help control local pollution and achieve other types of benefits such as lower public expenditure, traffic improvement, reductions in atmospheric pollution, among other aspects important to the quality and everyday life of communities.”*

Carlioni (2012) suggests that cities GHG emissions inventories can be important tools for identifying opportunities to implement public and business emission reduction policies. The results of the inventory, together with other statistical information, such as population and economic growth, and urban occupation and expansion, allow the development of scenarios and the identification of the need for intervention by the authorities through the creation of public policies.

The first Rio's GHG inventory was presented in 2000 for the emissions of 1990, 1996 and 1998, considering the emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). This three main greenhouse gases were analyzed in 2010 in the emission inventory of 2005, and in 2012 for the sectors

of Energy; Industrial Processes and Product Use (IPPU); Agriculture, Forestry and Other Land Use (AFOLU) and Solid Waste.

A permanent international challenge was the adoption of different methodologies for the elaboration of city GHG inventories. The lack standardization makes comparisons between cities difficult and increases the questioning of data quality. To address this issue, in 2011, WRI, ICLEI and C40 launched a joint initiative to develop a global protocol for accounting and reporting GEE of cities: The Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC) (GHGP-GPC, 2014).

In the inventory of 2012, the municipality of Rio considered this Global Protocol methodology to present its emissions, which had been calculated in 22.6 million tons of CO<sub>2</sub> equivalent (Mt CO<sub>2e</sub>). Also, the estimates for 2005 (11.6 Mt CO<sub>2e</sub>) was reviewed and the action plan for emission reduction was presented for the sectors under municipal responsibility (Energy, AFOLU and Waste) for the years of 2016, 2020 and 2025.

After conducting three municipal inventories of GHG emissions and in accordance with the Municipal Policy on Climate Change and Sustainable Development (Law N° 5,248/2011), Rio de Janeiro City decided for periodical update its inventories for which a GHG Emission Monitoring System has been decided to be implemented in accordance with the GCP.

Using this background and the previous municipal experience on climate change, the monitoring system objectives and operational structure were determined. The system development is expected to begin in 2017 with the technical and financial assistance of the World Bank, as part of the Strengthening Public Sector Management Project, called *Rio de Excelência*.

The main system characteristics and functionalities and database are: in addition to the three gases mentioned previously, consider the hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF<sub>6</sub>) and the black carbon: contemplate different categories of GHG emissions, separating them by type and origin; review of past inventories in events of significant methodologies actualization, as well as permitting the system actualization; and allow remote querying and data manipulation with different levels of editing permissions.

The implementation of the Web System will facilitate the control of GHG emission data through the elaboration of appropriate tools for collecting, processing and storing information, along with training the municipal technical staff for its continuous updating. Additionally, it will enable the follow-up of local Action Plan for reducing Greenhouse Gas Emissions, meet targets set by cities, and guide and identify in real time the most critical sectors.

Once the infrastructure is created and its acceptance test approved, the system will be completed with previous inventories information to create a historical emission database. This activity will enable the municipality to verify the evolution of emissions per sector and the effectiveness of the implemented policies.

Then, the 2016 emissions data will be gathered by an application of online forms under the supervision of the Environmental Secretariat to be then insert in the system. The 2016 GHG Inventory will be elaborated in 2017, through the system, providing all the necessary information for reviewing policies and action plans and checking emission reduction and mitigation targets.

In 2016, Rio Environmental Secretary also set the Strategy for an Adaptation Plan on Climate Change in the City with the collaboration of COPPE - Alberto Luiz Coimbra Institute for Graduate Studies and Engineering Research of Rio de Janeiro, Federal University (SMAC, 2016).

## **CONCLUSION AND DISCUSSION**

This system aims to strengthen the municipality on facing climate change by creating a protocol for data collection and continuous analysis of the effectiveness of implemented policies.

An additional, the project has its focus on environmental secretariat capacity building and staff training for maintaining and updating GHG emission inventories, implementing measures to reduce GHG emissions, and elaborating mitigation, adaption and resilience measures on climate change effects, thus reducing financial needs and hiring of external consultants.

As the project follows all international standards on analyzing GHG emissions, it can be replicate for others local governments interested to improve their actions to combating climate change.

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