Smart City – Good Practice

Governance effectiveness

GHG Inventory 2012

Rio de Janeiro, Brazil

POCACITO
european post-carbon cities of tomorrow

Pioneering city in applying and testing a brand new GHG inventory standard

One of the central projects of Rio de Janeiro´s City Government is the reduction of greenhouse gas (GHG) emissions in the city. With the Rio 2012 and 2016 Strategic Plan [1, 2], the Municipal Climate Change and Sustainable Development Law (no. 5248/2011) and the Rio Low Carbon City Development Program (LCCDP) [3], a set of coordinated planning tools has been developed for defining sustainable and low-carbon goals and implementing concrete mitigation actions within the city. Within these strategies, Rio has also prepared a detailed GHG inventory, and developed a basic tool to calculate GHG emissions of a city in a consistent way and to identify the most effective GHG mitigation actions. Rio already has much experience in performing GHG inventories: In 2013 the city finalized its third GHG inventory (2012) by applying and testing the new global inventory standard of the Global Protocol for Community-Scale GHG Inventories (GPC). The Protocol was developed by the World Resource Institute (WRI), the C40 Cities network and ICLEI [4, 5]. Thus Rio de Janeiro has become a pioneer in applying one of the newest GHG inventory schemes currently available.

Country/City Profile

Country		City	
Population (2014)	206.1 million [6]	Population (2013)	6.187 million (city)[3] 11.8 million (metropolitan)[3]
Land area (km²)	8.515 million[6]	Land area (km²)	1,260 (city)[3] 4,557 (metropolitan)[7]
GDP per capita (2014, current international $, at purchasing power parity)	16,155[10]	GDP per capita (2014, US$, at purchasing power parity)	n/a (city)[8] 14,176 (metropolitan)[11]
Region	Latin America	Region	coastal (22°54'S 43°12'W)

City's physical geography		
	Location	✓ On a narrow coastal plain of the Atlantic Ocean **(precipitation extremes, tidal flooding, heat islands)** ✓ also mountainous area with rainforests **(flooding risks, landslides)**
	Climate	✓ tropical savanna, heavy rainfalls in summer **(average temperature: 27.3 C°, 1170 mm/year annual rainfall)**

Initiating context

Rio de Janeiro´s vision of sustainability goes back to the Rio Earth Summit in 1992. After a period of a declining economy, rising poverty and degrading urban infrastructure, the city started to overcome these challenges in the new millennium. Rio was one of the first cities to carry out a GHG inventory on a municipal level. The first GHG inventory was presented in 2000 (presenting GHG emission data for the years 1990, 1996 and 1998),the second one in 2010 (presenting 2005 GHG emission data) and the last and newest one in 2013 documenting the GHG emissions of 2012. In parallel, the city defined in the Rio 2012 and 2016 Strategic Plans [1, 2], comprehensive urban, economic and environmental actions and initiatives in the fields of health, education, transport, housing and urban planning, public oder and conservation, management and public finance, environment and sustainability, economic development, culture and social development. For some of these actions GHG emission reductions were estimated and documented in the GHG inventories.

Project description

The 2012 GHG inventory, based on the Global Protocol for Community-Scale GHG Inventories (GPC), is in comparison to former inventories characterized by more detailed and consistent, reliable, comparable and internationally recognised data [4]. In accordance with the IPCC 2006 Guidelines the following sectors are subject of the inventory: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and other Land Use (AFOLU) and Waste. Detailed subdivision of these sectors and their linked GHG emissions were done according to

GPC recommendations with respect to emission sources, and methods used to define boundaries and responsibilities.

The following total GHG emission reduction targets in comparison to 2005 were defined in Rio´s Municipal Climate Change and Sustainable Development Law (no. 5247/2011): minus 8% GHG emissions in 2012 (0.93 Mt CO_2equivalents), minus 16% in 2016 (1.86 Mt CO_2e) and minus 20% in 2020 (2.32 Mt CO_2e). For Rio de Janeiro a business as usual scenario was defined (scenario A for 2005, revised in 2013 for some sectors with updated data). In a scenario B different GHG emission reductions were calculated, based on actions and initiatives defined in the Rio 2012 and 2016 Strategic Plans [1, 2]. For some actions estimations of emissions saved for 2020 and 2025 have been conducted.

Implementation Process

The GHG Inventory 2012 was implemented by Rio Prefeitura (Mayor, Municipal Environment Secretary and City government team) together with the Center for Integrated Studies of Climate Change (Centro Clima) and the Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering (COPPE/UFRJ) [4], and received technical support of the World Resource Institut in context of the GHG Protocol and the Development of the GPC [5]. Work started in 2011 within the GPC network and was funded by the World Bank [9]. The 2012 inventory was finalised in November 2013.

Stakeholder involvement occurred during the search and definition of initiatives and actions for the city as to how to reduce GHG emissions as documented in the Rio 2012 and 2016 Strategic Plans [1, 2]. To promote stakeholder involvement, The city established the Rio Climate Change and Sustainable Development Forum, a public forum with representatives of the public sector, private sector and civil society. Central goal of this forum is to contribute to the search of feasible solutions for public policies in the area of GHG emission reduction actions. To enlarge the available budget for necessary investments Rio focused also on new business opportunities with the creation of a new agency, “Rio Business” and the exploitation of Public Private Partnerships (PPP).

Results

Rio is one of the first cities in the world to test the new global GPC inventory standard. The results of this inventory show that for 2012 The city emitted a total of 22.6 million tonnes of CO_2 equivalents (Mt CO_2e) [4]. For 2005 11.6 Mt CO_2e were calculated (revised version but still less detailed and comprehensive methodology). Summed GHG emission reductions in 2012 based on implemented projects from the Strategic Plan 2012 and 2016 have been calculated to account for 378 Mt CO2e (see Table 1), as compared to 929 Mt CO_2e originally planned in scenario B [4]. This deviation of actual achieved and originally planned GHG emission savings is mainly based on project delays. These emission reductions are not high enough to obtain a reduction of Rio´s total GHG emissions from 2005 to 2012, as targeted in Rio´s Municipal Climate Change and Sustainable Development Law (see above). In contrast Rio´s GHG emissions have doubled within these seven years, mainly due to changing economic conditions, a growing population, an increase in private vehicle use and the opening of a new large steel mill within the boundaries of the city. In addition, changes of the country´s energy policy beyond the responsibility of the city influenced this increase. Electricity generation by thermopower plants and the use of gasoline increased and ethanol production tumbled during the economic crisis.

The 2012 Inventory indicates that the energy sector is responsible for 79% of GHG emissions. Within this sector transport is the highest emitter (30% of total GHG emissions), followed by the energy generation sector (14%) and industrial energy consumption (11%). The industrial processes and product use (IPPU) sector caused 10%, the AFOLU sector 2% and the waste sector 10% of the 2012 GHG emissions.

For 2016 a total GHG emission reduction of 1,833 Mt CO_2e is planned, based on the implementation of all actions defined in the Strategic Plan 2012 and 2016. The most important emission reduction actions in the energy sector are linked to the transport sector. They are all related to the development of public transport services such as new BRT lines, a new rail subway and new rail cars for existing subways. Other actions in the energy sector cover the installation of LEDS for traffic lights, a housing program, and the replacement of parts of the gas distribution network. For 2016 a total GHG emission reduction of 543 Mt CO_2e in the energy sector is estimated.

In the AFOLU sector two reforestation projects have been started: The Rio Capital Verde program with reforestation activities in a originally forested area of the city and the reforestation of existing squares and parks in the city, both will be finalised in 2016. Estimated GHG emission reductions through carbon absorption in 2012 are 36.6 Mt CO2e and those estimated for 2016 with full implementation will be 49.7 Mt CO2e.

Estimated GHG emission reductions - Strategic Plan Actions 2012 and 2016 [1, 2]					
		2012[1)]	2016	2020	2025
Energy	**Strategic Plan Actions (Mt CO2e) - difference to Scenario A**				
	Reduced emissions from stationary energy sources	**0.69**	**0.74**	**0.74**	**0.74**
	Installation of LEDs for traffic lights (32,000 units)	0.64	0.64	0.64	0.64
	Minha Casa Minha Vida Housing program: solar thermal heaters (1,000 units)	0.05	0.01	0.01	0.01
	Reduced energy fugitive emissions	**5.7**	**17**	**11.4**	**11.4**
	Replacement of old gas distribution network (CEG)	5.7	17	11.4	11.4
	Reduced emissions from Transport – stationary sources	**79.6**	**525**	**529.7**	**530.4**
	Five new BRT bus lines	7.7	211,1	215.8	216.5
	One BRS bus line	17.6	17.6	17.6	17.6
	New Jardim Oceanico rail subway	0.0	85.5	85.5	85.5
	New rail cars for subways (+550,000 passengers/day)	51.1	204.4	204.4	204.4
	Expansion of the bicycle lanes network (300km)	3.2	204.4	204.4	204.4
	Total emission reductions in energy sector	**86**	**543**	**542**	**543**
AFOLU	**Strategic Plan Actions(Gg CO2e) – difference to Scenario A**				
	Rio Capital Verde Reforestation project	33.5	39.9	-	-
	Reforestation of parks and squares	2.8	9.8	-	-
	Total removals (carbon sequestration)	**36.3**	**49.7**	**-**	**-**
Waste	**Strategic Plan Actions(Gg CO2e) – difference to Scenario A**				
	Carbon removals by capturing and burning landfill gas (2 landfills)	255.7	1,240		
	Total for two landfills	**255.7**	**1,240**		
Total for all sectors	**Total for Energy, AFOLU and Waste**				
		378	**1,833**		

[1] Estimated values based on implemented projects

In the waste sector carbon reductions are based on capturing and burning landfill gas from two landfills with a reduction of 243.8 Mt CO_2e in 2012 (instead of 824.2 Mt CO_2e planned). Originally it was planned that purified landfill gas would be used as fuel for a refinery of Petrobras, but the project was not realised. For 2016 planned GHG emission reductions in in the waste sector will amount for 1,240 Mt CO_2e.

Lessons learned

A GHG inventory is a tool to consistenty identify, calculate and report GHG emissions on community-scale. In performing a GHG inventory, the implementation of GHG emission reduction actions can be reported in a proper manner with possible access to local and international climate financing. Due to the large increase of GHG emissions in Rio de Janeiro City between 2005 and 2012 and the delay of some planned emission reduction actions the original reduction goals as defined in the Municipal Climate Change and Sustainable Development Law were not achieved.

With the GPC inventory, the city has now a robust and transparent framework for a consistent identification and calculation of GHG emissions which can be tracked over time and allows for the calculation GHG emission reductions in different scenarios. Meanwhile the city is updating their GHG reduction actions and looking for new actions and projects. In the energy sector additional actions to be evaluated include energy efficiency, electricity generation by renewables, the application of smart grids, but also a new waterway transit project. For the AFOLU sector additional reforestation projects are already under evaluation (e.g. Pedre Branca State Park). In the waste

sector new actions such as increased recycling, and adoption of new technologies, such as organic composting plants, thermal plants for electricity generation and use of recovered methane, will be considered and evaluated.

References

[1] Rio de Janeiro (2011): Plano Estratégico da Prefeitura do Rio de Janeiro 2009-2011: Pós – 2016 = Rio mais Integrado e Competivo. Prefeitura da Cidade do Rio de Janeiro.http://www.rio.rj.gov.br/dlstatic/10112/2116763/243779/planejamento_estrategico_site.pdf

[2] Rio Prefeitura (2013: Strategic Plan Rio de Janeiro Municipal Government 2013 – 2016 http://www.conselhodacidade.com/v3/Book_StrategicPlanRio20132016/content/Strategic_Plan_Rio_City_Government_2013_2016.pdf

[3] World Bank (2013): The Rio de Janeiro Low Carbon City Development Program. Program Document. World Bank Institute, Washington, USA, 2013 https://einstitute.worldbank.org/ei/sites/default/files/Upload_Files/RiodeJaneiroLowCarbonCityDevelopmentProgram_PD.pdf

[4] Centro Clima, COPPE 50 and RIO Prefeitura (2013): Greenhouse Gas Emissions Inventory of the City of Rio de Janeiro in 2012 and Updating of the municipal Plan of Action for Emissions Reduction. Technical Summary. Rio Prefeitura, December 2013. http://www.rio.rj.gov.br/dlstatic/10112/1712030/4114527/CRJ_InventarioGEE2012_resumo_tecnicoINGLESFINAL1.pdf

[5] World Resources Institute, C40 Cities and ICLEI (2014): Greenhouse Gas Protocol, Global Protocol for community-scale Greenhouse Gas Emission Inventories. An Accounting and Reporting Standard for Cities. WRI, USA, 2014. http://ghgprotocol.org/files/ghgp/GHGP_GPC.pdf

[6] World Bank: Data http://databank.worldbank.org/data/reports.aspx?source=2&country=BRA&series=&period=

[7] Wikipedia, Rio de Janeiro: http://en.wikipedia.org/wiki/Rio_de_Janeiro

[8] Newgeography (2015): http://www.newgeography.com/content/003438-the-evolving-urban-form-rio-de-janeiro

[9] Greenhouse Gas Protocol (2012): http://www.ghgprotocol.org/City-Accounting-Case-Study-Rio,-Brazil

[10] World Bank: GDP per capita, PPP: http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD

[11] 2014 Global Metro Monitor Map, Brookings Institution, Rio de Janeiro: http://www.brookings.edu/research/reports2/2015/01/22-global-metro-monitor

(accessed in June 2015)

Author/ Contact

© JOANNEUM RESEARCH – LIFE: Centre for Climate, Energy & Society

Leonhardstraße 59
8010 Graz, AUSTRIA
Tel. +43 316 876 6700
life@joanneum.at

http://www.joanneum.at/en/life/