CDP, C40 and AECOM are proud to present results from our third consecutive year of climate change reporting for cities. It was an impressive year, with 110 cities reporting on their climate change data (a 50% increase from 2012), making this the largest and most comprehensive survey of cities and climate change published to date by CDP. City governments from Dallas to Hanoi to Ouagadougou participated, including over 80% of the membership of the C40 – a group of the world’s largest cities dedicated to climate change leadership.

Approximately two thirds of reporting cities measure city-wide emissions. Together, these cities account for just over 1 billion tonnes of greenhouse gas emissions, putting them on par with Japan, the world’s third largest economy and fourth largest emitter of greenhouse gas emissions. Over 70% of all reporting cities now have a plan for adapting to the effects of climate change. And cities reported over 1,000 individual actions designed to reduce emissions and adapt to a changing climate.

CDP salutes the hard work and dedication of the world’s city governments in measuring and reporting these important pieces of data. With this report, we provide city governments the information and insights that we hope will assist their work in tackling climate change.

The data presented here conveys information about every aspect of climate change measurement and management in Rio de Janeiro.

This document contains the questionnaire data provided to CDP from the city of Rio de Janeiro as part of its 2013 CDP submission.

To see all of the results for all participating cities, visit cdpcities2013.net
Rio in context

Number of cities responding per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>48</td>
</tr>
<tr>
<td>2012</td>
<td>73</td>
</tr>
<tr>
<td>2013</td>
<td>110</td>
</tr>
</tbody>
</table>

Rio de Janeiro participation: ✓ ✓ ✓
Total population of cities responding in 2013

296,471,000

Where Rio de Janeiro fits

27 cities with less than 600,000 people
33 cities with 600,000 to 1,600,000 people
50 cities with greater than 1,600,000 people

Rio de Janeiro

6,323,037 people
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year reported</td>
<td>2013</td>
</tr>
<tr>
<td>Area</td>
<td>1,244 km²</td>
</tr>
<tr>
<td>Population</td>
<td>6,323,037</td>
</tr>
</tbody>
</table>

### Rio in focus

**Inventory method**

2006 IPCC Guidelines for National Greenhouse Gas Inventories
69 cities reporting emissions in 2013

- 63,640,300 metric tonnes CO₂e
- 49,750,736 metric tonnes CO₂e
- 44,284,675 metric tonnes CO₂e
- 10 cities reporting emissions of greater than 30,000,000 metric tonnes CO₂e
- 29,460,000 metric tonnes CO₂e
- 6 cities reporting emissions of 20,000,000 to 30,000,000 metric tonnes CO₂e
- 19,780,964 metric tonnes CO₂e
- 17 cities reporting emissions of 10,000,000 to 20,000,000 metric tonnes CO₂e
- Rio de Janeiro: 11,351,700 metric tonnes CO₂e
- 4,762,364 metric tonnes CO₂e
- 36 cities reporting emissions of less than 10,000,000 metric tonnes CO₂e
Introduction

The urban site of Rio de Janeiro has two main areas: the lowlands and the mountainous massifs defining the division of the macro-basins of the city. The Macro-basin of Guanabara Bay has a very rugged coastline and more dense and ancient occupation, with many landfills. Numerous islands and beaches are important in this stretch.

The forests of Rio harbor a rich fauna and the remnants of the Atlantic Forest. Stretches of the coastline and lagoons shelter the mangrove swamps.
Rio is blessed with lush landscaping, making a scene of great beauty by the contrast of its mountains, sea and urban landscape.

The climate is tropical, hot and humid, with local variations due to differences in altitude, vegetation and proximity to the ocean. The typical intense rainfalls concentrated in the summer, and the diversity of relief, promote the spread of water down the slopes and their concentration in low areas.

Rio de Janeiro is the city with the second highest GDP in Brazil. The service sector accounts for the largest share of GDP (65.52%), followed by tax revenue (23.38%) and industrial activity (11.06%).
Rio de Janeiro established itself at first around the Tijuca Massif, and the urban growth was at the expense of intense changes in the natural landscape.

The absence of rational land policies, land use and transport, associated with an economic model with emphasis on the tertiary sector, and worsened by economic recession resulting from the national situation; the loss of the headquarters of the Federal Government and the fusion of Guanabara State with the State of Rio de Janeiro; accentuated the illegal occupation of territory by slums and a decrease in investments in urban infrastructure.
The economic recovery process now encourages investment in City conservation, through structuring projects in urban infrastructure by rationalizing and integrating the physical and fair public transport, and cycling network expansion, in urban sanitation, in waste policy and the increase of green areas.

The City administration is divided in five planning areas, which are subdivided into 34 administrative regions. The City Hall comprises the following agencies of Direct Administration: the Mayor Office, 26 Municipal Secretariats, General Attorney and General Controller. Municipal Administration also comprises: 3 autarchies, 10 Public Companies and 6 Foundations.
In the current municipal administration which began in 2009 (and whose mayor was reelected in 2013) climate change measures are coordinated by the Municipal Environment Secretariat (SMAC) through its Climate Change Office (GMC), involving co-ordination among different areas of municipal administration, partnerships with academic institutions through shared actions and innovative activities in several sectors, such as: solid waste management, transport, urban planning, energy and civil defense sectors, among others. The goal is to achieve sustainability, the mitigation of GHG emissions and the adaptation to climate change impacts.
The main piece of the Regulatory Framework is the Law n. 5.248/2011, that establishes the Climate Policy of the City and sets measurable, reportable and verifiable reduction targets of GHG emissions for 2012 (8%), 2016 (16%) and 2020 (20%), based on emissions recorded in Greenhouse Gas Inventory of Rio de Janeiro City, published in 2011. The Law also establishes City adaptation policy to face the climate change effects.

Rio de Janeiro provides incentives for management of climate change issues, including the attainment of greenhouse gas (GHG) reduction targets.

We maintain permanent contacts and joints to obtain better results for mitigation and adaptation processes of the city. As Rio de Janeiro is the state’s capital, measures and mitigation projects have a strong impact on state level and vice versa (eg: wastewater treatment, water supply, among others).
Risks & Adaptation

Current and/or anticipated effects of climate change present significant physical risks to Rio de Janeiro:

**Seriousness**
- Low 🙄alore
- Medium 🙄alore
- High 🙄alore

**Timescale**
- Current
- Short-term
- Medium-term
- Long-term

**Hotter summers**

Risk: 🙄alore  Timescale: 🙄alore

Epidemics of dengue occurred in Rio from the 1980s, with huge impacts to the population and loss of lives. These epidemics are closely related to the hot, humid summers, which facilitate the proliferation of its vector, the mosquito Aedes aegypti. Extending the temperature and humidity of summer to the autumn period, the period favorable for dengue will also worsen the risks to public health.
More frequent heatwaves

Risk: ⭕⭕⭕ Timescale: ⭕⭕⭕

It should increase the incidence of respiratory disorders resulting from heatwaves, pushing the demand on health services.

Increased urban heat island effect

Risk: ⭕⭕⭕ Timescale: ⭕⭕⭕

The city heat islands (Bangu, Realengo and nearby, Penha, Copacabana and Center) tend to widen.

More intense rainfall

Risk: ⭕⭕⭕ Timescale: ⭕⭕⭕

Systematic occurrence of storms, linked to local topography and occupation, dates back to the early history of the City and represents the most serious risk factor for the population, due to the landslides and flooding episodes. The tragic history of life and properties losses and the severe social and public health consequences contributed to the creation of the Operation Center COR – Centro de Operações Rio by the Municipality, in order to monitor and optimize the city functions.

Change in seasonality of rainfall

Risk: ⭕⭕⭕ Timescale: ⭕⭕⭕

The projections are not conclusive. The rains should be more intense and poorly distributed. In dry periods, it should increase the risk of wildfires. High intensities of rainfall after long dry periods (resulting in low permeability of the soil), should lead to increased run-off and inefficiency of groundwater recharge, contributing to the failure of water supply and sanitation systems.
Sea level rise
Risk: ⬤ ⬤ ⬤  Timescale: ❋

The Brazilian coast already presents a 4mm/year increase in sea level. The salinity deposits of ground water should lead to the loss of quality for consumption and the reduction of agriculture in coastal areas, causing health problems and food insecurity. The damage to sanitation infrastructure should increase the environmental contamination risk.

More frequent rainfall
Risk: ⬤ ⬤ ⬤  Timescale: ❋

Less intense but long term rains should worsen the degradation of urban forests, which should generate slumps along the road blocks, creeps into colluvial deposits along the axes of the valleys and slides in shallow soils. These landslides should involve risks of life, public health (stress the risks of epidemics of leptospirosis and dengue), and social risks, putting in collapse the city transit system.

Increased average annual rainfall
Risk: ⬤ ⬤ ⬤  Timescale: ❋

The increased contributions of undesirable rainwater from sanitary facilities and a greater infiltration of groundwater into the sewage system due to the higher water table should involve impairment of hydraulic and sanitary operation of all elements of the supply water and sanitation system.
Increased risk of storms surges

There is a tendency of increased episodes of heavy rains in Brazilian Southern and Southeastern regions, with intensification of storms and hurricanes in the ocean close to the coast, and an increase in rainfall on the slopes facing the ocean. On the coast of Rio de Janeiro, there were strong tidal waves in the past decade. These events can lead to impairment of coastal infrastructure - protection works and urbanization. Storms and floods should generate social risks, overload in public health system, and post-traumatic stress in the population affected by loss of property and lives.

More hot days

It is estimated an increase in annual water consumption by 20%, pushing the water demand on the supply and sanitation public system. For the 2nd half of the century, a general increase in temperature, hotter nights, heat waves and extreme rainfall events are expected.

Warmer water temperatures

It was registered over the last century in Brazil the increase of 0.75°C in water average temperature. The continued phenomenon associated with the increased availability of CO2 for photosynthesis, could lead to more recurrent episodes of uncontrolled proliferation of algae in the lagoon systems.
Compounding factors may worsen the physical effects of climate change in Rio de Janeiro.

The main factors focus on hillsides and wetland habitats, in the sectors of waste, sanitation and the high cost of implementing urban mobility, exacerbated by the low level of environmental education of the population of the city and neighboring municipalities.

Rio considers that the physical impacts of climate change could threaten the ability of businesses to operate successfully.

The risk of loss of lives and material losses directly affect the employment and income generation, transport and public health. Risks of landslides, floods and outbreaks devalue the affected areas, damage to urban mobility, endangering property and investments.
Municipality staff has a deep commitment to the City, its history and its future. The research processes are based on thematic working groups that work in producing diagnostics and finding solutions to identified problems. The collaboration with the Academy and research centers is permanent. These activities generate subsidies to the knowledge of the physical risks that affect Rio de Janeiro City. The largest grant now available is Rio Operation Centre (COR), which includes about 30 agencies (municipal, state, and utilities) in monitoring and optimizing the city functions on a daily basis.

* This graphic was taken from the CDP CITIES 2013: Summary report on 110 global cities

Cities use a variety of methodologies to evaluate physical risks from climate change. Many of these methodologies are based on or heavily influenced by the IPCC’s risk assessment guidance, including ADAPT and UKCIP.
The meteorological data required for weather events anticipation are received by weather radar with a range of 250 km located in Sumaré, and processed by the system forecast Weather High Resolution (PMAR), developed by IBM.

The Climate Vulnerability Map - Vulnerabilidades das Megacidades Brasileiras às Mudanças Climáticas: Região Metropolitana do Rio de Janeiro (SMAC / INPE, 2011), which addresses the impacts on the physical environment, the vulnerabilities of natural systems and socio-economic vulnerabilities of the River, is a key to a perspective view of the risks that hang over the city.
The interpretation of the contents of the Inventory-Inventário e Cenário dos Gases do Efeito Estufa da Cidade do Rio de Janeiro (COPPE / SMAC, 2011), associated with information and training opportunities and qualification arising from institutional linkages established with the Academy, Research Centres, Institutions public and private, allow to debug the technical findings. Several other sources can be consulted, such as:

• Seminary Rio: Próximos 100 Anos Anals (IPP/SMAC, 2007): articles from the scientific community in the following areas: physical vulnerabilities of the coast; liable city Areas to flooding by rising sea levels; extreme weather events and Microclimate; ecosystem of the Atlantic forest on the hillsides; mangroves and lagoon systems; Infrastructure urban drainage; water supply and sanitation systems; public health and social risk.

• Plano Municipal de Saneamento do Rio de Janeiro (PCRJ, 2011)

• Plano Diretor da Cidade do Rio de Janeiro - Lei Complementar n.º 111 / 2011.

• Plano Estratégico da Prefeitura do Rio de Janeiro 2009-2016 (PCRJ, 2009)
Rio de Janeiro has a plan for increasing its resilience to the expected physical effects of climate change.

Actions Rio is taking to reduce the risk to infrastructure, citizens, and businesses from climate changes include the following:

More frequent rainfall

**Action: Other: The Climate Vulnerability Map**

The Climate Vulnerability Map - Vulnerabilidades das Megacidades Brasileiras às Mudanças Climáticas: Região Metropolitana do Rio de Janeiro (SMAC / INPE, 2011), which addresses the impacts on the physical environment, the vulnerabilities of natural systems and socio-economic vulnerabilities of the River, is a key to a perspective view of the risks that hang over the city.
Increased frequency of large storms

**Action:** Crisis management including warning and evacuation systems

The Emergency Action Plan of Civil Defence aims to combat floods and is connected to the activities of the Rio Operations Center that are designed to neutralize and counter the impacts of climate change in the city of Rio de Janeiro.

More intense rainfall

**Action:** Tree planting and/or creation of green space

The Program of Reforestation Effort aims to help stabilize the slopes of hillsides.
Rio has undertaken or will undertake additional efforts to ensure operational continuity for both the city government and the businesses in the event of a significant weather-related event.

The Climate Vulnerability Map will be updated and the Emergency Action Plan of Civil Defence is quite broad reaching not only environmental issues but also socio economic.
Rio de Janeiro faces social risks as a result of climate change.

**Population displacement**

Irregular occupation (occupation of hillsides and wetlands): population migrations by due to unfavorable conjunctures at their places of origin, the low level of environmental education of the population, inadequate water distribution systems and sanitation.

### Top five social risks

By region, # of cities

*This graphic was taken from the CDP CITIES 2013: Summary report on 110 global cities*

<table>
<thead>
<tr>
<th>Cities reporting social risks from...</th>
<th>Increased risk to already vulnerable populations</th>
<th>Increased incidence and prevalence of disease</th>
<th>Increased demand for public services (including health)</th>
<th>Increased resource demand</th>
<th>Fluctuating socio-economic conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td><img src="#" alt="2" /></td>
<td><img src="#" alt="4" /></td>
<td><img src="#" alt="1" /></td>
<td><img src="#" alt="1" /></td>
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<td><img src="#" alt="6" /></td>
<td><img src="#" alt="4" /></td>
<td><img src="#" alt="4" /></td>
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</tr>
<tr>
<td>Europe</td>
<td><img src="#" alt="12" /></td>
<td><img src="#" alt="6" /></td>
<td><img src="#" alt="8" /></td>
<td><img src="#" alt="5" /></td>
<td><img src="#" alt="3" /></td>
</tr>
<tr>
<td>Latin America</td>
<td><img src="#" alt="15" /></td>
<td><img src="#" alt="10" /></td>
<td><img src="#" alt="6" /></td>
<td><img src="#" alt="6" /></td>
<td><img src="#" alt="5" /></td>
</tr>
<tr>
<td>North America</td>
<td><img src="#" alt="15" /></td>
<td><img src="#" alt="10" /></td>
<td><img src="#" alt="11" /></td>
<td><img src="#" alt="8" /></td>
<td><img src="#" alt="4" /></td>
</tr>
<tr>
<td>South Asia / Oceania</td>
<td><img src="#" alt="3" /></td>
<td><img src="#" alt="2" /></td>
<td><img src="#" alt="4" /></td>
<td><img src="#" alt="2" /></td>
<td><img src="#" alt="0" /></td>
</tr>
</tbody>
</table>
Opportunities

Climate change action presents economic opportunities for Rio de Janeiro.
Rio de Janeiro is positioning itself to take advantage of opportunities from taking climate change action.

**Increased energy security**

RIOLUZ and Eletrobras have signed a financing agreement for RELUZ Program, in order to promote the development of efficient systems of street lighting. The City Hall will replace 32,480 luminaires, with reduced consumption of 33,243.32 MWh.

**Carbon finance income**

City Hall and the State Government have created the Green Stock Market, that will sell carbon credits from reforestation actions.

**Green Jobs**

The City Hall has launched the Selective Collection Expanded Program, with support from BNDES (2011); six sorting center will be built to receive the material divided by the population and collected by COMLURB. The collectors will separate the different types of recyclables and marketing sell the products; SMAC supports the Reforestation Program Effort in partnership with poor communities, in which are recruited 700 workers.

---

**Cities that report climate change presents an economic opportunity**

# and % of cities

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 cities</td>
<td>4 cities</td>
<td>98 cities</td>
<td>6 cities</td>
</tr>
<tr>
<td>(4%)</td>
<td>(91%)</td>
<td>(8%)</td>
<td></td>
</tr>
</tbody>
</table>
Rio is reporting a GHG measurement inventory for a period of one year.

**Sat 01 Jan 2005 – Sat 31 Dec 2005**

Boundary typology used for Rio’s GHG emissions inventory:

**Geopolitical Boundary**
Defined as physical areas over which local government has jurisdictional control.

Rio de Janeiro has used the 2006 IPCC Guidelines for National Greenhouse Gas Inventories to calculate GHG emissions.
Rio has used the following methods of calculation and processes for data collection:

The methodology was developed by the Climate / COPPE / UFRJ, from the 2006 IPCC Guidelines for National Greenhouse Gas, with the adjustments already made in the Inventory of Anthropogenic Emissions and Removals of Greenhouse Gas Emissions not Controlled by Montreal Protocol - Initial Communication of Brazil (MCT, 2004), and upgraded to the standard division in scopes as in GHG Protocol. The main methodological issue considered is the delimitation of the inventory scope, by restricting those sources whose emissions result only from socio-economic activities that are the responsibility of the Municipality of Rio de Janeiro. The inventory, so called Emissions Inventory Greenhouse Gas of Rio de Janeiro City and not, “in Rio de Janeiro City,” does not incorporate the emissions occurring in the geographical boundaries of the municipality, but those occurring under their responsibility.

Total (Scope 1 + 2) emissions for Rio

11,351,700 metric tonnes CO$_2$e

Breakdown of Rio’s GHG emissions by scope:

Scopes are a common categorization method. Scope 1: All direct GHG emissions (with the exception of direct CO$_2$ emissions from biogenic sources). Scope 2: Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

Total Scope 1 activity

9,563,700 metric tonnes CO$_2$e

Total Scope 2 activity

482,600 metric tonnes CO$_2$e
Breakdown of these emissions by end user, economic sector, IPCC sector, GHG or any other classification system used:


<table>
<thead>
<tr>
<th>Sector</th>
<th>Metric Tonnes CO$_2$e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Transportation</td>
<td>4,391,300</td>
</tr>
<tr>
<td>Air Transportation</td>
<td>1,062,900</td>
</tr>
<tr>
<td>Waterway Transportation</td>
<td>10,600</td>
</tr>
<tr>
<td>Residential</td>
<td>795,600</td>
</tr>
<tr>
<td>Commercial</td>
<td>319,200</td>
</tr>
<tr>
<td>Public and other</td>
<td>210,900</td>
</tr>
<tr>
<td>Category</td>
<td>Emissions (metric tonnes $\text{CO}_2 e$)</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Industrial</td>
<td>1,416,400</td>
</tr>
<tr>
<td>Oil Refining</td>
<td>75,000</td>
</tr>
<tr>
<td>Fugitive Emissions</td>
<td>53,600</td>
</tr>
<tr>
<td>IPPU</td>
<td>409,800</td>
</tr>
<tr>
<td>AFOLU</td>
<td>220,500</td>
</tr>
<tr>
<td>Urban Solid Waste</td>
<td>1,580,300</td>
</tr>
<tr>
<td>Industrial waste</td>
<td>24,300</td>
</tr>
</tbody>
</table>
Railways
13,400 metric tonnes CO$_2$e

Domestic / Commercial wastewater
659,100 metric tonnes CO$_2$e

Industrial Effluents
108,800 metric tonnes CO$_2$e

Total amount of fuel consumed in Rio de Janeiro during the reporting year:

Natural gas
51,375 TJ

Gas/Diesel Oil
20,316 TJ

Distillate fuel oil nº2
657 TJ

Motor gasoline
20,376 TJ
Liquefied petroleum gas (LPG)
6,874 TJ
Jet kerosen
14,852 TJ
Anhydrous ethanol
4,711 TJ
Hydrous ethanol
1,618 TJ
Electricity, heat, steam, and cooling that has been consumed by Rio during the reporting year:

Electricity

52,237 TJ

Rio measures Scope 3 emissions.

Mobile Combustion

123,500 metric tonnes CO$_2$e

Waste

1,181,900 metric tonnes CO$_2$e
The GHG emissions data Rio de Janeiro is currently reporting has not been externally verified or audited in part or in whole.

After an exhaustive search to gather the needed data to complete this inventory, it was chosen the base year of 2005, when it has been achieved to converge all sectors of the inventory. An update was also made, where possible, of the years of 1996 and 1998, earlier in the inventory published in 2000 by SMAC, in the work also done by Centroclima / COPPE / UFRJ. Bases and local statistics may be deficient to subsidize all the information necessary to perform a Municipal inventory. Thus, this survey attempted to match and allocate the various existing data sources, where possible.
Rio de Janeiro does not have a GHG emissions reduction target in place for local government operations.

Law n. 5.248/2011 does not determine specific targets for emissions of responsibility of the Municipal Administration. The targets are established for emissions of the Rio de Janeiro City.

* This graphic was taken from the CDP CITIES 2013: Summary report on 110 global cities.
Activities undertaken to reduce Rio’s emissions in its government operations:

**Transport** > Improve the accessibility to public transit systems

**Metro expansion**

**Transport** > Improve bus transit times

**Implementation of BRT systems** (Bus Rapid Transit) Transoeste, TransCarioca, TransOlímpica - BNDES financing / consortium

**Waste** > Landfill gas capture

**Biogas capture and burning**

**Waste** > Recycling or composting collections and/or facilities

**Aerobic composting and selective collection**

**Waste** > Waste prevention policies or programs

**Selective Collection**

**Transport** > Infrastructure for non-motorized transport

**Construction of more than 305km of cycle ways around town.**

**Outdoor Lighting**

**Installing LEDs in traffic lights - protocol technical and financial cooperation with Ligh**
Transport > Improve fuel economy and reduce CO2 from motorized vehicles

**Light Vehicles Inspection and Maintenance Program**

Energy Demand in Buildings > Renewable on-Site energy generation

**Installation of solar heating water equipment in houses - Minha Casa, Minha Vida Program, CEF**

Urban Land Use > Greenspace and/or bio-diversity preservation and expansion

**Reducing deforestation in 80% of Forest land use category.**

Energy Supply > Transmission and distribution loss reduction

**Replacing the cast iron net by polyethylene tubes for distribution of natural gas (CEG)**

Emissions from municipal sustainable initiatives are being calculated so there is no data from such emissions yet. This information will be included in the update of the inventory of greenhouse gases, with the base year 2012, which will be published in 2013.
Rio de Janeiro has a GHG emissions reduction target in place for its community.

Rio’s GHG emissions reduction target in detail:

Baseline year

2005

Baseline emissions are not available

Percentage reduction target

20%

GHG sources to which the target applies

Road Transportation, Railway, Residential, Commercial, Public Sector, Fugitive emissions and other, Forest and land use, Urban Solid Waste, Wastewater.

Target date

2020
Activities currently being undertaken to reduce emissions city-wide:

Energy Demand in Buildings

**Renewable on-Site energy generation**

Anticipated emissions reduction over lifetime

100 metric tonnes CO$_2$e

Installation of solar heating water equipment in houses: Minha Casa, Minha Vida Program, CEF

Urban Land Use

**Greenspace and/or bio-diversity preservation and expansion**

Anticipated emissions reduction over lifetime

203,700 metric tonnes CO$_2$e

Reducing deforestation in 80% of Forest land use category.

Waste

**Landfill gas capture**

Anticipated emissions reduction over lifetime

1,473,000 metric tonnes CO$_2$e

Biogas capture and burning
Energy Supply

Transmission and distribution loss reduction
Anticipated emissions reduction over lifetime

11,400 metric tonnes CO₂e
Replacing the cast iron net by polyethylene tubes for distribution of natural gas (CEG)

Waste

Recycling or composting collections and/or facilities
Anticipated emissions reduction over lifetime

11,900 metric tonnes CO₂e
Aerobic composting

Waste

Recycling or composting collections and/or facilities
Anticipated emissions reduction over lifetime

58,200 metric tonnes CO₂e
Selective Collection
Transportation

**Improve the accessibility to public transit systems**

Anticipated emissions reduction over lifetime

**289,900 metric tonnes CO₂e**

Metro Expansion

**Improve the accessibility to public transit systems**

Anticipated emissions reduction over lifetime

**99,900 metric tonnes CO₂e**

Implementation of BRT systems (Bus Rapid Transit) Transoeste, TransCarioca, TransOlimpica - BNDES financing / consortium

**Improve fuel economy and reduce CO2 from motorized vehicles**

Anticipated emissions reduction over lifetime

**87,500 metric tonnes CO₂e**

Light Vehicles Inspection and Maintenance Program
Transportation

**Infrastructure for non-motorized transport**

Anticipated emissions reduction over lifetime

5,500 metric tonnes CO$_2$e

Expanding the cycle way network.

**Urban Land Use**

**Greenspace and/or bio-diversity preservation and expansion**

Anticipated emissions reduction over lifetime

18,300 metric tonnes CO$_2$e

Reforestation.

**Transport**

**Improve the accessibility to public transit systems**

Anticipated emissions reduction over lifetime

17,600 metric tonnes CO$_2$e

Implementation of BRS system (Rapid Bus Service)
Outdoor Lighting

LED / CFL / other luminaire technologies

Anticipated emissions reduction over lifetime

20 metric tonnes CO₂e

Installing LEDs in traffic lights - protocol technical and financial cooperation with Light
Anticipated lifetime emissions reductions reported by cities
By category (millions metric tonnes CO₂e)

* This graphic was taken from the CDP CITIES 2013: Summary report on 110 global cities

<table>
<thead>
<tr>
<th>Category</th>
<th>Emissions (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>4.78m</td>
</tr>
<tr>
<td>Energy demand in buildings</td>
<td>11.95m</td>
</tr>
<tr>
<td>Energy supply</td>
<td>14.68m</td>
</tr>
<tr>
<td>Waste</td>
<td>20.92m</td>
</tr>
<tr>
<td>Transport</td>
<td>24.65m</td>
</tr>
<tr>
<td>Education</td>
<td>1.43m</td>
</tr>
<tr>
<td>Food</td>
<td>1.25m</td>
</tr>
<tr>
<td>Urban land use</td>
<td>0.98m</td>
</tr>
<tr>
<td>Water</td>
<td>0.11m</td>
</tr>
<tr>
<td>Outdoor lighting</td>
<td>0.05m</td>
</tr>
<tr>
<td>Public procurement</td>
<td>0.05m</td>
</tr>
</tbody>
</table>

Note that anticipated emissions reductions are difficult to estimate. This data therefore reflects a significant bias toward emissions reduction actions that are easier to quantify.
Climate change-related projects for which Rio de Janeiro hopes to attract private sector involvement:

**Implementation of construction, goods and services Contracts; Eco-efficiency and Control Supplies measures; Education for Sustainability; Municipal Solid Waste and Transportation targets; and Adaptation Policy; as provided for in Regulations of Law number 5248/2011**

**Implementation of GHG Emissions Monitoring System**

**Expansion of selective waste collection and reforestation actions**

**Exploration of the gas generated by the Center for Waste Treatment in Seropédica**

**Decarbonization of Mega Events, as from regulations in development**

**Implementation of electrical cars rental system, installations and necessary urban furnishing, considering the Mega Events**

**Expansion of bike-sharing system already deployed**

Rio incorporates desired GHG emissions into the masterplanning for the city.

From the recovery of energy efficiency sector by SMAC, through its Office of Climate Change, is being developed a Target Plan for Energy Efficiency, through joints with Eletrobras, COPPE / UFRJ, C-40, GIZ, Rio-light, CET-Rio, the Municipal Administration and Finance.
Rio de Janeiro foresees substantive risks to its water supply in the short or long term.

Risks to Rio’s water supply as well as timescale:

**Timescale**

<table>
<thead>
<tr>
<th>Timescale</th>
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<tbody>
<tr>
<td>Current</td>
</tr>
<tr>
<td>Short-term</td>
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<tr>
<td>Medium-term</td>
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<tr>
<td>Long-term</td>
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</table>

**Limitation**

The hydrographic network of the Municipality has modest volume of water. The Guandu River, which receives water diverted from the Paraíba do Sul River, is responsible for much of the supply, supplemented by the water mains, for sources located in neighboring municipalities. The water supply is a Regional Government competence through CEDAE - State Company Water and Sewage Treatment. The conditions in implementing actions to reduce risks in water supply by the City are limited.

Actions (on the supply and demand side) that Rio de Janeiro is taking to reduce risks to its water supply:

SMAC has developed in conjunction with CEDAE a Sanitation Plan of Rio de Janeiro City (2010), which sets targets for the water supply system.