

energy, among others – should be defined. Incentives are also welcome: for example, preference given to fully occupied vehicles and tax benefits to constructions using renewable energy.

These measures success implies society's change in behavior, and is likely to unbalance the relation between individual cost and collective benefit. As a consequence, disseminating cleaner and more efficient technologies requires a mandatory public policy on minimum efficiency standards, taxation and other economic tools.

The transition to a low carbon economy is inevitable. The world undoubtedly moves towards a period of more environmental constraints. Therefore, sustainable urban planning should not lag behind the future development model.

There is also a wide range of adaptation options available; however, a broader approach to the current state of affairs is required so as to reduce vulnerability to climate change. Existing barriers, limits and costs have not been fully understood yet. However, the lack of action on adaptation will cost much more in the future. The ideal scenario would be to remodel and plan cities according to existing priorities, making them become resilient to climate change.

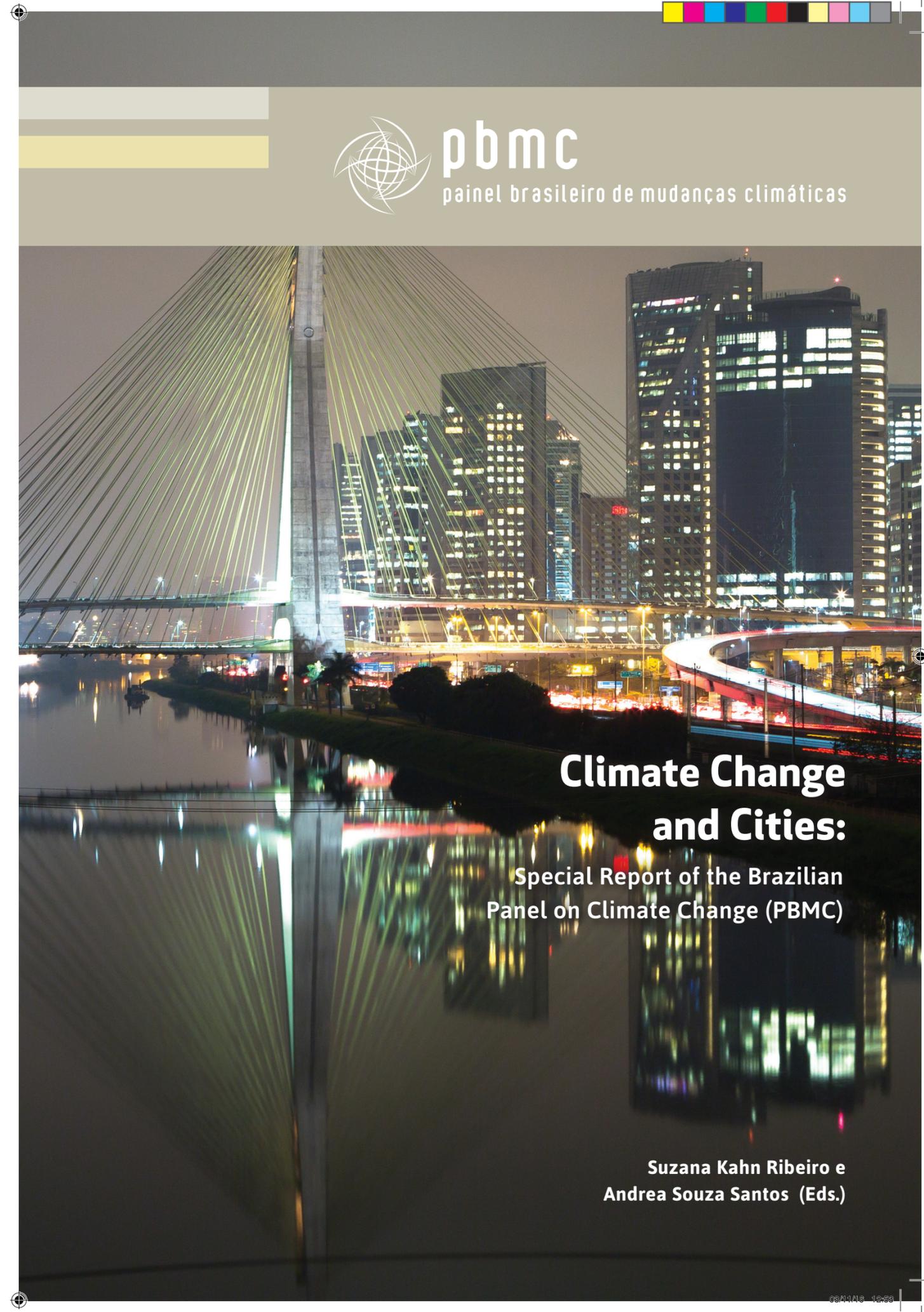
Efficient responses on mitigation and adaptation will depend on policies and measures at various levels: international, regional, national and sub-national, supporting technology development, dissemination and transfer, as well as funding to responses to climate change.

Current literature on adaptation shows successful cases of adaptation measures in cities. They range from planting trees to construction engineering, and refer to both cities' sustainable development – especially in countries under development – and investment in infrastructure adapted to resist the effects of climate change.

It is important that city planning includes knowledge of existing vulnerabilities and risks connected with extreme climate events.

PBMC Secretaria Executiva / Executive Secretariat

Prédio COPPE - Vallourec, Parque Tecnológico
Rua Paulo Emídio Barbosa, 485 1º andar - Quadra 8 lote C, Ilha do Fundão
CEP: 21941-615 - Rio de Janeiro, RJ - Brasil
Telefone: +55 (21) 3733-4121 - <http://www.pbmc.coppe.ufrj.br>



Climate Change and Cities:

**Special Report of the Brazilian
Panel on Climate Change (PBMC)**

**Suzana Kahn Ribeiro e
Andrea Souza Santos (Eds.)**

Climate Change and Cities 2016



Executive Summary Highlights

Cities' vulnerability to climate change

Climate change may stress pre-existing pressures on urban centers, and its impacts should occur at different levels, according to the specific characteristics of each region of Brazil.

The concept of vulnerability refers to social, environmental, economical and institutional conditions that determine whether a society is capable of avoiding damage or is bound to suffer the consequences.

Growing urbanization has significant impacts on climate change: air quality, water availability and quality, land use, and waste management. Provided that the right policies are put into practice, the current accelerated urbanization offers an unprecedented opportunity to create sustainable, habitable and dynamic cities.

Brazilian cities are vulnerable to climate change, and its possible impacts should occur at different levels, according to the vulnerability and specific features of each region of Brazil. Some may show changes in temperature and precipitation caused by global warming. Major vulnerabilities, risks and potential impacts of climate change in cities mainly refer to ecosystems, urban infrastructure (energy, transport, buildings, waste, water resources, sewage and urban drainage), health and coastal zones.

Climate change impacts should occur at regional level, concentrated in the poorest areas of the country. Adaptation strategies are needed to promote the resilience of affected populations.

Alternatives to mitigation and adaptation in urban areas

It is important that city planning includes knowledge of existing vulnerabilities and risks connected with extreme climate events, and stimulates a low carbon economy. Responses to adaptation and mitigation involve joint benefits, synergies and exchanges; they range from planting trees to construction engineering and technology modernization, and require a change in behavior and current consumption patterns.

Since cities are vulnerable to climate change and there are many risks related to extreme events, it is necessary to define mitigation and adaptation strategies to make cities become more resilient.

Mitigation options are available in all main city sectors. Today, the biggest potential for emissions reduction in Brazilian cities lays on the energy, transportation and waste management sectors. Major alternatives in these sectors embrace: buildings and modern eco-friendly equipment, the use of more efficient technologies like LED public lighting, promotion of waste recycling, widening waste collection and treatment, the use of waste-to-energy technology, and the search for a more sustainable transportation system – putting together not only new vehicle, fuel and infrastructure technologies, but also new practices and consumption patterns.

Policies that emphasize energy efficiency and better use of natural resources in all urban activities – for example, restrictive measures like urban toll, minimum vehicle, building and equipment efficiency, support to the use of renewable

Cities' contribution to climate change

Cities play a major role in facing climate change since they concentrate the majority of human activities. They also account for the more than half of the world's primary energy consumption, and not only exacerbate global warming but also become highly vulnerable to the impacts of climate change.

The international scientific community on climate points up that anthropogenic emissions of greenhouse gases (GHG) are extremely likely to have been the dominant cause of the rise in temperature since mid-20th century. A great deal of such emissions is produced in cities, owing mainly to energy consumption and transportation. Cities currently consume more than half of the world's primary energy, which exacerbates global warming.

More than half of the world's population (3.6 billion) lives in cities. It is expected that urban population will reach 5.6-7.1 billion by 2050. In global terms, the production of materials to support this urban growth alone will account for half of the permitted carbon emissions by mid-21st century – approximately 10 billion tons, in case the aim of maintaining the planet's average temperature raise below 2°C by 2100 (in relation to pre-industrial levels) is followed.

Cities still concentrate the majority of built assets and economic activities – factors that make these environments highly vulnerable to climate change –, in addition to a large concentration of people exposed to risks. Urban centers have already been feeling the impacts of climate change, which have been happening more frequently and intensely in the last few years. The main impacts cities experience are the rise in temperature and sea levels, heat islands, floods, water and food shortage and extreme events. Most Brazilian cities already face environmental problems related to the development and transformation of geographical areas. Global warming drastic changes in the hydrological cycle tend to increase the risks of existing hazards, such as floods, mudslides, heat waves and limitations to potable water supply.

There is expectation over cities' leadership skills and political influence towards contributing not only to the reduction of GHG emissions – as proposed by signatories of the Paris Agreement, through the Nationally Determined Contributions (NDCs) – but also to being more ambitious in the revision of such goals.