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Climate Change and Cities

Special Report of Brazilian Panel on Climate Change

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Brazilian Panel on Climate Change

Climate Policies and Impacts on Urban Infrastruture

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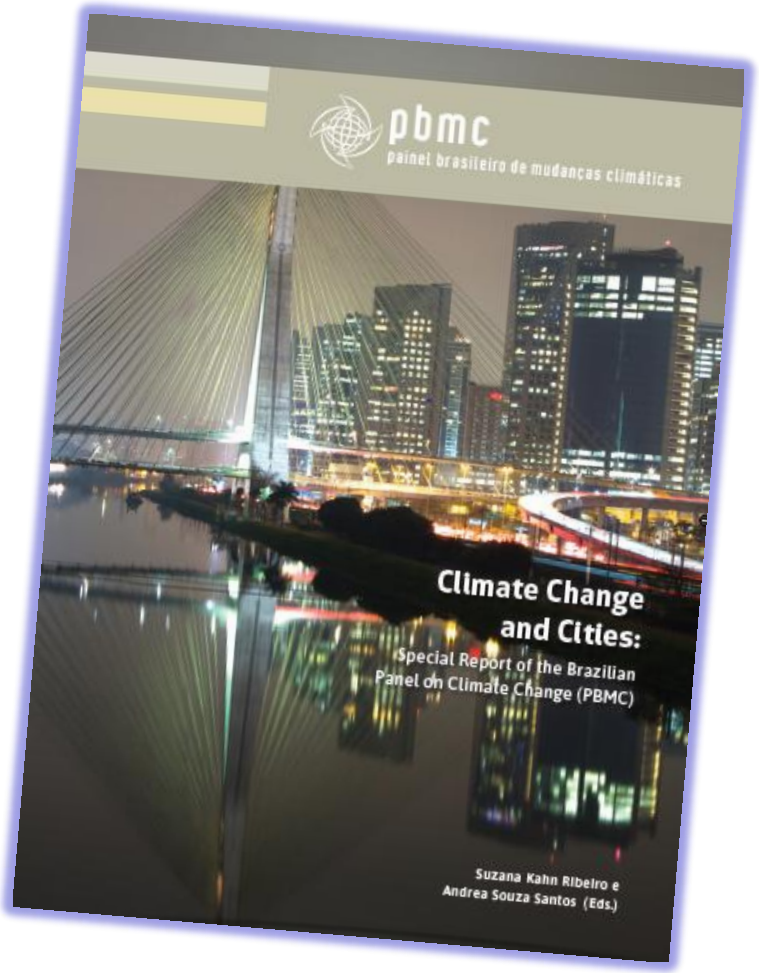

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Climate Change & Cities

- More than half of the world's population (3.6 billion) lives in cities which should face many challenges related to climate change.

- Climate Change shall put pressure on urban areas: increase of heat waves, higher frequency and intensity of extreme precipitation events such as floods and droughts, implicating on limitations to potable water supply.

- In the case of cities located in coastal zones, sea level rise and storm occurence shall create impacts to inhabitants, infrastructure and ecosystems.

Climate Change & Cities

- Urbanization is a global trend transforming societies and energy use. By 1900 the global population was 1.6 billion and only 13% of this population was living in urban areas (about 200 million). Today more than half of the world's population (3.6 billion) are living in cities. By 2050 the urban population is expected to grow to 5.6-7.1 billion, it means 64-69% of the world's population.

- Cities consume more than half of the world's primary energy with corresponding CO2 emissions.
  - 67-76% of global energy consumption
  - 71-76% of CO2 related emissions

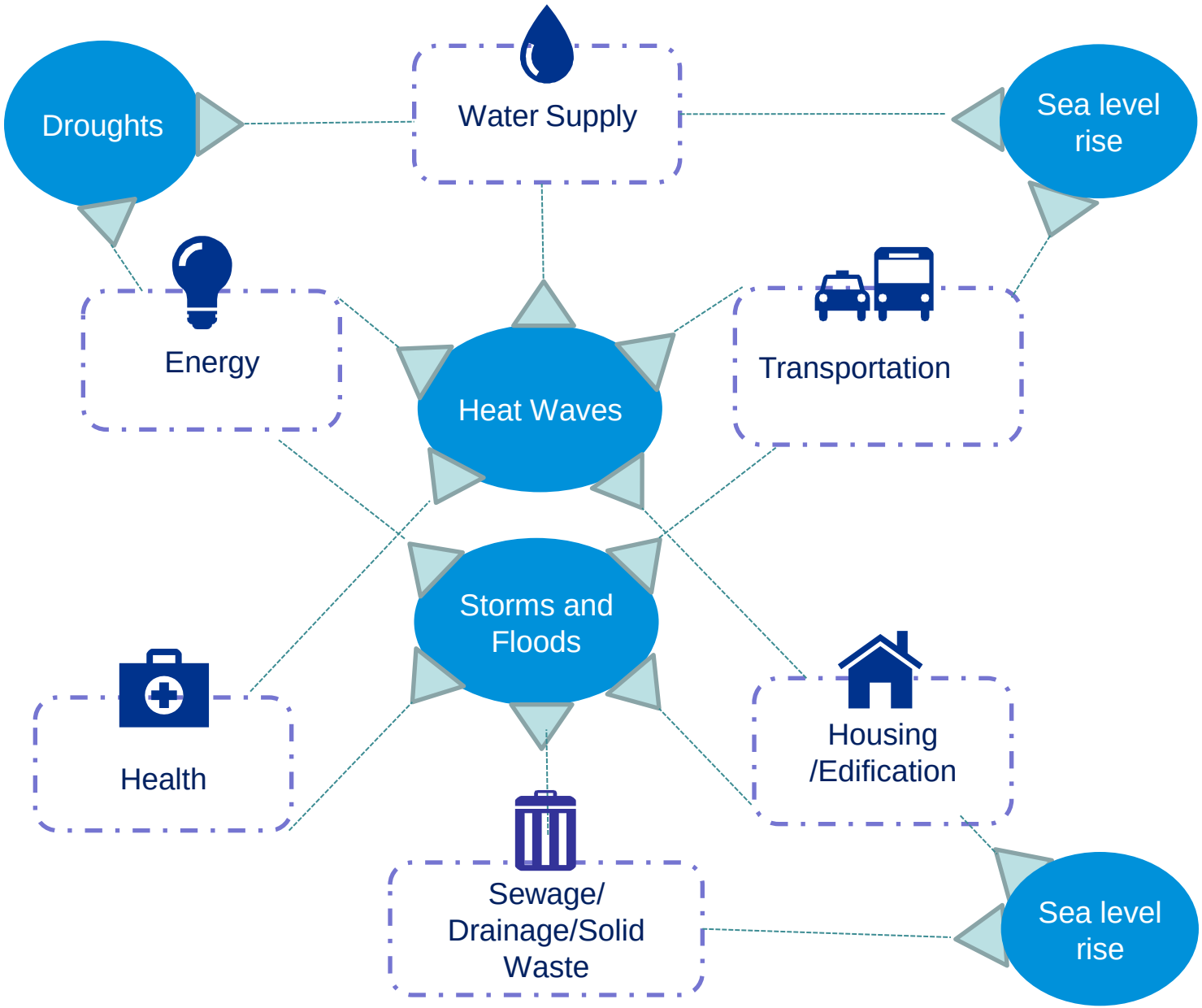
Cities Vulnerabilities to Climate Change

- Climate change may stress pre-existing pressures on urban centers.
- Temperature increases faster in cities because of global warming and heat islands due to prevalent concrete surfaces.
- Lack of ecossystems, triggered by uncontrolled urbanization reduce cities resilience towards the increase of heat islands, air pollution and floods.
- Climate change shall significantly impact several sectors in the majority of cities: local energy supply system; water demand, supply and sewage treatment; transportation; and public health with higher severity in costal areas;

Main climate change impacts related to cities
(IPCC latest report)

- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions.
- The global rise in sea level predicted for 2100 can vary between 26cm and 55cm in the best case scenario and between 52cm and 98cm in the worst scenario.
- Rainfall changes for South America varies geographically, most notably showing a reduction of –22% in northeast Brazil.
- South America: warming varies from +1.7˚ C to +6.7˚ C in South America region.

Climate Change Impacts on each sector



Current Pressures on Urban Areas in Brazil

Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development.

Main vulnerabilities in Brazil:

- High concentration of people living in risky areas that were occupied irregularly: more than 3 million residences in 6,329 subnormal agglomerates (slums) in 2010.
- The average attendance rate of sewage disposal services is 49.8% and only 40.8% of the total wastewater generated is treated (SNIS, 2014).

Current Pressures on Urban Areas in Brazil

- About 41.5% of total mass of waste collected is distributed in “dumps” and controlled landfills – inadequate destinations (SNIS,2014).
- Drainage solutions adopted at the majority of the largest cities – storm water networks and rivers canalization - transfers the flooding from upstream to downstream of the watercourse.
- Floods promote the incidence of infectious diseases such as leptospirosis, viral hepatites and diarrhea diseases.
- Diseases transmitted by vectors and bugs as *“dengue”* are already a public health problem.

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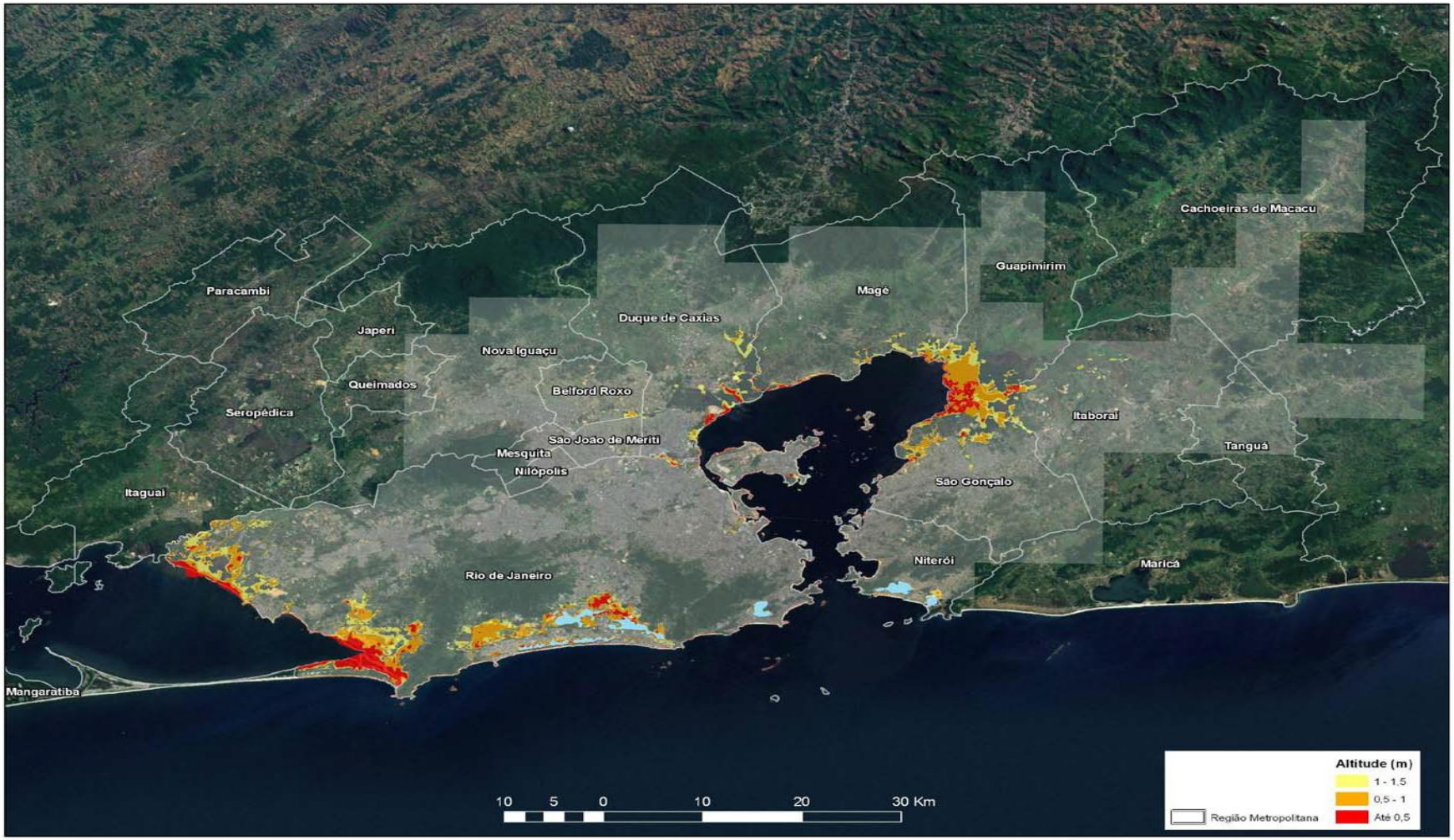
Vulnerability due to sea level rise – Rio de Janeiro



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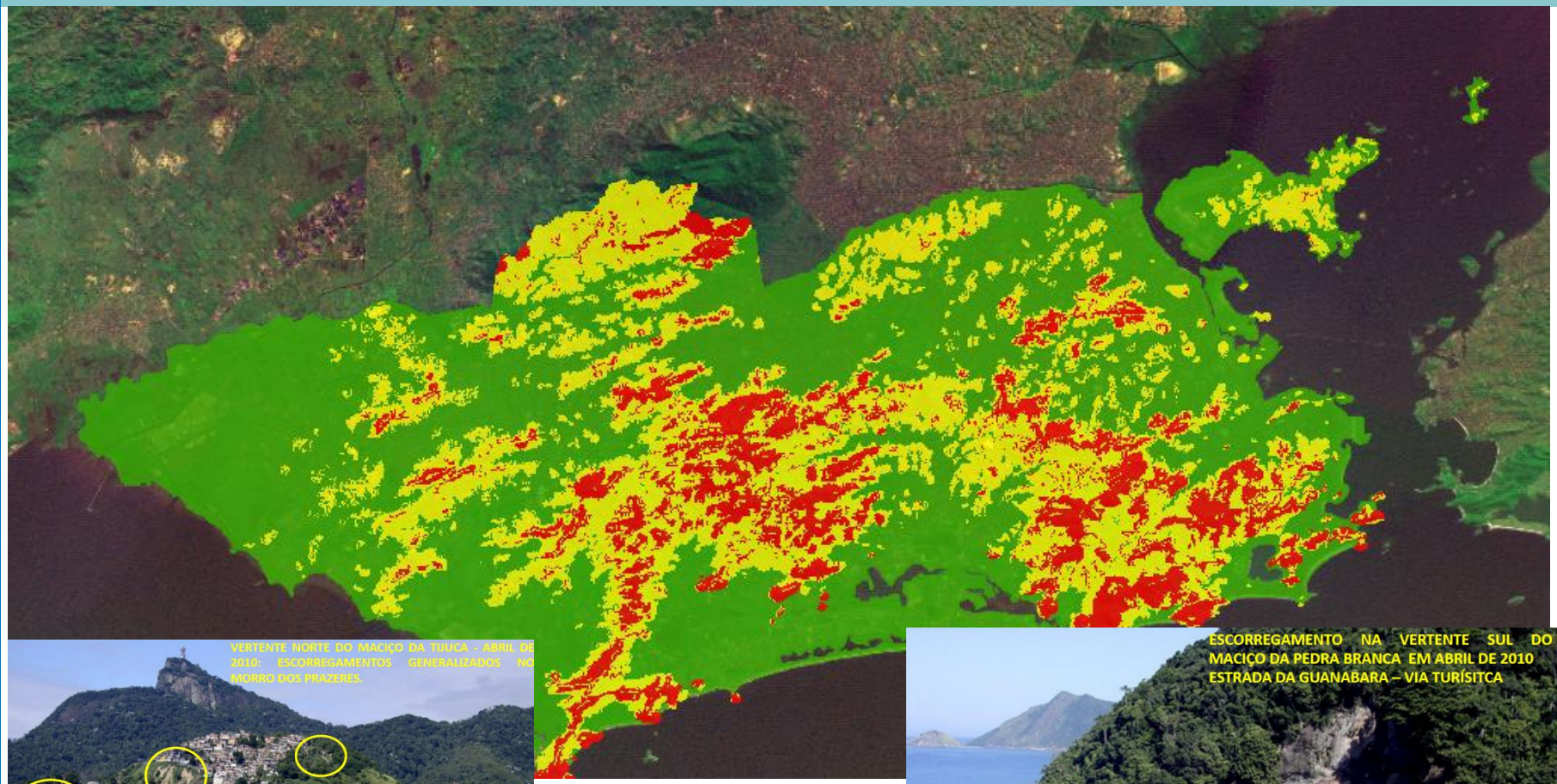
Vulnerable area to land sliding – Rio de Janeiro



Urban Infrastructure Measures – Mitigation and Adaptation

- Adaptation and mitigation are complementary strategies for reducing and managing the risks of 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.

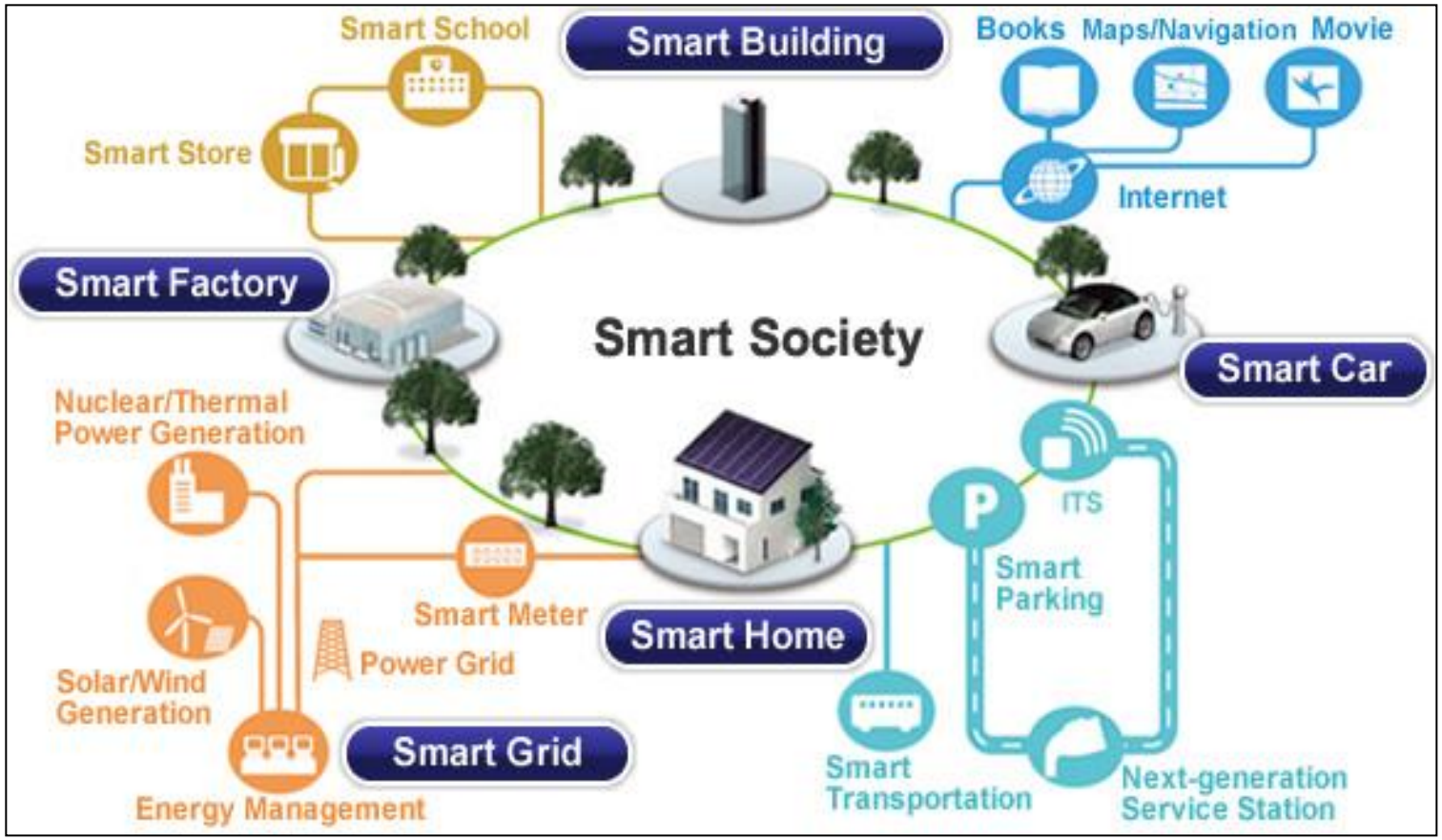
Urban Infrastructure Measures – Mitigation

Today, the biggest potential for emissions reduction in Brazilian cities lays on the energy, transportation and waste management sectors.

Mitigation actions - urban infrastructure:

- Urban Mobility / Connectivity
- Intelligent systems
- Renewable energy distributed generation
- Shared economy
- LED public lighting
- Use of waste-to-energy technology

Using Inteligency as Mitigation Strategy

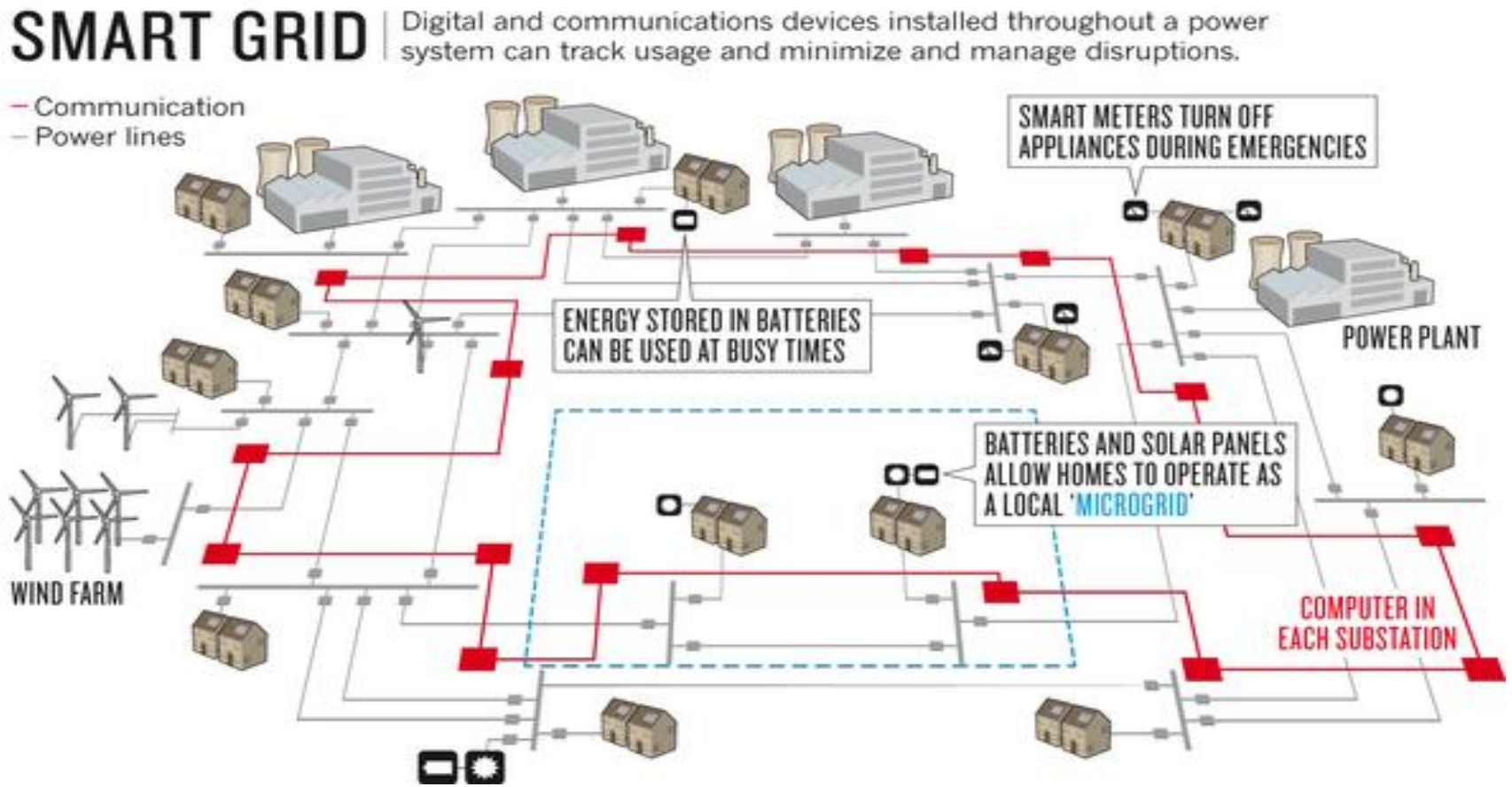


***Inteligency* - combination of:**

- Data Mining (**Technology**);
- Shared Economy (**Behaviour**)
- Data Analysis, problems identification and solution proposals (**Inovation**)

Smart Grids– Mitigation Policy

Fonte: Nature,499 145-147, 2013



The role of government addressing mitigation strategies

- Policies that emphasize energy efficiency and better use of natural resources in all urban activities should be defined: restrictive measures like urban toll, minimum vehicle, building and equipment efficiency
- Incentives are also welcome: for example, preference given to fully occupied vehicles and tax benefits to constructions using renewable energy
- Disseminating cleaner and more efficient technologies requires a mandatory public policy on minimum efficiency standards, taxation and other economic tools.

The role of society addressing mitigation strategy

- Efficiency enhancements and behavioral changes, in order to reduce energy demand compared to baseline scenarios without compromising development, are a key mitigation strategy in scenarios reaching atmospheric CO2eq concentrations of about 450 or 500 ppm by 2100

- Behavior, lifestyle and culture have a considerable influence on energy use and associated emissions, with high mitigation potential in some sectors, in particular when complementing technological and structural change

People Behavioral Dimension

Four main tools to influence and possibly change people´s environmental attitude

- Laws, Regulations and Incentives
- Education and awareness raising
- Community management of environmental resources (environmental care)
- Moral, religious or ethical principles (zero emission life style)

People Behavioral Dimension

- In general, rewards produce overall better outcomes than punishments.
- Rewards promote learning and internalization (sustainable changes)
- Punishment succeeds in compliance but is associated with avoidance

Urban Infrastructure Measures – Mitigation and Adaptation

Adaptation actions - urban infrastructure:

- Soil permeability
- Water storage systems
- Infrastructure resistant to extreme hydrological phenomena
- Contention of slopes/hillsides
- Urban geometry favorable natural to ventilation with open public spaces
- Increase in surface albedo (reflectivity)

Urban Infrastructure Measures – Mitigation and Adaptation

Adaptation actions – Energy and transportation:

- Reinforcement of power transmission and distribution infrastructure
- Installation of underground wiring in the distribution network
- Diversification of energy sources, giving preference to renewables
- Changes in projects, replacement and adjustment of structures (bridges, roads, streetlights, wiring and pavements, etc.)
- Reallocation and realignment of roads, pathways and distribution lines
- Emergency plans (E.g.: road closings during extreme events, alternative routes, fixing service teams)

Urban Infrastructure Measures – Mitigation and Adaptation

Adaptation actions – Land use, building and settlements:

•Creation of green spaces to improve drainage and reduce the effect of urban heat island.

•Protection of natural and artificial barriers. E.g: creation of dams, marshland and wetlands as a buffer to contain the sea level rise, etc.

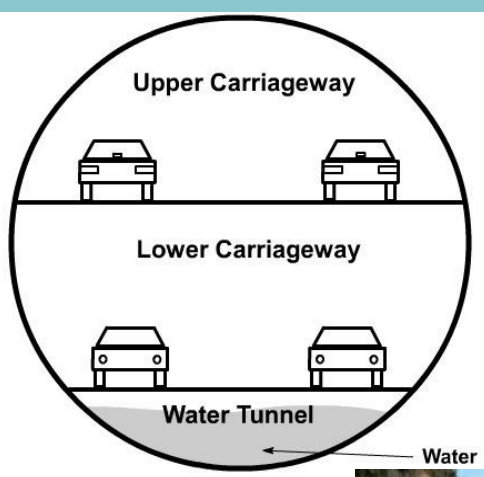
•Revision of building codes and regulations related to urban space use. E.g.: buildings elevation in areas vulnerable to flooding, use of permeable pavements, additional constructions to protect buildings, restricting the expansion of construction in coastal areas, etc.

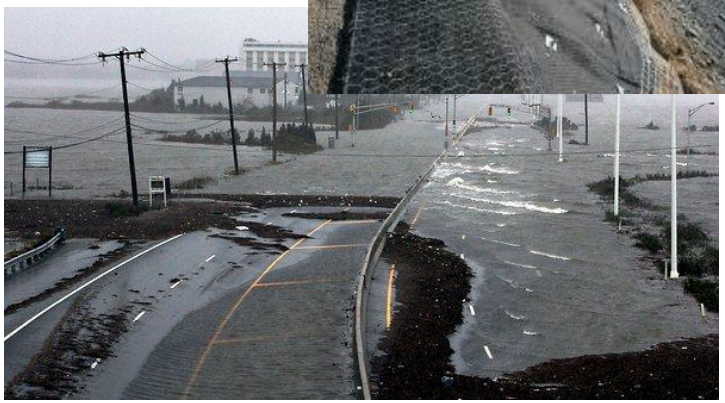
Urban Infrastructure Measures – Mitigation and Adaptation

Adaptation actions – Water resources:

- Water use efficiency: water conservation and storage techniques;
- Water reuse; desalination; rainwater collection.
- Review and amendment on surface and underground sources of water withdrawal and projects of water transfers.
- Increase facilities and capacity of storage.
- Watershed recovery.

Adaptation Policy on Urban Constructions





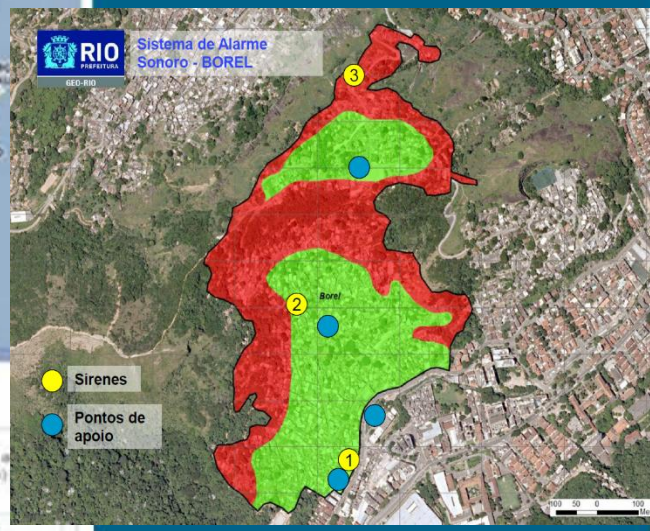
Adapting Coastal Infrastructure
to Sea Level Rise and Land Loss

Adaptation Policy – Control and Alert System

Radar em Tempo Real

As imagens de radar meteorológico são fundamentais para a detecção de tempestades. Este radar está localizado no Sumaré, suas imagens são atualizadas a cada dois minutos e permitem observar a localização, o deslocamento e a intensidade da precipitação (chuva, granizo). A refletividade captada pelo radar (legenda) pode ser relacionada à intensidade da precipitação. Quanto maior o valor em dbz, maior é a intensidade da formação, como mostra a tabela abaixo:

dbz	20	25	30	35	40	45	50
Intensidade	Muito Fraca	Fraca	Fraca a Moderada	Moderada	Moderada a Forte	Forte	Muito Forte



Final Consideration

•There is an 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 – but also to being more ambitious in the revision of such goals because climate change impacts will affect them considerably.

•Urban planning must take into account mitigation and adaptation strategies

• National action plan has to be fully compatible with all Municipal actions plan

Special Report on Climate Climate Change and Cities

- Download the full report : www.pbmc.coppe.ufrj.br