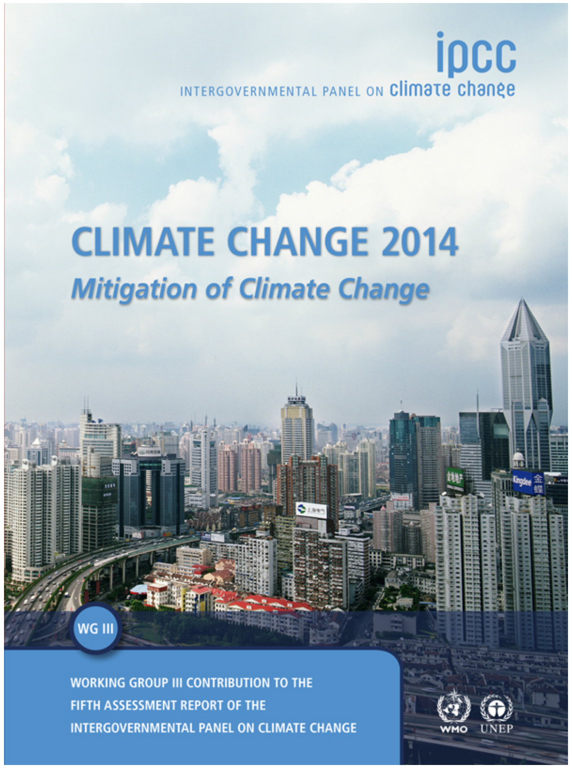
# Human Settlements and Climate Change Mitigation:
*Key findings from the latest IPCC WG3 report*

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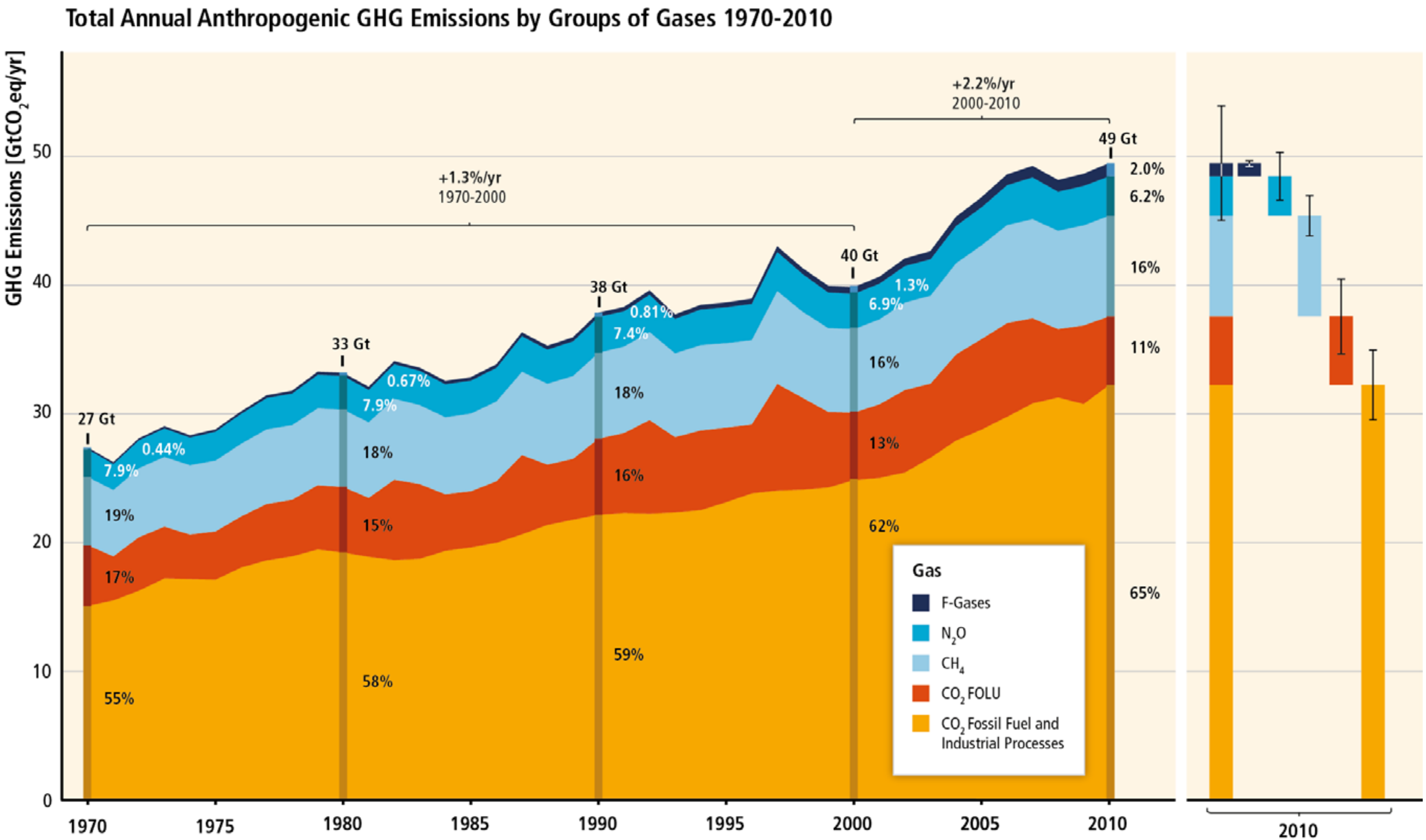
Working Group III contribution to the
IPCC Fifth Assessment Report

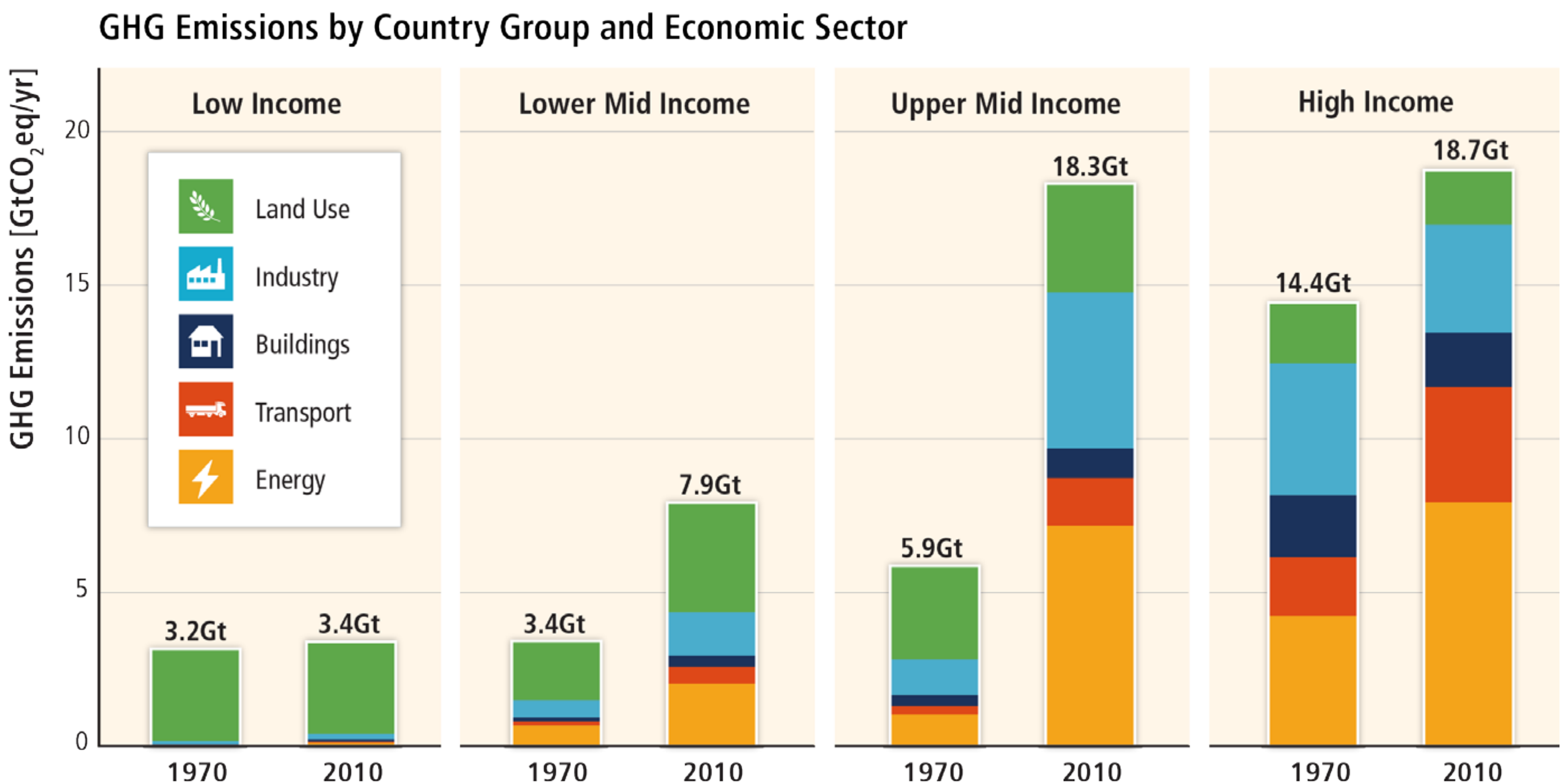
# GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.




1.3

Working Group III contribution to the
IPCC Fifth Assessment Report

# Regional patterns of GHG emissions are shifting along with changes in the world economy.




Based on Figure 1.6

Working Group III contribution to the
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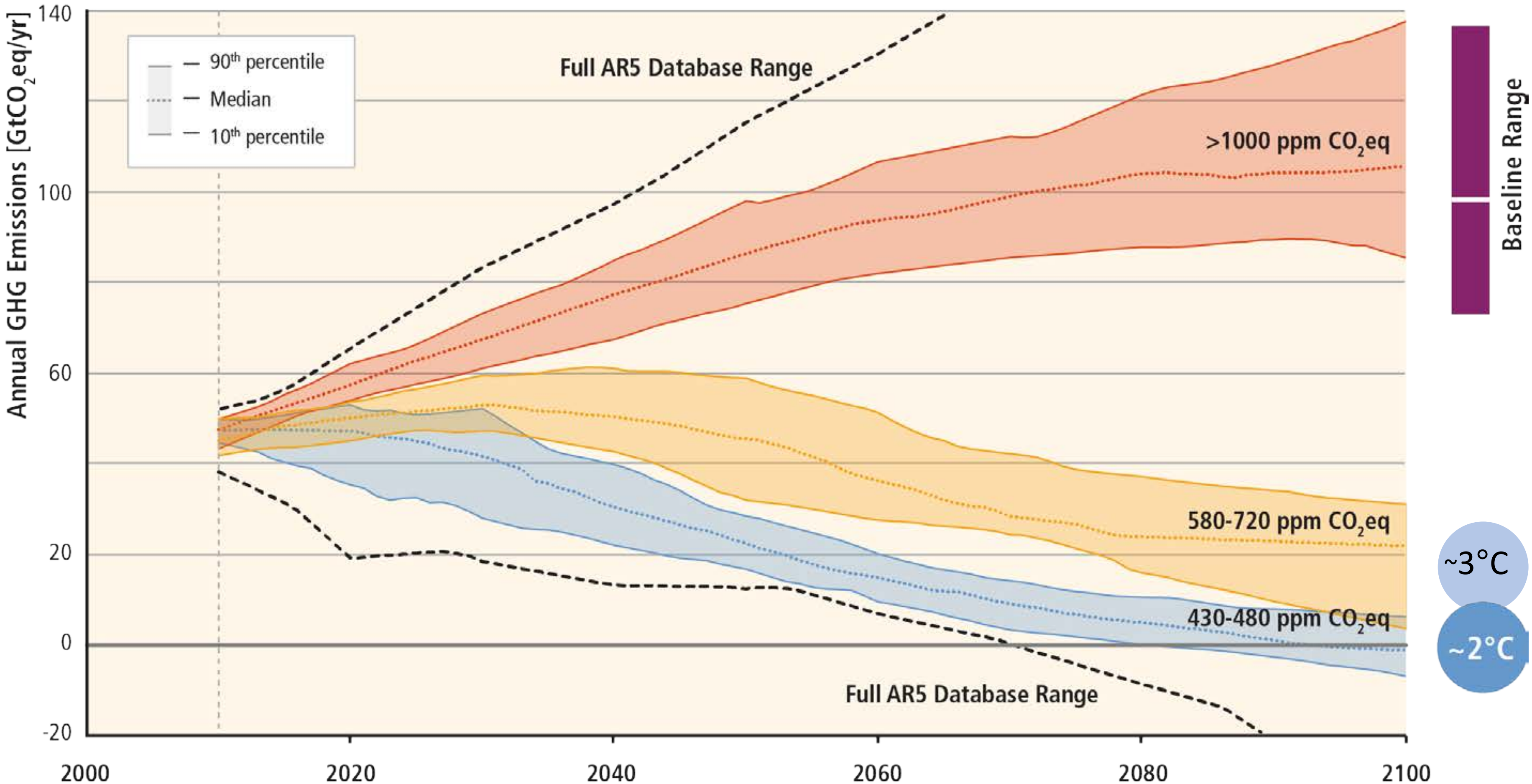
# Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.




Based on Figure 6.7

Working Group III contribution to the
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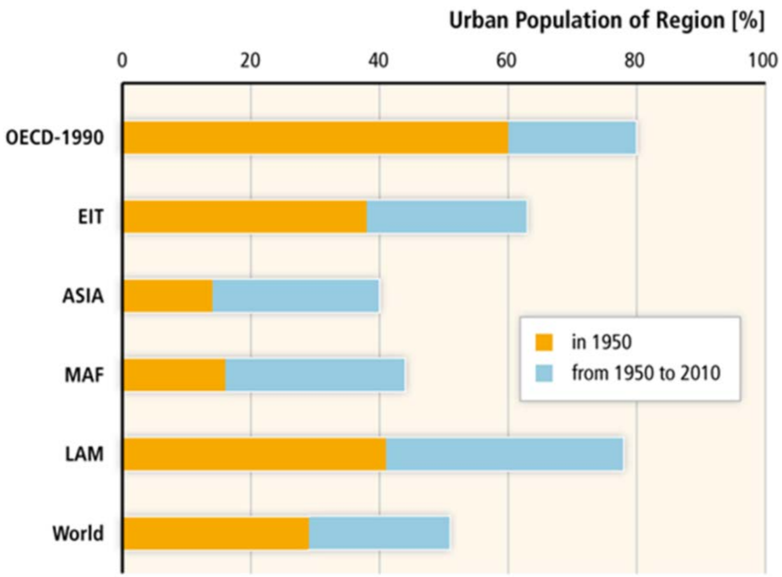
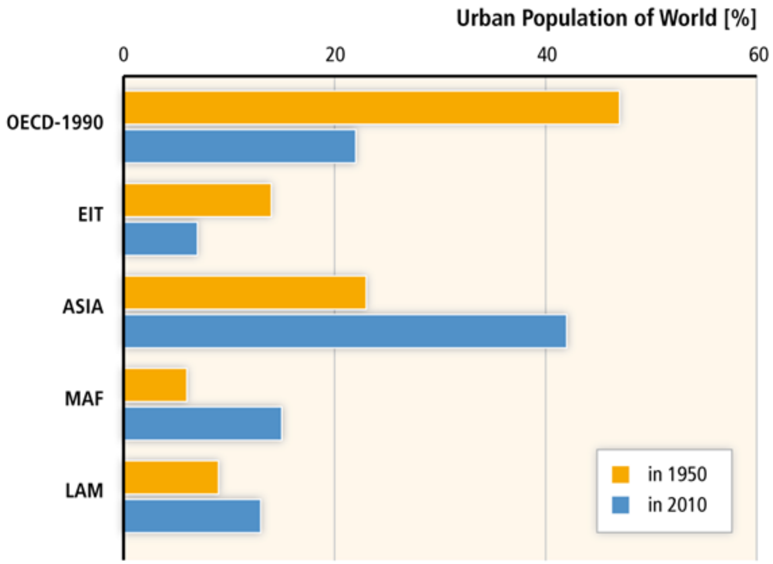
# Urbanization is associated with increases in income and higher urban incomes correlated with higher energy and GHG emissions




*Urbanization rates in developed regions are higher compared to Asia and Africa, but developing regions are catching up*




*The overall share of developed and developing regions in the global urban population have gone through a structural change in recent decades*

- Urban areas account for between 71% and 76% of $CO_2$ emissions from global final energy use and between 67-76% of global energy use
- Cities in non-Annex I countries have generally higher per capita final energy use and $CO_2$ emissions than national averages

## No single factor explains variations in per-capita emissions across cities, and there are significant differences within and across countries

- Influenced by a variety of physical, economic and social factors, development levels, and urbanization histories specific to each city
- Key factors include income, population dynamics, urban form, locational factors, economic structure, and market amongst others
- Key urban form drivers of energy and GHG emissions are density, land use mix, connectivity and accessibility

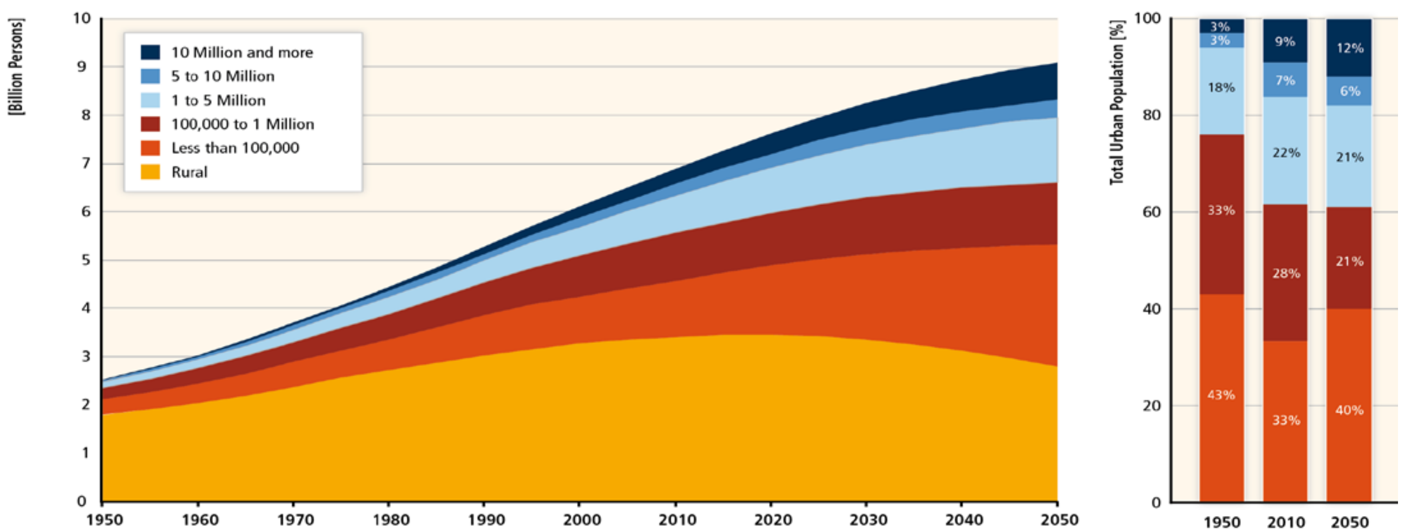
# Urban population and urban land is expected to expand further

- Expansion of urban areas is taking place at twice the rate of urban population growth
- Global rural population will decline soon and all population growth will be in urban
- 55% of the total urban land in 2030 is expected to be built in the first three decades of the 21st century
- Nearly half of the global growth in urban land cover is forecasted to occur in Asia; 55% of the regional growth to take place in China and India

Schneider et al., 2009; Angel et al., 2011; Seto et al., 2011, 2012

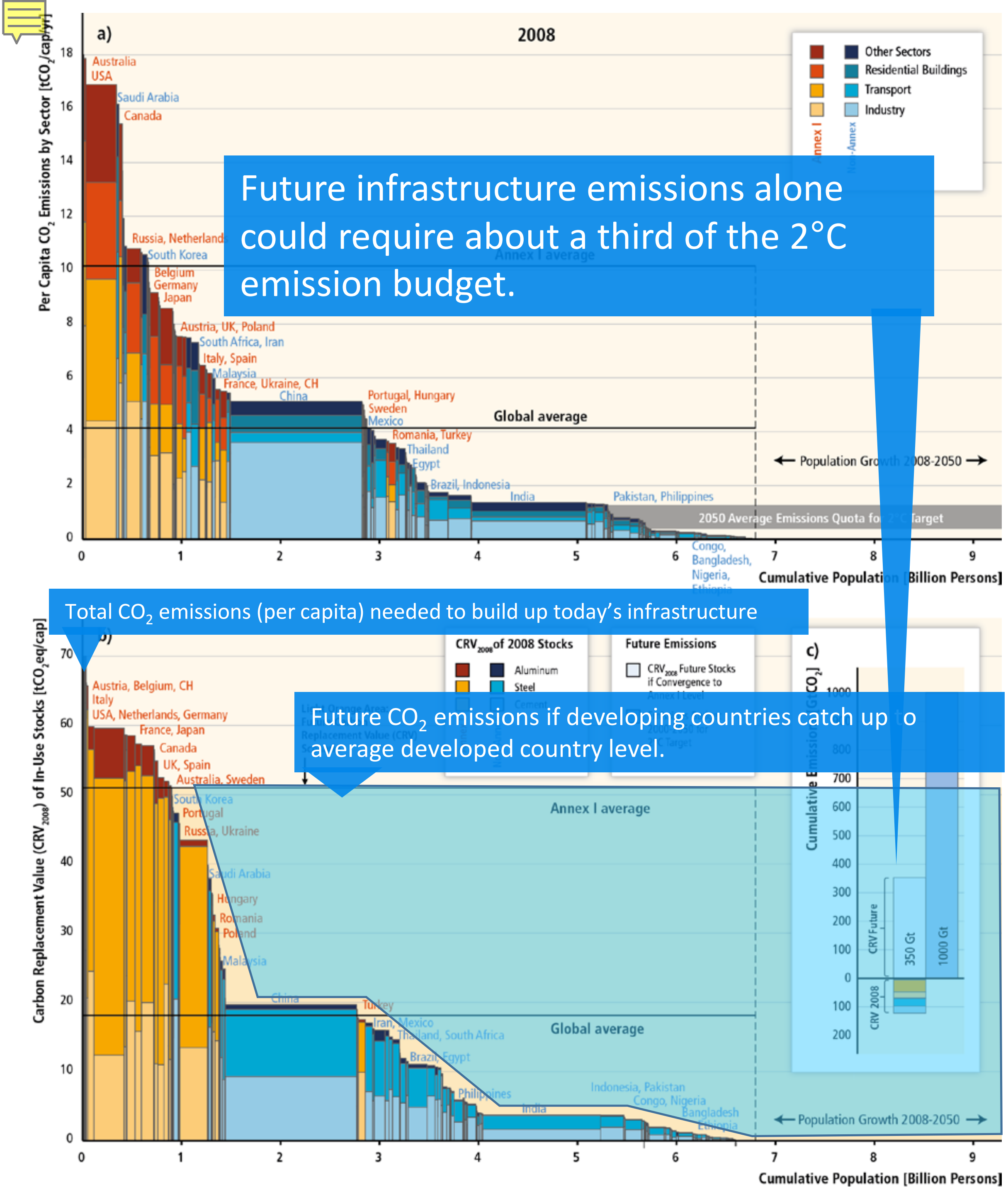
# The next two decades present a window of opportunity for mitigation as a large portion urban areas will be developed during this period.

- The kinds of towns, cities, and urban agglomerations that ultimately emerge over the coming decades will have a critical impact on energy use and carbon emissions




UN DESA, (2010), GEA (2012)

- Two sources of emissions: Construction of infrastructure and buildings (stock), usage of infrastructure and buildings (flow)
- Problem “Lock-in”: Long life of infrastructure and built environment determines energy and emissions pathways including lifestyles and consumption patterns




- **The existing infrastructure stock of the average Annex I resident**
  - **3 times that of the world average**
  - **about 5 times higher than that of the average non-Annex I resident**

- **The build-up of massive infrastructure in developing countries will result in significant future emissions**

Müller et al., 2013

# Key drivers for emissions from urban form are density, land use, connectivity and accessibility

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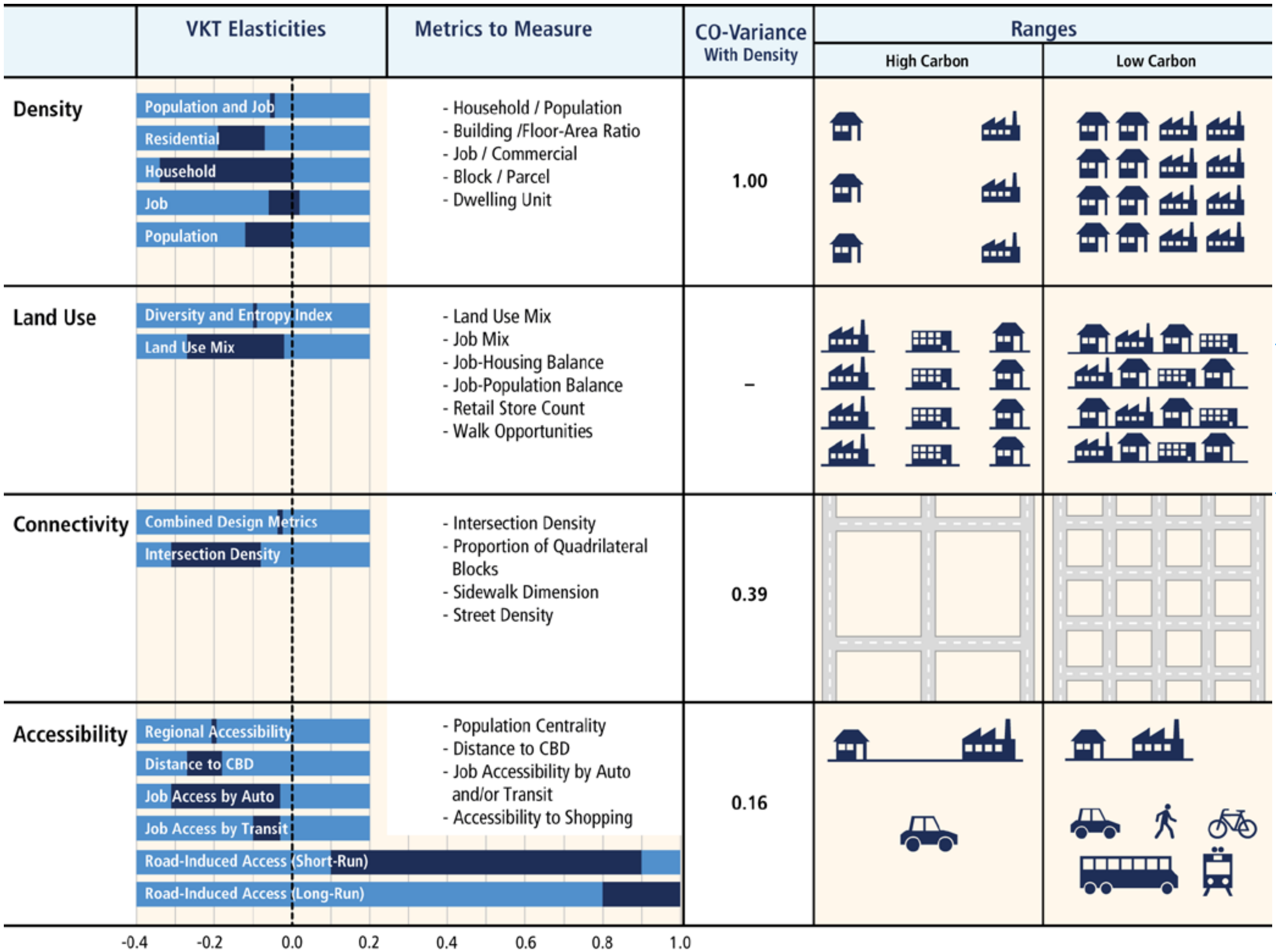



Higher density leads to less emissions (i.a. shorter distances travelled).

Mix of land-use reduces emissions.

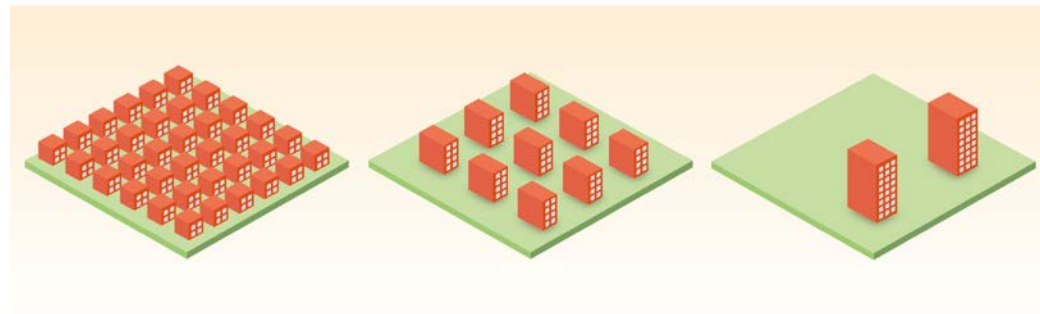
Improved infrastructural density and design (e.g. streets) reduces emissions.

Accessibility to people and places (jobs, housing, services, shopping) reduces emissions.

## Low carbon cities need to consider urban land use mix

## Density is necessary but not sufficient condition for lowering urban emissions

Manaugh and Kreider, 2013

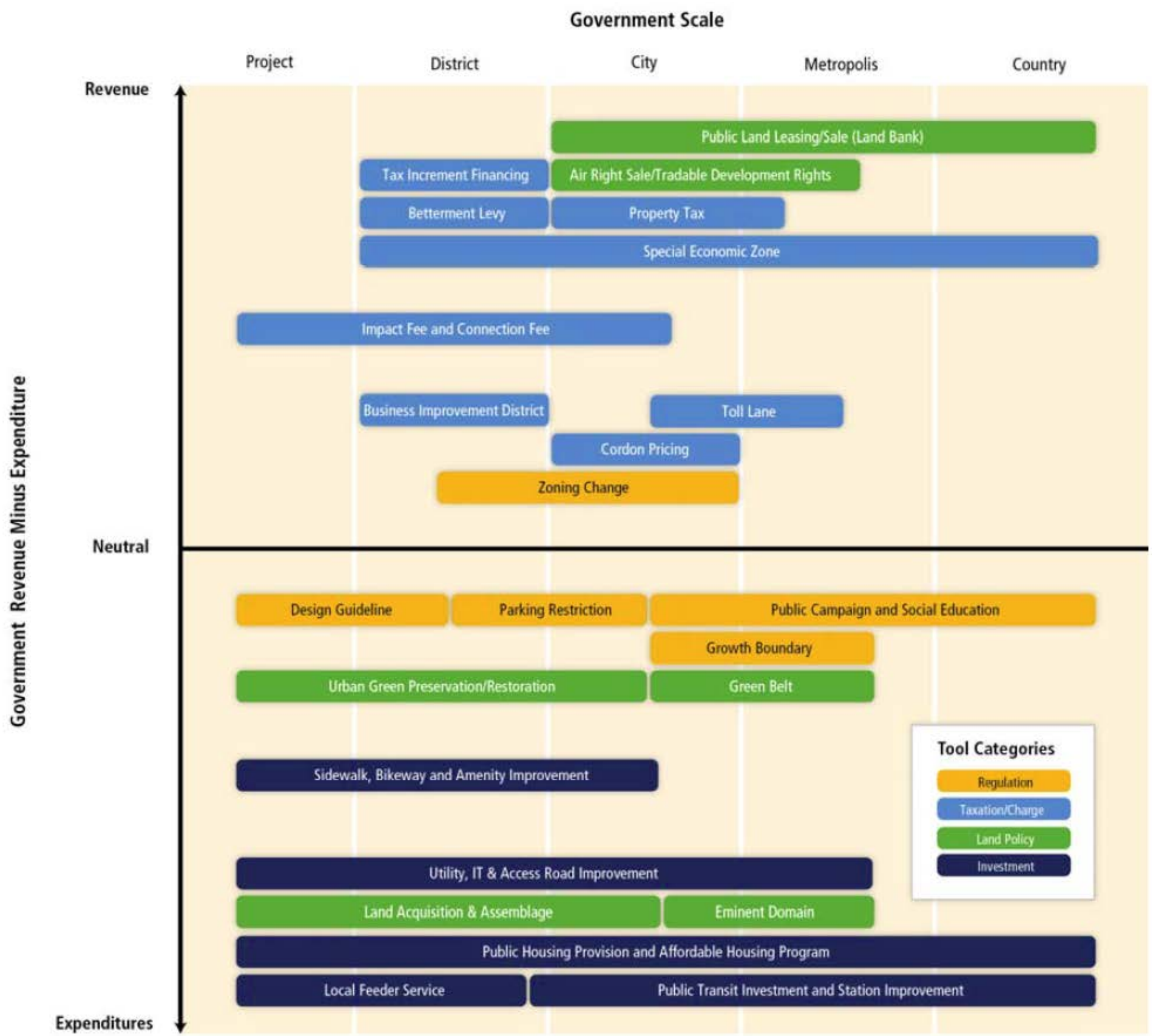

Adapted from (Cheng, 2009)

Mitigation options vary by urbanization trajectories and are expected to be most effective when policy instruments are bundled

**The largest mitigation opportunities with respect to human settlements are in rapidly urbanizing areas with**

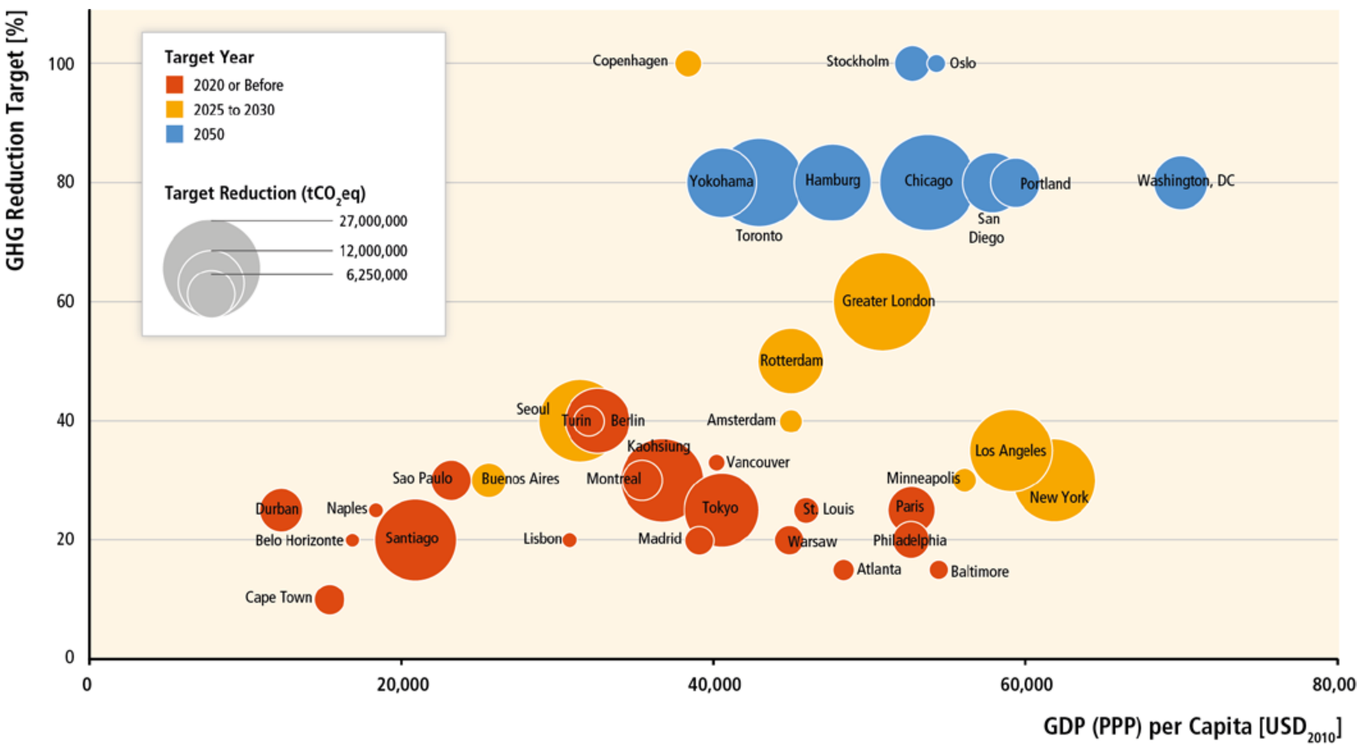
- **Small and mid-size cities**
- **Developing regions of the world**
- **Economical growing regions**
- **Infrastructure being built and yet not locked-in**

# The feasibility of spatial planning instruments for climate change mitigation is highly dependent on a city's financial and governance capability




Sources: Bahl and Linn (1998); Bhatt (2011); Cervero (2004); Deng (2005); Fekade (2000); Rogers (1999); Hong and Needham (2007); Peterson (2009); Peyroux (2012); Sandroni (2010); Suzuki et al. (2013); Urban LandMark (2012); U.S. EPA (2013); Weitz (2003).

# Thousands of cities are undertaking Climate Action Plans and mitigation commitments

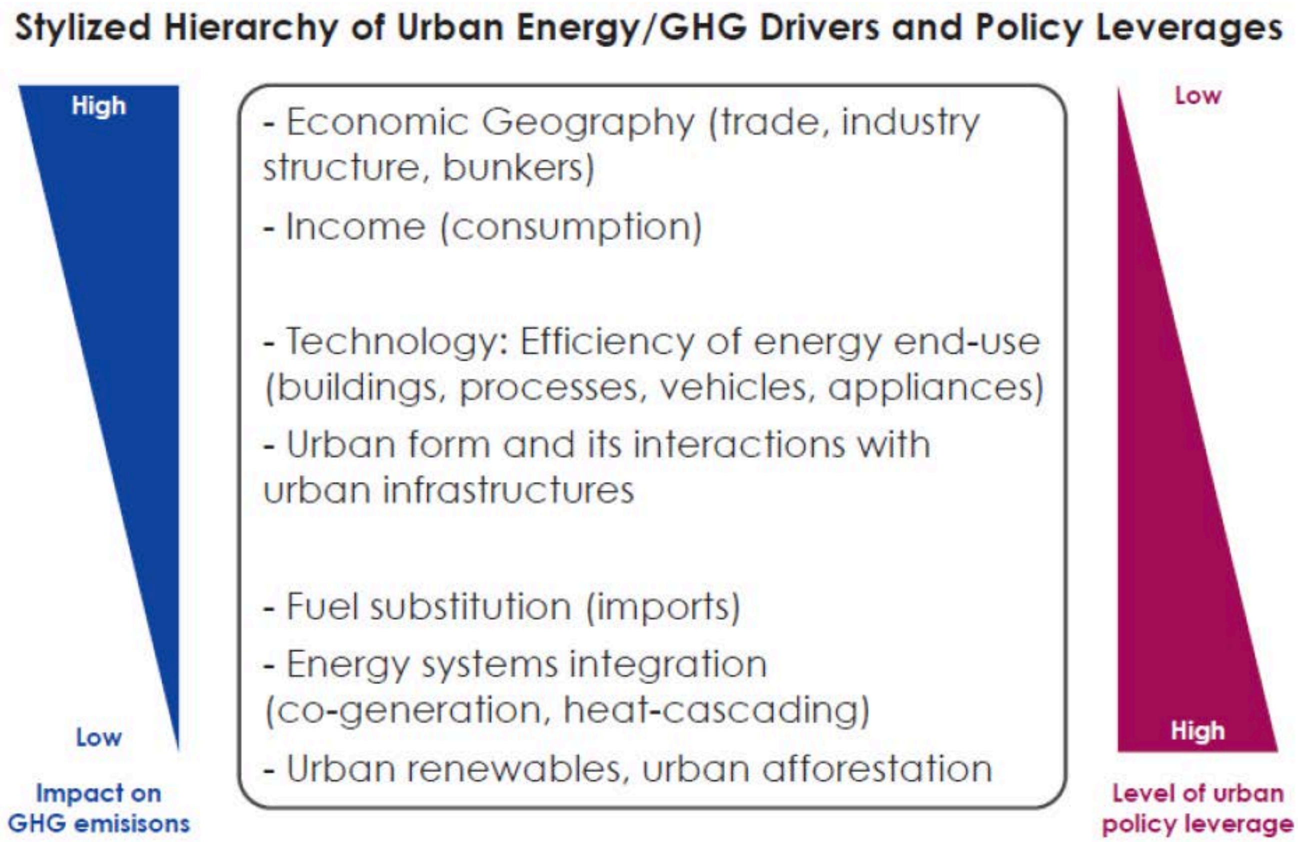



- Little systematic assessment on their level of implementation & the extent to which reduction targets are being achieved
- Focused largely on energy efficiency
- Limited consideration to land-use planning strategies and other cross-sectoral, cross boundary measures

Sources: Baseline emissions, reduction targets, and population from self-reported data submitted to Carbon Disclosure Project (2013). GDP data from Istrate & Nadeau (2012). Note that the figure is illustrative only; data are not representative, and physical boundaries, emissions accounting methods and baseline years vary between cities. Many cities have targets for intermediate years (not shown).

**Yet, their aggregate impact on urban emissions is uncertain**

# In decisions making, the policy leverages do not often match with the largest mitigation opportunities




**Systemic changes have more mitigation opportunities but hindered by policy fragmentation**

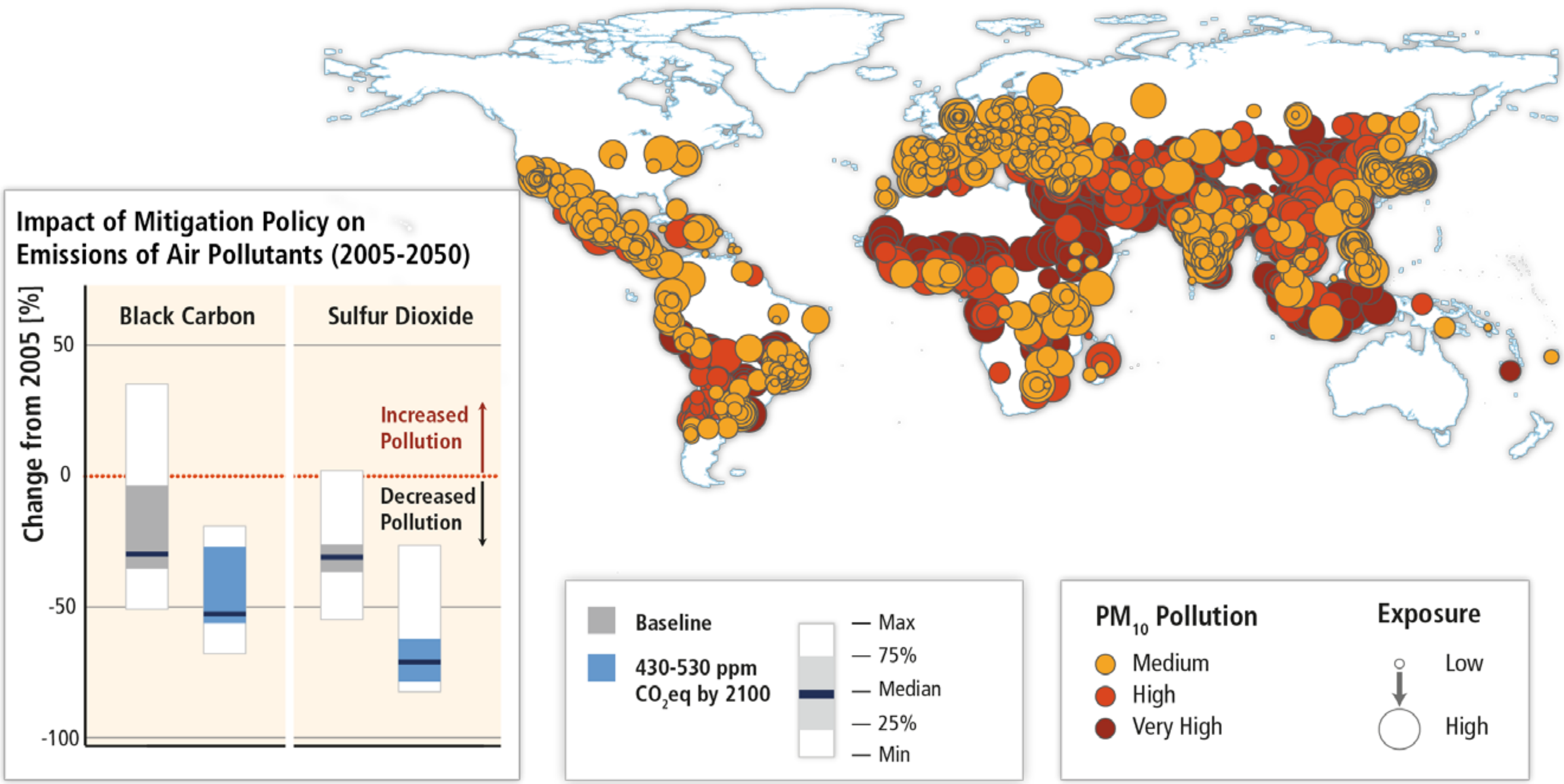
# Successful implementation of urban-scale climate change mitigation strategies can provide health, economic and air quality co-benefits

- Urban areas continue to struggle with challenges, including ensuring access to energy, limiting air and water pollution, and maintaining employment opportunities and competitiveness

- **Action on urban-scale mitigation often depends on the ability to relate climate change mitigation efforts to local co-benefits**

| Mitigation measures | Effect on additional objectives/concerns | | |
|---|---|---|---|
| | Economic | Social (including health) | Environmental |
| Compact development and infrastructure | ↑ Innovation and productivity[1]<br>↑↑ Higher rents & residential property values[2]<br>↑ Efficient resource use and delivery[5] | ↑ Health from physical activity[3] | ↑ Preservation of open space[4] |
| Increased accessibility | ↑ Commute savings[6] | ↑ Health from increased physical activity[3]<br>↑ Social interaction & mental health[7] | ↑ Air quality and reduced ecosystem/health impacts[8] |
| Mixed land use | ↑ Commute savings[6]<br>↑↑ Higher rents & residential property values[2] | ↑ Health from increased physical activity[3]<br>↑ Social interaction and mental health[7] | ↑ Air quality and reduced ecosystem/health impacts[8] |

# Mitigation can result in large co-benefits for human health and other societal goals.




Based on Figures 6.33 and 12.23

# ‘Governance paradox’ and need for a comprehensive approach

- ‘Systemic changes’ in urban areas have large mitigation opportunities but hindered by current patterns of urban governance, policy leverages and persisting policy fragmentation
- Governance and institutional capacity are scale and income dependent, i.e., tend to be weaker in smaller scale cities and in low income/revenue settings
  - However, the bulk of urban growth momentum is expected to unfold in small- to medium-size cities in non-Annex-I countries
  - The largest opportunities for GHG emission reduction might be precisely in urban areas where governance and institutional capacities to address them are weakest
- The feasibility of spatial planning instruments for climate change mitigation is highly dependent on a city’s financial and governance capability
- For designing and implementing climate policies effectively, institutional arrangements, governance mechanisms, and financial resources all should be aligned with the goals of reducing urban GHG emissions

# Knowledge gaps

1. Lack of consistent and comparable emissions and driver data at local scales. Lack of consistency and thus comparability on local emissions and accounting methods- and realistically comparing low carbon cities

2. Limited scientific understanding of the magnitude of the emissions reduction from altering systemic and spatial organization such as urban form, and the emissions savings from integrated infrastructure and land use planning – lots of sectoral knowledge but less integrated knowledge

3. Limited knowledge on urban climate action plans and their effectiveness.

4. Large uncertainties as to how urban areas will develop in the future and implications of or opportunities for multiple pathways

5. Lack of scientific understanding of how cities can prioritize climate change mitigation strategies, local actions, investments, and policy responses that are locally relevant for different city typologies

# Understanding urgency-China as an example

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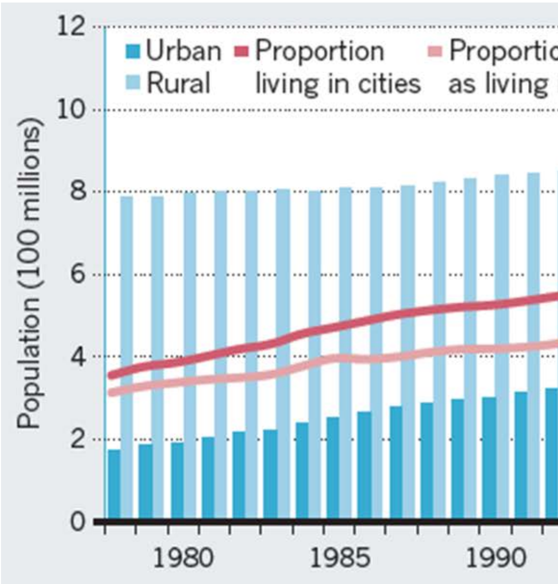



**GOVERNMENT TARGETS**

Main indicators and numerical targets in China's National New-type Urbanization Plan.

| Indicator | 2012 | 2020 |
|---|---|---|
| **Urbanization level** | | |
| Urbanization ratio (resident population) (%) | 52.6 | 60 |
| **Public services** | | |
| Proportion of peasant worker's children accompanying parents receiving mandatory education (%) | | ≥99 |
| Basic social-security coverage for urban and township resident population (%)* | 66.9 | ≥90 |
| Basic medical insurance coverage for urban and township resident population (%) | 95 | 98 |
| **Infr** | | |
| Pub 1 m | | 60 |
| Pub | | 90 |
| Pro | | 95 |
| Pro | | 95 |
| Bro (me | | ≥50 |
| **Resource and environment** | | |
| Per capita urban land use (square metres) | | ≤100‡ |
| Share of renewable energy consumption in cities and towns (%) | 8.7 | 13 |
| Share of 'green' buildings in new constructions in cities and towns (%) | 2 | 50 |
| Share of prefecture and above level cities that meet the national air-quality meeting standards (%) | 40.9 | 60 |

*Excludes resident students and people aged 0–16 years. †Data from 2011. ‡Standard is 65–115 square metres for urban built-up area, and 85–105 square metres in newly developed cities. Translated from the *National New-type Urbanization Plan (2014–2020)*.

- 7 trillion $ investment in infrastructure
- Infrastructure lock-in

- Alternative visions to reach there
- Implications to energy and GHG emissions

For further information

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# Bridging the key gaps require a consorted effort from research networks

- Data gaps- generating and consolidating data at urban scale
- Knowledge gaps- more place-based case studies, better top down studies, urban/city as a unit of analysis rather than its parts/sectors
- Scaling challenges (downscaling or upscaling data and knowledge)
- Methodological consistency for comparative analysis, e.g. GPC 2.0
- Needs for new methods/techniques that address multiple urban typologies and consider urban's complexity, treat urban as a holistic unit, and tackle its interconnectedness within and outside its boundaries
- Better empirical evidences of various planning practices' extent of reducing GHGs; role of best practices technologies and their potentials
- Better matrices/indicators for comparing and tracking low carbon city and city development

# Urbanisation

- **For most of human history:** The world population mostly lived in rural areas and in small urban settlements, and growth in global urban population occurred slowly
- **1800:** World population was around one billion, only 3% of the total population lived in urban areas and only one city—Beijing—had had a population greater than one million (Davis, 1955; Chandler, 1987; Satterthwaite, 2007)
- **1900:** Global share of urban population 13%; **1950:** 29%
- **1960:** Global urban population surpassed one billion (UN DESA, 2012)
- It took only additional 26 years to reach two billion; time for additional billion is decreasing
- Today, approximately 52% of the global population, or 3.6 billion, are estimated to live in urban areas (UN DESA, 2012).

# State of City GHG emission data

- Global Energy Assessment 250 cities final energy use
- ICLEI, Carbon*n* Registry- self reported
- C40 initiative- self reported
- European Covenant of Mayors
- World Bank compiled datasets
- Data is individual research articles
- Chinese cities

- Fragmented, incomplete, difficult to compare (scope, methodology, approach, coverage), largely in Europe, USA and Japan, very little in developing world cities
- Emerging effort to harmonize the accounting protocol
- Largely production based accounting

# Thank you