How are existing and future development options for cities, infrastructure and industry affected and how can we respond

Debra Roberts, Co-Chair IPCC WGII

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bit.ly/ipcc_outreach_ghana

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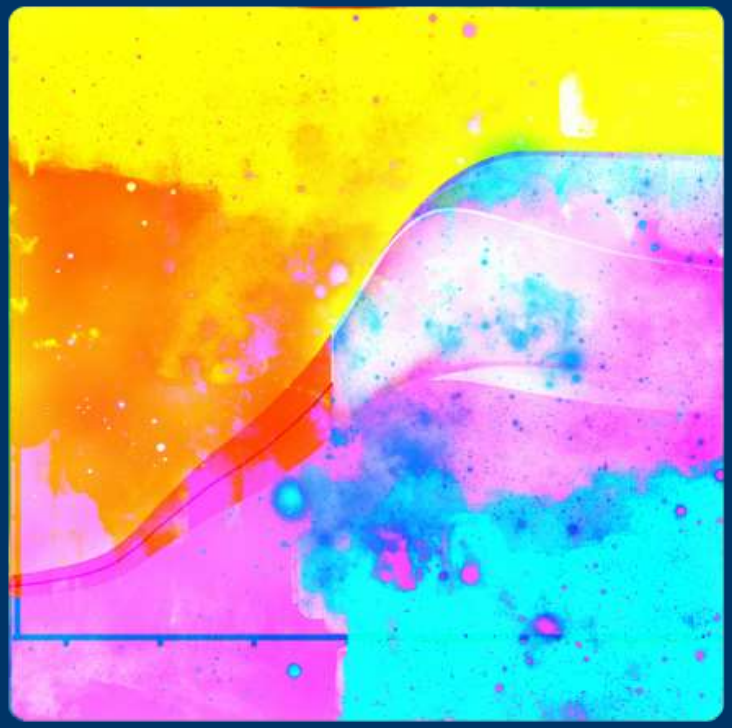
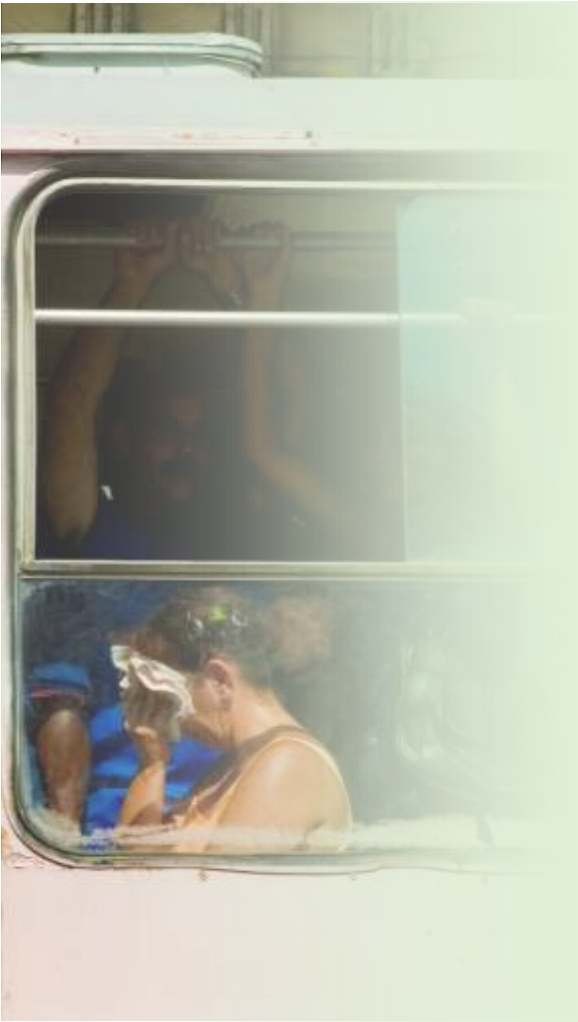
Solution
options



Cities, infrastructure and industry: IPCC Special Report on Global Warming of 1.5°C

Debra Roberts
IPCC Co-Chair Working Group II



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Urbanisation megatrend

- World population is rising especially in **small and medium-sized cities** in low- and moderate-income countries.
- Urban population projected to increase by **~2 billion by 2050**
  - 70 million additional urban residents per year until mid-century
- ~360 million people live in **urban coastal areas**
- ~3 billion people will live in **slums and informal settlements** by 2050

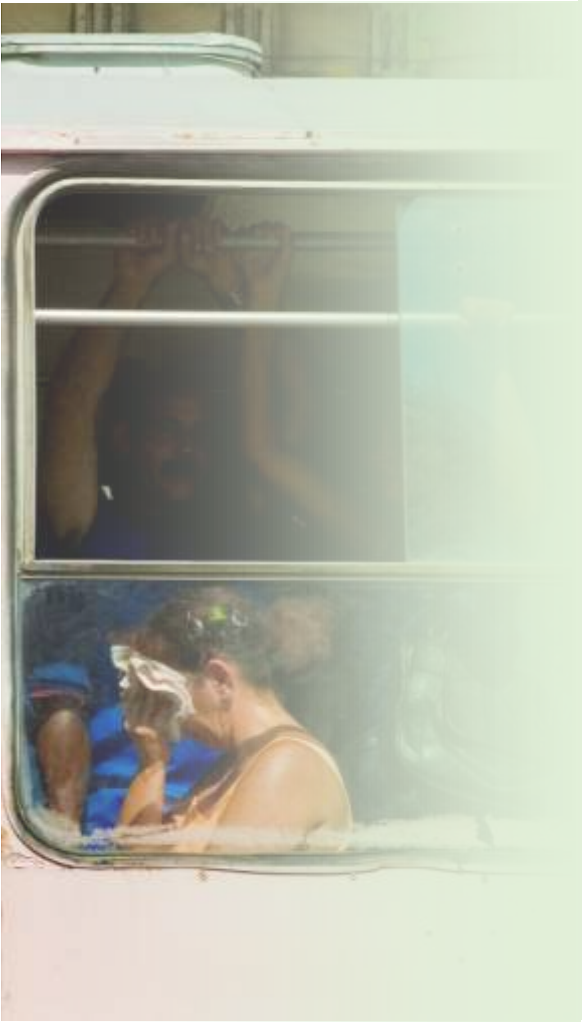
Four system transitions

"….require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems."

Rapid. Far-reaching. Unprecedented

The 1.5°C pathways require action in all cities and urban contexts.

Cities and risk



Cities – Increased risks

- **Climate change risks concentrate** in cities
  - heat stress, flooding, infectious and parasitic disease, new disease vectors, air pollution, water scarcity, landslides, fire
- These risks could **expose and amplify pre-existing stresses**
  - **Poverty**, exclusion, governance
  - Especially in **African and Asian** countries where urbanisation rates are highest

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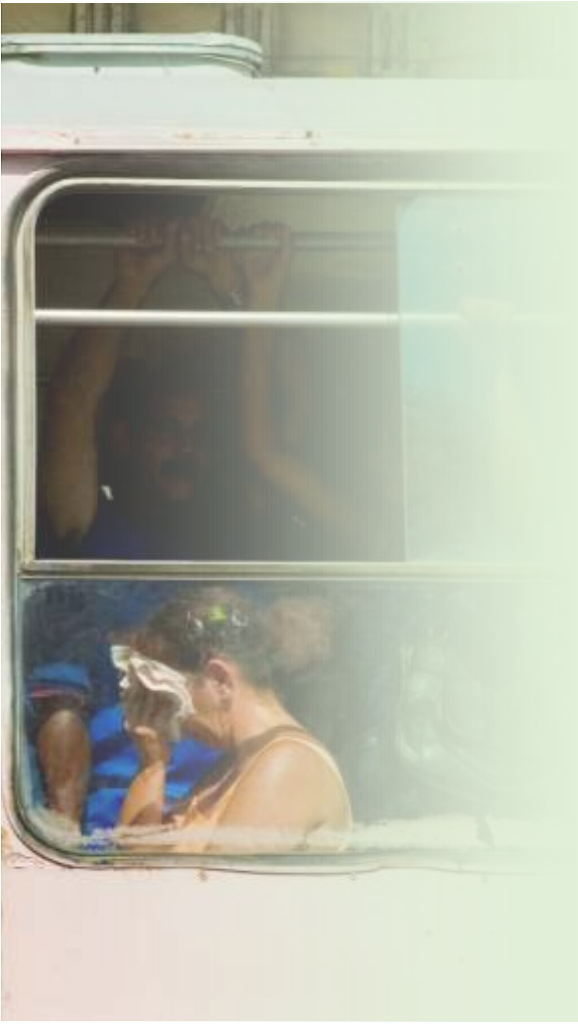

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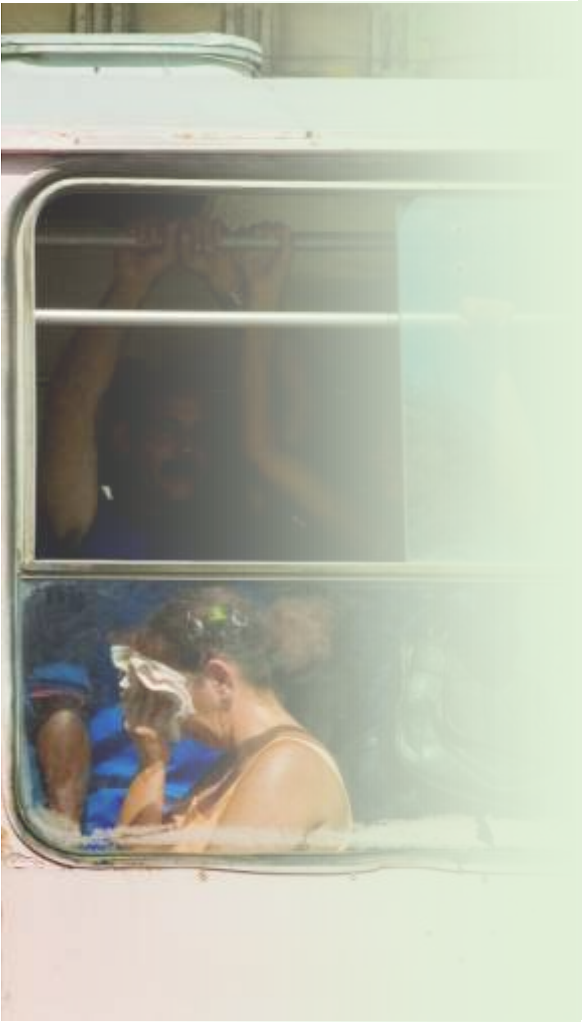
Cities - Heat

- **Urban heat island (UHI) effect –** projected to increase as population and city size increase
- Increases in UHI intensity could exacerbate warming of urban areas, with **up to a 30% increase for a doubling of CO_2**
- **Twice as many megacities** likely to become heat-stressed at 1.5˚C than today
- Exposing >**350 million more people** to **deadly heat** by 2050 (midrange population growth)



Cities – Flooding and drought

- Increased **flooding and damage** of infrastructure from extreme events linked to sea level rise

- **Compound flooding** (from multiple sources) in coastal cities
  - **likely to increase** with further development and sea level rise at 1.5˚C and 2˚C
  - globally **31–69 million** people exposed to coastal flooding at 1.5˚C and 32–79 million at 2˚C

- Urban populations **exposed to drought**
  - **350.2 (±158.8) million** at 1.5˚C, 410.7 (±213.5) million at 2˚C

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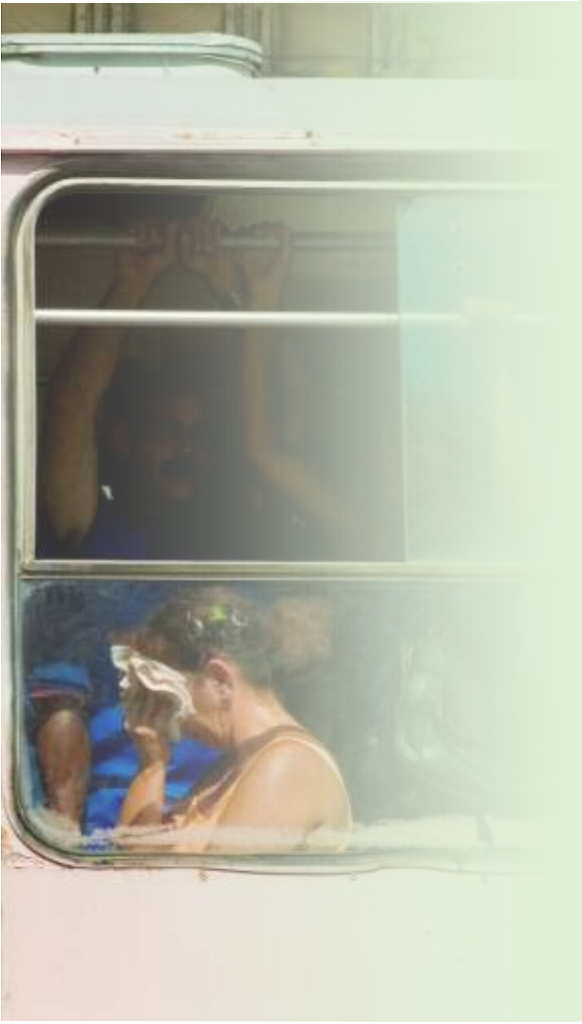

Cities - Sea level rise

- At least **136 megacities are at risk from flooding** due to sea level rise (with magnitudes of rise possible under 1.5˚C or 2˚C in the 21st century)
- Coastal urban areas are projected to see **salinization** of groundwater
- **Effect of storms** amplified by sea level rise
- Dike height under no-mitigation scenario is **2m higher in 2300** (on average for 136 megacities) compared to scenarios with mitigation, at 1.5˚C or 2˚C

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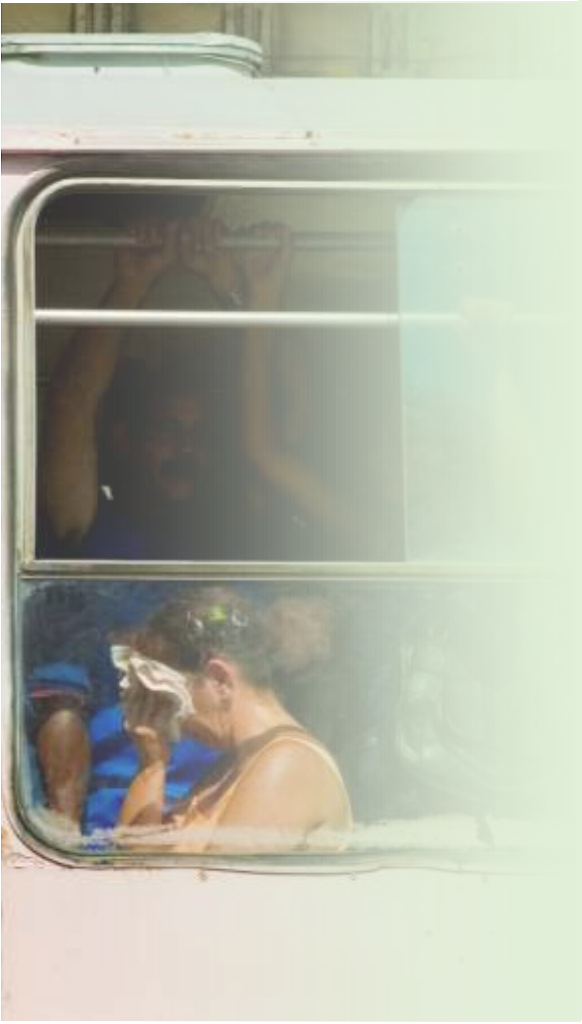

Cities – Poverty

- At approximately 1.5˚C climate change is a **poverty-multiplier** that makes poor people poorer
- **Climate change could force 3-16 million people** into extreme poverty
- **Most severe impacts** projected for **urban areas** and some rural regions **in sub-Saharan Africa** and Southeast Asia affected

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Adaptation

Cities - Adaptation

- Cities are at the **frontline of adaptation**
  - **Disaster risk reduction** and management
  - Flood and drought **early warning systems**
  - Improving **water storage** and use
- **Regional differences** in adaptation spending
  - Developing cities spend more on **health and agriculture-related**
  - Developed cities spend more on energy and water

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Cities - Adaptation

- Adaptation activities **lagging in emerging economies**
  - **Major centres** of population growth
  - Some of the worst impacts of 1.5°C on poor labourers, **poor urban dwellers in African cities**
  - Face **complex interrelated investment pressures** in health, housing and education

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Green Infrastructure and Sustainable Water

- **Green urban infrastructure** - increases urban resilience to impacts of 1.5˚C warming - can **be more cost-effective** than conventional infrastructure
- Realizing climate benefits sometimes requires **a city-region perspective**
- **Governance and finance** challenges

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Mitigation

Cities – Energy

- Urban economies more energy intensive due to **higher per capita** income, mobility and consumption
- **Rising demand for electricity** in cities can drive system transition (e.g. move to roof-top solar and energy storage)
- Recent **decoupling in cities from fossil fuel energy**, through efficiency, renewable energy and locally managed smart-grids
- Opportunity to **benefit from price changes** in renewable energy technologies to enable clean energy access to citizens

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Cities – Energy

- Replacing paraffin, wood and charcoal **in informal settlements improves air quality**, reduces fire-risk and deforestation, **which increases adaptive capacity** and raises demand

- **Small-scale distributed energy** implemented in developed and developing cities on residential and commercial rooftops offer **potential for consumers becoming producers** (called prosumers)

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Urban Infrastructure, Buildings, Appliances

- **Buildings consume 32% of global energy** and have a large energy saving potential
- Building emissions: **80–90% reduction needed** by 2050, for 1.5°C
- New construction: **fossil-free and near-zero energy** by 2020

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Urban Infrastructure, Buildings, Appliances

- Estimated that emissions from buildings can be reduced: **1.9 $GtCO_2e$ per year** through
  - **< embodied energy** (bio-based building materials and wood construction)
  - **> thermal performance** and direct energy use of buildings
- **Energy efficient appliances and lighting** can save 3 $GtCO_2e$ per year

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Urban Transport

- Energy use: **1.5ºC depends on a roughly 15% reduction** by 2050 relative to 2015
- Depends on enabling modal shifts, **avoided journeys** and incentives for improved fuel efficiency and changes in urban design that encourage **walkable cities, non-motorized transport and shorter commuter distances**
- **Bike-share schemes**: operational in 800 cities globally

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Urban Transport

- **Electric transport**: need to displace fossil fuel vehicles by 2035-2050 - **electric vehicle sales up**
- **Evidence of decoupling of car use and wealth** in high income cities
- **Transport-oriented development** is important to counter demand for private cars in developing country cities
- **Information and Communication Technologies**: car sharing, driverless cars, coordinated public transport
- Benefit from **reduced air pollution, congestion and road fatalities and improved social cohesion**.

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Urban planning and land use

- Land use planning can address **adaptation and mitigation** needs: influences energy intensity, risk exposure, adaptive capacity

- Effective urban planning can **reduce GHG emissions** from transport by **20 - 50%** and **compact cities** makes public transport **financially viable.**

- **Population density**: energy savings of US$26/year/10% density increase
  - High densities **in informal settlements are counter-adaptive** (e.g. on health risks) unless upgraded

Urban planning and land use

- **Adaptation plans**: reduce exposure to flood, heat stress, fire and sea-level rise
- Consider implications of **extreme events** in urban design
- Consider **justice, equity, and broad participation** to avoid negative impacts on poor

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Industry

Industry

- Consumes about **a third of global final energy**; produces (directly and indirectly) **a third of global GHG emissions**
- To remain under 1.5˚C: **67-91% GHG emission reduction**, reaching <2 $GtCO_2$ per year in 2050 compared to 2010
- **Only a small fraction** of corporations have developed adaptation measures
- **Transformation options**: efficiency, bio-based feedstocks, substitution, circularity, electrification, hydrogen, carbon dioxide capture, utilization and storage

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A different approach to urbanisation, infrastructure and industry in Africa….

"The long-lived urban transport, water and energy systems that will be constructed in the next three decades to support urban populations **in developing countries** …. will **have to be different** to those built in Europe and North America in the 20th century, if they are to **support the required transitions**."

Governance for action

Ashley Cooper/ Aurora Photos

Cities - Governance

- **Urban governance** is critical to ensuring that the necessary urban transitions deliver economic growth and equity
- Local governments can be **powerful agents** of climate action
- Governance is complicated for **urban population living in informality**
- Urban governance is **enhanced when it involves**:
  - multiple actors
  - supportive national governments
  - sub-national climate networks

THANK YOU FOR YOUR ATTENTION!

For more information:

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