Rapid urbanization in small and medium-sized cities: *Implications for climate and energy*

Preliminary findings

GLOBAL COVENANT of MAYORS for CLIMATE & ENERGY
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About the Global Covenant of Mayors for Climate & Energy (GCoM)

GCoM is the largest global alliance for city climate leadership, uniting a global coalition of over 13,800 cities and local governments and 100+ supporting partners. The cities and partners of GCoM share a long-term vision of supporting voluntary action to combat climate change and towards a resilient and low-emission society. GCoM serves cities and local governments by mobilizing and supporting ambitious, measurable, planned climate and energy action in their communities by working with city/regional networks, national governments, and other partners to achieve our vision. Led today by UN Special Envoy on Climate Ambition and Solutions Michael R. Bloomberg and European Commission Executive Vice-President Teresa Ribera, the coalition comprises cities across 6 continents and 147 countries, representing over 1 billion people or more than 13 percent of the global population.

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Content

Overview

As cities become home to more people and businesses, the scale and complexity of increasingly rapid urbanization carries significant consequences for urban dwellers and the places they inhabit. This trend has significant implications for climate and energy, both in terms of how to reduce emissions while providing key services including housing, energy, water, and transport, and limit devastating impacts from increased heat, flooding, and drought. Rapid urbanization impacts natural resources, economic growth, wellbeing, built environments, and infrastructure, yet the exact implications for climate and energy are not well understood.

This report seeks to improve our understanding about the impacts of rapid urbanization on small and medium-sized cities. Considering the critical role these smaller cities will play as the sites of most future urban growth, it is strategic and urgent for urban scholars to center them in the analysis of such growth – particularly in relation to climate and energy vulnerabilities. The paper aims to inform how future GCoM alliance activities can deepen engagement across rapidly urbanizing cities through knowledge, technical support, and partnerships. It seeks to provide preliminary answers to the following questions:

1. What are some of the **defining characteristics** of this cohort of small and medium-sized cities undergoing rapid urbanization?
2. What are the particular **emerging challenges** this cohort faces in relation to climate and energy.
3. What are some of the **key opportunities** for this cohort in terms of different financial and policy levers, urban planning mechanisms, and governance strategies to enable climate resilient development in the context of rapid urbanization?

Based on primary data taken from the Global Human Settlement Layer (GHSL), this report focuses on cities of 50,000 to 3,000,000 inhabitants. It also draws from self-reported data from the CDP Open Data Portal, alongside a desk review of relevant literature including grey literature, peer-reviewed academic studies, international organization reports, and national and local climate-relevant documents.

In this report, rapid urbanization is defined as an average annual population growth rate of urban settlements at 2.5% or higher. Accordingly, we analyzed 1,818 small and medium-sized cities currently undergoing rapid urbanization with GHSL data[1].

This list was cross-referenced with all 13,732 GCoM cities, resulting in 111 cities of the GCoM alliance identified as rapidly expanding small and medium-sized cities.

[1] The GHSL is a comprehensive data set covering built environments, population density and settlement to understand patterns of human presence on Earth. It is produced at the Joint Research Centre of the European Commission.

Population and Income Distribution

Growth is recent and intense: 49% of these cities were established in the past 15 years, with 24% emerging between 2020–2025. Population growth averaged 4.4% annually between 2000–2020 — over three times the global average of 1.3% for the same period. Income distribution skews heavily toward lower tiers, with 65% located in low- or lower-middle-income countries. The cohort is overwhelmingly located in the Global South (96%), underscoring the alignment of rapid urbanization with contexts of lower fiscal capacity and higher climate vulnerability.

Typology Clusters

Five city typologies (A–E) reveal distinct development patterns, each with specific challenges and opportunities. Most cities in this cohort are relatively small — nearly nine in ten have populations under 500,000, and almost half have fewer than 100,000 residents — yet they are expanding at extraordinary rates, with average population growth more than three times the global urban average. Most are relatively new urban centers located in lower-income countries, where limited fiscal capacity and high climate vulnerability compound the pressures associated with rapid urban expansion.

A clustering analysis was used to group cities into five distinct typologies summarized in the table below.

Table 1: Key characteristics of each typology cluster for rapidly urbanizing cities

	A Service-Rich, Older, Mid-sized Cities	B Explosive Sprawlers with Weak Services	C Older, Larger Cities with High Environmental Pressures	D Mid-Sized Cities with Low Quality of Life	E Newer, Compact Cities with Moderate Services
	194 cities	678 cities	212 cities	245 cities	489 cities
Urban Growth & Age	Old, slowest growth	Yougest, smallest, fastest growth	Oldest, Large, slow growing	Mid-age, moderate growth	Newer, moderately fast growth
Services & Quality of Life	Best services, high HDI	Weakest Services	Poor services, low HDI	Lowest quality of life	Moderate services & HDI
Environmental Impact	Highest GHG per capita	Moderate Emissions	Highest pollution & health burden	Lowest Emissions, but still polluted	Moderate Emissions, better air
Spatial Form	Compact, efficient	Most sprawling	Very Compact	Semi-Compact	Compact with green space


Naga, Philippines


Embu County, Kenya


Gaziantep, Türkiye


Pemba, Mozambique


Tangará da Serra, Brazil

Key Distinctions Across Clusters

Across all typologies, per capita emissions are generally lower than global city averages, the industrial and energy sectors dominate, with some clusters showing distinct emissions patterns (e.g., waste in Cluster D). Across typologies, infrastructure provision lags far behind global averages — particularly in waste, water, and health systems — undermining both mitigation and adaptation potential. Quality of life also varies sharply, with Cluster A cities performing best and Cluster D the worst, underscoring large disparities in resilience capacity. Land conversion rates exceed global averages in all clusters, while green space remains limited in many fast-growing cities, heightening climate risks.

Figure 1: World map showing global distribution of rapidly urbanizing small and medium-sized cities according to typology clustering

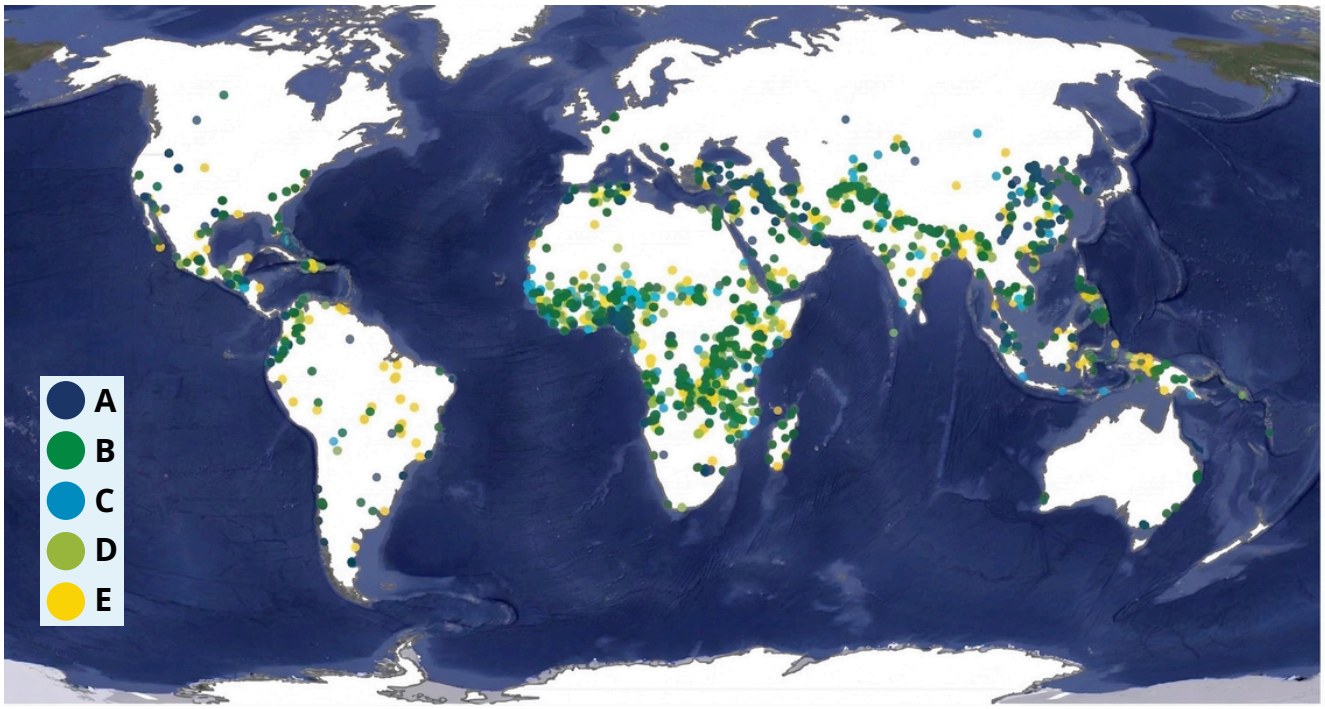
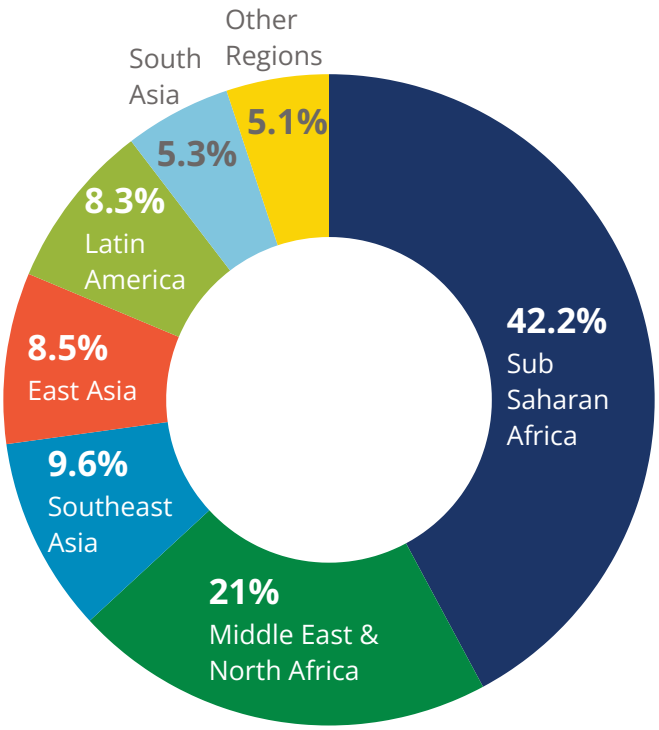


Figure 2: World map showing regional breakdown of small and medium-sized cities identified as rapidly urbanizing

Overview of Regions

There are eleven GCoM regions with rapidly urbanizing small and medium-sized cities, however five of those regions combined only represent 5% of the rapidly urbanizing cities included in this study, as shown in Figure 3. The other six regions, Sub-Saharan Africa, the Middle East and North Africa, Southeast Asia, East Asia, Latin America, and South Asia account for almost 95% of all rapidly urbanizing cities, so the regional analysis focuses on these six regions.

Figure 3: Regional distribution of rapidly urbanizing small and medium-sized cities



Other Regions includes: USA (2.5%), Oceania (1%), Eastern Europe & Central Asia (0.7%), Korea (0.6%), European Union & Western Europe (0.2%), Canada (0.1%)

Significant Regional Variations

Regional dynamics show significant variation across the six regions that account for nearly all rapidly urbanizing cities — Sub-Saharan Africa, the Middle East and North Africa, Southeast Asia, East Asia, Latin America, and South Asia. Sub-Saharan Africa hosts the largest share, while Latin American cities are more compact with higher human development and lower emissions, and Southeast Asian cities face the fastest land conversion despite larger green space areas. By contrast, only a small fraction — just over 5% of the total cohort — are found in the six minority regions. Latin America emerges as a region with a lot of opportunities and positive trends, and could act as a model for other rapidly expanding regions.

To ground these patterns, the report presents five case studies drawn from different typologies and regions: Naga, Philippines, Embu County, Kenya, Gaziantep, Türkiye, Pemba, Mozambique, and Tangará da Serra, Brazil. These cases illustrate how rapid urban growth intersects with climate risks and infrastructure pressures in distinct contexts, offering insight into both shared challenges and place-specific opportunities for climate action.

Four Key Levers of Action for Cities

The ability of rapidly urbanizing cities to respond to climate and energy challenges also depends on four key levers: governance, capacity, planning, and finance. Weakly devolved governance and boundary mismatches often constrain local action, while limited staffing and technical expertise create a persistent "capacity crisis," especially in African and Asian cities. Land use planning frameworks are frequently outdated or poorly enforced, accelerating sprawl, ecosystem loss, and exposure to climate risks. Finally, access to finance remains a critical barrier: small and medium-sized cities — where the fastest growth is projected — struggle to secure credit and attract investment, leaving those most vulnerable with the least resources for adaptation and resilience. Strengthening these levers will be essential to align rapid urbanization with climate-resilient development pathways.

Table 2: Comparison of opportunities and challenges across typology clusters of rapidly urbanizing small and medium-sized cities

Typology	Opportunities	Challenges
A: Service-Rich, Older, Mid-Sized Cities	Higher service provision and quality of life and better transport infrastructure.	High per capita emissions and low amounts of green space.
B: Explosive Sprawlers with Weak Services	Largest drop in per capita emissions between 2010 and 2020 and high amounts of green space.	High climate risks and rates of land conversion.
C: Older, Larger Cities with High Environmental Pressures	Second lowest per capita emissions.	High levels of air pollution and low quality of life.
D: Mid-Sized Cities with Low Quality of Life	Low per capita emissions and moderate levels of green space.	High share of GHG emissions in waste sector and lack of infrastructure and services.
E: Newer, Compact Cities with Moderate Services	Compact with relatively large amounts of green space.	Medium-high climate risks.

Emerging Findings & Recommendations

Rapid urbanization in small and medium-sized cities is uneven, structurally differentiated, and central to future climate and development outcomes. The use of typologies combined with the regional analysis and in-depth exploration of five case study cities helps to provide a more nuanced understanding of how this urban growth looks, as well as what it means for climate mitigation and adaptation.

As of the completion of this stage of research, the Global Human Settlement Layer (GHSL) currently provides the only dataset enabling global-scale comparability of smaller cities, yet its reliance on built-up grid cells rather than municipal boundaries exposes a structural disconnect between global data systems and local governance realities. Divergences, particularly between emissions and population estimates, between GHSL estimates and self-reported municipal data further underscore this mismatch.

Despite these limitations, the analysis provides a clear evidence base for identifying priority research gaps and guiding how the GCoM alliance could tailor its initiatives, partnerships, and technical support to the specific conditions of rapidly expanding cities.

Data, Research and Innovation

1. **Inconsistent methodologies and mismatched datasets limit comparability across rapidly urbanizing cities, underscoring the need for standardized, fit-for-purpose datasystems.** The case studies revealed sectoral inconsistencies between GHSL-derived data and self-reported municipal inventories or CDP-ICLEI Track submissions, reflecting the absence of standardized approaches at the small and medium-city scale and making cross-city comparisons difficult, and at times misleading. Emissions profiles and service indicators vary depending on the dataset used, raising concerns about reliability for benchmarking and target setting. Clarifying the purpose and intended end-users of emissions data — whether for city-level mitigation targets, typology-based collaboration, or financing decisions — will also be critical to ensuring that data systems align with municipal governance structures and planning realities.

2. **Climate vulnerability in rapidly urbanizing cities cannot yet be robustly assessed at global scale, limiting prioritization and comparability.** Climate risk and fragility could not be comprehensively analyzed across the full cohort due to the absence of reliable global vulnerability datasets. While GHSL provides built-up area and hazard occurrence data, it lacks robust indicators of exposure, sensitivity, and adaptive capacity, and typological aggregation further constrains the usefulness of risk insights. As a result, the analysis relied heavily on case studies to understand localized vulnerabilities, limiting comparability, and generalization. Developing methodologies that allow climate risk information to be catalogued and aggregated from local to global levels, without erasing contextual nuance, remains a critical research priority.

3. **Institutional capacity constraints in rapidly urbanizing cities are likely more severe than current reporting suggests.** Because the case studies focused on GCoM cities, findings likely reflect municipalities with relatively higher levels of planning engagement and reporting capacity. Many non-GCoM cities undergoing rapid growth may face even greater limitations in staffing, technical expertise, and financial resources, suggesting that the overall capacity gap may be underestimated.

4. **High-tech and AI-driven tools can accelerate data coverage, but must be paired with community-led validation to avoid reinforcing blind spots.** Artificial intelligence, machine learning, and satellite imagery offer powerful tools to interpret land-use change, detect informal expansion, predict hazards, and integrate datasets across scales, while mobile platforms can help capture community-generated information that reduces the invisibility of informal settlements and workers. However, these technologies face accuracy limitations at the neighborhood scale, frequently misclassifying informal areas and potentially reproducing algorithmic bias. Pairing technological innovation with ground-truthed, community-led data collection is therefore essential to ensure that local vulnerabilities are accurately represented.

5. **Global research and innovation platforms must elevate rapidly urbanizing small and medium-sized cities within climate discourse and investment agendas.** Historically, global research has centered on large metropolitan areas with stronger institutional capacity, yet this analysis demonstrates that smaller cities are absorbing the fastest population growth and facing distinct infrastructure and climate pressures. Elevating these cities within global research agendas will better align scientific inquiry and investment strategies with demographic reality. Processes such as the IPCC Special Report on Climate Change and Cities, Innovate4Cities, and the Global Research and Action Agenda on Cities and Climate Change Science provide timely opportunities to highlight the specific conditions facing rapidly urbanizing cities.

Tailored Technical Support – Windows of Opportunity in Rapidly Urbanizing Cities

6. **Rapid infrastructure expansion presents a critical opportunity to improve quality of life without locking cities into high-emissions development pathways.** In several regions — particularly Sub-Saharan Africa, MENA, and Southeast Asia — and within Typology D: Mid-Sized Cities with Low Quality of Life, urgent expansion of water, sanitation, housing, energy, and health systems are required. Without strategic guidance, related investments risk significantly increasing per capita greenhouse gas emissions. Evidence from Latin American cities and Typology E: Newer, Compact Cities with Moderate Services suggests that relatively compact urban forms combined with moderate service provision can improve living standards while limiting emissions growth, highlighting the importance of integrated infrastructure planning that aligns service expansion with long-term decarbonization and resilience objectives.

7. **Accelerating land conversion threatens climate resilience, making green space conservation a strategic priority in rapidly urbanizing regions.** While not all regions exceed global averages, land conversion rates are significantly above global benchmarks in several regions and are especially pronounced in Typology B: Explosive Sprawlers with Weak Services. In these contexts, rapid outward expansion reduces green space per capita, increases exposure to flooding and heat stress, and accelerates ecosystem degradation, particularly in parts of Southeast Asia and Sub-Saharan Africa. Developing a stronger business case for conserving green space and managing spatial growth can simultaneously advance mitigation and adaptation objectives by reducing emissions from land-use change while preserving ecosystem services that buffer climate impacts. Spatial planning tools, ecosystem valuation methodologies, and targeted land-use reforms can help guide more compact and risk-sensitive development that strengthens long-term resilience.

8. **Climate action planning must explicitly integrate rapid urbanization dynamics rather than treating growth as an external variable.** The case studies revealed limited evidence that rapid demographic expansion is systematically incorporated into climate action plans. Urban planning tools should incorporate projected population growth, land conversion trends, and exposure mapping to guide development away from high-risk zones and toward compact, low-carbon urban forms such as high-density, transit-oriented development. At the same time, divergences between CDP-ICLEI Track self-reported data and municipal climate plans raise concerns about whether plans reflect local priorities and implementation realities or external reporting frameworks, underscoring the need to evaluate relevance and execution rather than focusing solely on the existence of climate plans.

Social Inclusion and Equity

9. **Socioeconomic inequality and informality remain insufficiently captured in global and municipal datasets, limiting equitable climate action.** Both the GHSL analysis and case studies revealed significant gaps in city-level socioeconomic data, with indicators such as HDI and income frequently downscaled from national averages and more granular measures — such as city-level Gini coefficients — often unavailable, obscuring intra-urban disparities. Data on informal settlements and informal labor is largely absent from global datasets and inconsistently captured in municipal reporting, limiting the visibility of populations most exposed to climate risk. Without systematic incorporation of community-collected data into municipal, national, and global databases, climate planning risks overlooking the very populations most affected by rapid urbanization and climate stress.

10. **Disaggregated and qualitative data are essential to capture differentiated climate vulnerability in rapidly expanding urban contexts.** City-wide and global datasets often fail to reflect gender-differentiated climate risks, migrant vulnerabilities, and distinctions between newly arrived and established populations, particularly in rapidly urbanizing areas where demographic change reshapes exposure and adaptive capacity. Incorporating qualitative data and participatory engagement processes into reporting and planning frameworks would enable more tailored climate interventions and prevent investments from reinforcing existing inequalities rather than addressing them.

Multi-Level Coordination and Partnerships

11. **Rapid urbanization is not consistently reflected in state and national climate action frameworks, despite being shaped by multi-level governance and economic dynamics.** The case studies of Embu in Kenya and Tangará da Serra in Brazil demonstrate how economic dynamics and governance arrangements at state and national levels influence patterns of urbanization as well as the prioritization of emissions and adaptation sectors. In Kenya, decentralization is channeling greater resources to county governments; however, climate action planning at the county level does not always adequately capture the rapid urban expansion occurring in administrative capitals. This misalignment highlights the need to more explicitly integrate urban demographic growth and spatial transformation into subnational and national climate strategies to ensure coherence between governance structures, infrastructure investment, and evolving urban realities.

12. **Rapid urban expansion increasingly transcends administrative boundaries, requiring regional-scale territorial planning approaches.** As cities expand into peri-urban and rural areas, ecosystems, infrastructure networks, and livelihoods are transformed beyond municipal borders, creating cross-boundary climate risks and planning challenges. Managing these dynamics requires coordinated territorial planning approaches supported from national to local levels to align ecosystem conservation, economic growth, and infrastructure development across expanding urban regions.

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