SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN | Lee Kuan Yew Centre for Innovative Cities

Pulse of

Global Smart and Low Carbon Urban Development

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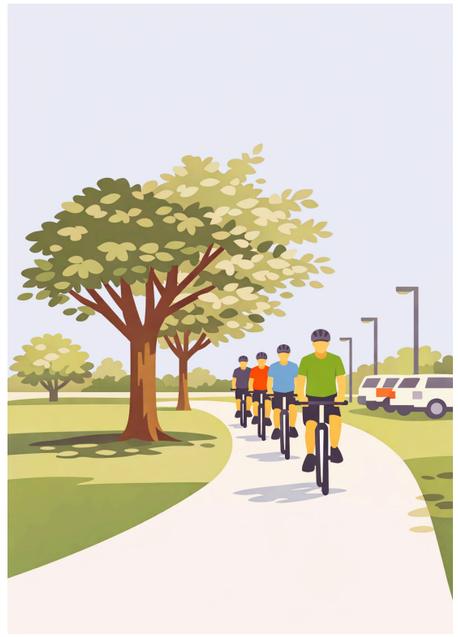
List of Abbreviations	
ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
C40	C40 Cities Climate Leadership Group
CDP	Carbon Disclosure Project
COP	Conference of the Parties (UNFCCC)
FDI	Foreign direct investment
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Geographic information system
HDI	Human Development Index
ICT	Information and communication technology/technologies
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunication Union
NDC	Nationally determined contribution
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
PM2.5	Particulate matter with aerodynamic diameter ≤2.5 □m
PPP	Public–private partnership
RFID	Radio-frequency identification
SDG	Sustainable Development Goal
SPV	Special Purpose Vehicle
TEVET	Technical, Entrepreneurial and Vocational Education and Training
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-Habitat	United Nations Human Settlements Programme
WFP	World Food Programme
WHO	World Health Organization
WRI	World Resources Institute

Chapter 1



Introduction

Chapter 1: Introduction

The future world is urban. Over half of the world's population now live in cities, and this population is expected to expand to 70% by 2050.[1] However, global urbanisation is highly uneven, with regional disparities. This report takes a global scan of these regional disparities (Africa and the Middle East, Asia, Europe, Latin America and the Caribbean, North America, and Oceania), identifying key trends, existing and emerging urban challenges, solutions and transition pathways to achieving sustainable urban development. The analysis draws on desktop research, including a range of reports, policy papers, analytical reviews, and peer-reviewed academic research on urbanisation and sustainable urban development. It covers projection horizons to 2100, with attention on short- and medium-term action to 2050 (Table 1.1). These discussions are informed by widely recognised global urban priorities—such as SDG-linked targets, digital transformation, demographic shifts, and climate resilience. The temporal framing reinforces the importance of aligning urban development strategies with global priorities and evolving regional and local challenges and opportunities. Identifying key temporal landmarks is a tested pathway in urban solutioning—it encourages coordinated action to ensure that large, long-term aspirations are broken down into manageable, actionable steps where short-term actions (like achieving SDG, building foundational resilience) are integrated with medium- and long-term transitions towards resilient, smart, low carbon, and inclusive development.

1 United Nations Global Perspective Human Stories. (2025, November 18). Cities now home to nearly half of humanity: UN report | UN News. https://news.un.org/en/story/2025/11/1166395

Table 1.1. Projection horizons, themes, and examples

Horizon	Timeframe	Main Themes	Actionable Examples
Short-term	To 2030	SDG 11 (Sustainable Cities), disaster risk reduction, inclusive urbanisation, climate adaptation, nationally determined contributions (NDCs)	UNDP NDC Global Report 2024, IPCC AR6 Synthesis Report, UNDP-ODI Analytical Review, OECD Regions and Cities at a Glance
Medium-term	2030–2035	Scaling up digital transformation, smart city initiatives, digital governance, urban mobility, energy	Research Trends on Sustainable Development in Smart Cities, Grand Challenges in Sustainable Cities, OECD Strengthening Regional Policy for Resilient Places
	2035–2040	AI adoption, digital inclusion, urban technology, emissions reduction, demographic change	Systematic Review of Sustainable Urban Community Development, Smart City & AI Integration Studies, OECD Regional Development Papers
Long-term	2041–2060	IPCC mid-term for climate/urban risk, adaptation effectiveness, infrastructure resilience	IPCC AR6 WGII Technical Summary, Building Urban Resilience: Principles, Tools and Practice, Cities Turning Crisis into Change
	2050 and beyond	Net-zero emissions, climate resilience, low-carbon pathways, nature-based solutions, demographic transitions	IPCC AR6 Synthesis Report, UNDP-ODI Analytical Review, World Bank – Banking on Cities, OECD Long-Term Scenarios
	2081–2100	IPCC long-term for climate/urban risk, adaptation/mitigation limits, sustainability of pathways	IPCC AR6 WGII Technical Summary, IPCC AR6 Synthesis Report
End-of-century	2100	Ultimate benchmark for climate, urban, and resilience scenarios (warming, sea-level rise, population)	IPCC AR6 Synthesis Report, World Bank – Building Urban Resilience.

The analysis applies a holistic approach, encompassing the environmental (planet), economic (prosperity), social (people), and technological (innovation) lens of sustainable development to provide a comparative understanding of the challenges, trajectories, and solutions for urbanisation and sustainable development (Figure 1.1).

Figure 1.1. Analytical framework

- Environmental lens focuses on cities as both contributors to ecological pressures—such as greenhouse gas emissions, biodiversity loss, and resource depletion, and as focal points for climate adaptation and resilience strategies, including nature-based solutions and risk-informed planning and management to ensure that resources are available for future generations.[2]
- Economic lens discusses urban areas as drivers of growth, innovation, and productivity, while also being sites of pronounced inequality, informality, and vulnerability to global shocks, and the goal of building resilient, thriving economic systems that support human health and wellbeing.[3]
- Social lens emphasises improving quality of life and building resilient communities. Most actionable examples focus on governance structures, demographic transitions, and patterns of inclusion and exclusion, with a focus on equity, participation, and the lived experiences of diverse urban populations.[4]
- Technological lens identifies the innovation/catalyst/accelerator that improve environmental, economic, and social outcomes. The Technology-Environmental, Economic, and Social Sustainability Theory posits that, to be effective, technological innovation must simultaneously improve environmental, economic, and social outcomes.[5] Reports on global innovation trends track the adoption of digital infrastructure, smart city initiatives, and data-driven governance, emphasising both the transformative potential and the risks of deepening digital divides.[6]

Methodologically, the comparative scope of the global scan is supported by a mix of quantitative data, case studies, and policy frameworks, with regional coverage spanning megacities, secondary cities, and rapidly urbanising regions in both the Global North and Global South. Thematic focus varies from climate change and infrastructure to social inclusion and digital innovation, cross-regional comparisons and the identification of both universal trends and context-specific challenges and strategies. The goal of this integrated, comparative approach seeks to not only map current urban realities but also inform adaptive, forward-looking strategies for sustainable urban futures.

1.1 Global trends

Urbanisation continues to accelerate worldwide, driven by economic opportunities and demographic shifts.[7] Global urbanisation has surged from 3% in 1800 to 47% in 2000, with a projection to reach 70% by 2050. From 2015 to 2020, urban populations worldwide increased by over 397 million, mostly in less developed regions. By 2050, cities are expected to add 2.5 billion more people, with about 90% of this growth occurring in

2 Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.* (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647; Jha, A. K., Miner, T. W., & Stanton-Geddes, Z. (Eds.). (2013*). Building Urban Resilience: Principles, Tools, and Practice*. The World Bank. https://doi.org/10.1596/978-0-8213-8865-5

3 OECD. (2025). Strengthening regional policy for resilient places: Key issues and policy considerations. *OECD Regional Development Papers*. https://doi.org/10.1787/ea24eab5-en; Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.

4 Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., …Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.* (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647; Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.

5 Al-Emran, M. (2023). Beyond technology acceptance: Development and evaluation of technology-environmental, economic, and social sustainability theory. *Technology in Society*, 75, 102383.

6 OECD. (2025). Strengthening regional policy for resilient places: Key issues and policy considerations. *OECD Regional Development Papers*. https://doi.org/10.1787/ea24eab5-en; Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.

7 Onyango, A. O. (2018). Global and Regional Trends of Urbanization: A Critical Review of the Environmental and Economic Imprints. *World Environment*, *8*(2), 47–62.

Asia and Africa. [8] While urbanisation processes may bring economic opportunities, they often also contribute to increased vulnerability, which in conjunction with climate change, amplify urban risks and associated impacts. 9 The most significant rise in urban vulnerability has occurred globally in cities and settlements with limited adaptive capacity, notably within unplanned and informal areas of low- and middle-income countries and in small to medium-sized urban centres.[10] At the same time, developed areas are also facing their own challenges such as lower birth rates and an ageing population.[11]These trends present notable challenges, including growing inequality, increased stress on infrastructure, and heightened environmental concerns as well as opportunities to act and transition towards sustainable urban futures.

1.1.1 Urban resilience trends

Urban resilience has become a central theme in global urban policy, with frameworks emphasising integrated planning, adaptive governance, nature-based solutions, and regenerative cities to mitigate risks and enhance sustainability.[12] Urban resilience refers to the capacity of urban systems—including infrastructure, communities, and governance structures to withstand, adapt to, and recover from shocks and stresses while maintaining essential functions and pursuing sustainable development. It encompasses multiple dimensions: physical robustness of infrastructure, social inclusion, economic adaptability, ecological integrity, and governance effectiveness.[13] Contributing factors include risk-informed land-use planning, redundancy in critical systems, participatory governance, and integration of ecosystem services into urban design.[14] However, definitions vary across disciplines and institutions—some prioritise disaster risk reduction, others stress socio-economic equity or climate adaptation making urban resilience a "boundary concept" with contested interpretations.[15]

The concept of urban resilience has evolved significantly over time: initially rooted in engineering resilience (focused on consistent operation in a stable state), it shifted towards ecological resilience in the 1990s, emphasising adaptability, and later to evolutionary resilience post-2010, which views resilience as a dynamic process of transformation and learning. [16] Over the past twenty years, urban resilience research has grown rapidly, developing through three main phases: an initial stage (2003–2011) with nascent discourse, a development stage (2012–2017) spurred by attention toward global disasters, and a rapid growth stage (after 2017) influenced by climate change and the COVID-19 pandemic. The field draws on multiple disciplines, with research interests moving from risk management topics like PM2.5 and flood risks to areas such as green infrastructure, urban ecosystem services, and lately, interconnected systems and cascading impacts. Recently, new topics have come into focus, including environmental justice, urban farming, and creating urban resilience indices. Another is regenerative city.

Emerging out of an ecological worldview, the regenerative approach moves beyond mitigating further harm in urban centres to consider how human actions can contribute to the self-healing capacity of nature and natural systems.[17] The regenerative approach aims to achieve net positive outcomes for a 'mutually supportive symbiosis' between the built, cultural and natural environments, shifting the human-nature relationship from binary, hierarchical, and exploitative to integrated, co-evolutionary, mutually dependent, and dialectically beneficial. [18] Regenerative development often involves continuous processes (e.g., collaborative processes) to ensure the regenerative (self-renewing) capacity of a project (e.g., resource regeneration, built environment regeneration). These projects are emerging mostly in cities in Europe and North America, e.g., Copenhagen, Los Angeles, Vancouver, emphasising the co-evolution of human and natural systems

8 Intergovernmental Panel on Climate Change (Ed.). (2023). *Climate change 2022: Impacts, adaptation and vulnerability: Working Group II contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

9 Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland*. (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647.

10 Onyango, A. O. (2018). Global and Regional Trends of Urbanization: A Critical Review of the Environmental and Economic Imprints. World Environment, 8(2), 47–62.

11 Haase, D., Güneralp, B., Dahiya, B., Bai, X., & Elmqvist, T. (2018). Global Urbanization: Perspectives and Trends. In C. Griffith, D. Maddox, D. Simon, M. Watkins, N. Frantzeskaki, P. Romero-Lankao, S. Parnell, T. Elmqvist, T. McPhearson, & X. Bai (Eds.), *Urban Planet: Knowledge towards Sustainable Cities* (pp. 19–44). Cambridge University Press. https://doi.org/10.1017/9781316647554.003

12 Jha, A. K., Miner, T. W., & Stanton-Geddes, Z. (Eds.). (2013). *Building Urban Resilience: Principles, Tools, and Practice*. The World Bank. https://doi.org/10.1596/978-0-8213-8865-5; Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.

13 Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.; Jha, A. K., Miner, T. W., & Stanton-Geddes, Z. (Eds.). (2013). *Building Urban Resilience: Principles, Tools, and Practice*. The World Bank. https://doi.org/10.1596/978-0-8213-8865-5

14 Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.; Jha, A. K., Miner, T. W., & Stanton-Geddes, Z. (Eds.). (2013). *Building Urban Resilience: Principles, Tools, and Practice*. The World Bank. https://doi.org/10.1596/978-0-8213-8865-5; Stewart, J. (2024). *Urban Content of NDCs*. UNDP and United Nations Human Settlements Programme 2024. https://unhabitat.org/sites/default/files/2025/09/ndc_global_report_2024.pdf

15 Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. *Landscape and Urban Planning*, *147*, 38–49. https://doi.org/10.1016/j.landurbplan.2015.11.011

16 Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, *4*, 1–23.; Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary Resilience and Strategies for Climate Adaptation. *Planning Practice & Research*, *28*(3), 307–322. https://doi.org/10.1080/02697459.2013.787695; Sun, J., Li, W., Mu, H., Li, M., Zhai, N., & Liu, H. (2025). Mapping the Evolving Landscape of Urban Resilience: A Scientometric Analysis Using CiteSpace. *Journal of Planning Literature*, 08854122251322735. https://doi.org/10.1177/08854122251322735

17 Clegg, P. (2012). A practitioner's view of the 'regenerative paradigm'. *Building Research and Information*, *40*(3), 365–368.

18 du Plessis, C. (2012). Towards a regenerative paradigm for the built environment. *Building Research & Information, 40*(1), 7–22.

and building natural and social capital, not just resilience.[19]

Collaborative work is most common among institutions in developed regions—especially Europe and North America—with the United States, United Kingdom, Italy, Australia, Germany, and the Netherlands leading in both research output and partnerships. China has increased its publication count but still trails behind in international cooperation. Currently, the research landscape is increasingly influenced by big data, AI, and participatory interdisciplinary approaches, alongside a stronger emphasis on practical solutions and thorough assessment frameworks for urban resilience.[20] This evolution reflects growing recognition of cities as complex adaptive systems. While global frameworks such as the SDGs, New Urban Agenda, and Sendai Framework endorse resilience as a universal goal, its operationalisation differs widely by region and context, indicating that consensus on a single definition remains elusive.[21]

The discourse on urban resilience increasingly intersects with the rise of smart city initiatives and low carbon development strategies, reflecting a systemic shift towards integrated sustainability solutions. Smart cities leverage digital technologies—such as IoT, AI, and big data analytics—to optimise resource use, enhance energy efficiency, and improve urban governance, thereby reinforcing resilience against environmental shocks and long-term climate risks.[22] Low carbon pathways complement this by embedding decarbonisation targets into urban planning, promoting renewable energy adoption, electrified mobility, and circular economy practices that reduce greenhouse gas emissions while safeguarding ecological integrity.[23] From an environmental perspective, these approaches enable real-time monitoring of air quality, water systems, and energy flows, supporting adaptive responses to climate variability.[24] Economically, they foster innovation ecosystems and green entrepreneurship, creating new markets for sustainable technologies and services.[25] Socially, the integration of participatory governance and digital inclusion within smart city frameworks addresses equity concerns, ensuring that technological benefits extend to marginalised communities rather than exacerbating digital divides.[26] Technologically, the convergence of smart infrastructure and low-carbon design underpins resilient urban systems capable of anticipating and mitigating risks while advancing global sustainability goals.[27] This synergy positions urban resilience not as an isolated concept but as a dynamic, multi-dimensional strategy embedded within broader transitions towards smart, low carbon futures.

1.1.2 Smart city trends

Smart cities are urban environments that strategically leverage digital technologies, information and communication infrastructure, and data-driven approaches to enhance the efficiency of urban services, improve the quality of life for citizens, and foster sustainable environments.[28] Rather than being defined solely by the presence of advanced technologies, scholars increasingly highlight sustainability and inclusivity such as people-centric urban transformation towards sustainability transition.[29] In parallel, the United Nations organisations (e.g., the International Telecommunication Union) emphasises the notion of smart sustainable cities, the purposeful use of ICT and other digital tools to meet the economic, social, environmental, and cultural needs of both present and future generations by fostering collaboration, capacity building, policy development, and awareness-raising.[30] UN-Habitat underscores the people-centred smart city, defining it as, [31]

> *"a city that leverages technology to improve the quality of life of people and the social, economic and environmental sustainability and resilience of cities and human settlements. It ensures that smart city innovations are developed through participatory approaches and collaboration, providing equitable access to digital services, skills and infrastructures especially for persons in*

19 Boselli, F. (2016). Cities must be regenerative. But what kind of regeneration are we actually talking about. *World Future Council*. https://www. worldfuturecouncil. org/cities-must-regenerative-kindregeneration-actually-talking.

20 Sun, J., Li, W., Mu, H., Li, M., Zhai, N., & Liu, H. (2025). Mapping the Evolving Landscape of Urban Resilience: A Scientometric Analysis Using CiteSpace. *Journal of Planning Literature*, 08854122251322735. https://doi.org/10.1177/08854122251322735

21 Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.; Stewart, J. (2024). *Urban Content of NDCs*. UNDP and United Nations Human Settlements Programme 2024. https://unhabitat.org/sites/default/files/2025/09/ndc_global_report_2024.pdf

22 Stewart, J. (2024). *Urban Content of NDCs*. UNDP and United Nations Human Settlements Programme 2024. https://unhabitat.org/sites/default/files/2025/09/ndc_global_report_2024.pdf; Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.* (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647

23 Stewart, J. (2024). *Urban Content of NDCs*. UNDP and United Nations Human Settlements Programme 2024. https://unhabitat.org/sites/default/files/2025/09/ndc_global_report_2024.pdf; OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

24 Intergovernmental Panel On Climate Change (Ipcc). (2023). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009325844

25 OECD. (2025). Strengthening regional policy for resilient places: Key issues and policy considerations. *OECD Regional Development Papers*. https://doi.org/10.1787/ea24eab5-en

26 Stewart, J. (2024). *Urban Content of NDCs*. UNDP and United Nations Human Settlements Programme 2024. https://unhabitat.org/sites/default/files/2025/09/ndc_global_report_2024.pdf; Cao, Y., Wilkinson, E., Pettinotti, L., Colenbrander, S. and Lovell, E. (2021) *A Decade of Urban Resilience: An Analytical Review*. UNDP.

27 Intergovernmental Panel On Climate Change (Ipcc). (2023). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009325844

28 De Guimarães, J. C. F., Severo, E. A., Felix Júnior, L. A., Da Costa, W. P. L. B., & Salmoria, F. T. (2020). Governance and quality of life in smart cities: Towards sustainable development goals. *Journal of Cleaner Production*, *253*, 119926. https://doi.org/10.1016/j.jclepro.2019.119926

29 Yuen, B., Cai, Y., Chan, F., Yang, X., & Lim, K. (2024). *11 Smart Cities*. World Scientific.

30 ITU. (n.d.). *Smart sustainable cities*. https://www.itu.int:443/en/mediacentre/backgrounders/Pages/smart-sustainable-cities.aspx

31 UN-Habitat. (n.d.). *People-centered smart cities*. https://unhabitat.org/sites/default/files/2021/01/fp2-people-centered_smart_cities_04052020.pdf

> *vulnerable situations. It promotes and protects human rights and fundamental freedoms, with multi-level governance systems and regulations ensuring that technology supports sustainable development rather than becoming the goal itself."*

Smart cities are generally understood to have first emerged in the early–mid 1990s, when the term began to be used to describe cities leveraging information and communication technologies (ICT) to address urban governance, economic competitiveness, and quality of life challenges rather than purely physical infrastructure.[32] The earliest adopters were primarily European and North American cities between 1990 and 2000—e.g., Amsterdam's De Digitale Stad (The Digital City, 1994-2001)[33], which inspired similar initiatives in Germany, Austria, United Kingdom, France, Italy, Sweden, Canada, and the United States. Other early initiatives in cities such as San Diego, Ottawa, and Southampton, utilised ICT to promote digital access, online public services, citizen participation, and knowledge-based economic development, laying the foundations for the later, more sensor- and data-driven smart city models of the 2000s.[34]

Smart cities present a governance-driven process that requires coordination and collaboration across sectors and stakeholders, integrates digitalisation and innovation efforts with key urban objectives and citizens' quality of life, and overcomes the digital divide and social inequality. The global literature on smart cities identifies several trends in smart city adoption. One notable trend is the growing citizen-centric approach to smart city development, including involving citizens in urban planning and policies as the drivers and actors through digital platforms and co-creation initiatives.[35] A second trend is the alignment of smart city strategies with broader urban policy agendas such as climate action, sustainable development, and social inclusion, signalling a shift from technology-centric development to institutionally embedded urban transformation.[36] A third trend is that policymakers increasingly adopt an entrepreneurial mindset to promote and implement key smart technologies, such as the Internet of Things, Cloud Computing, and Artificial Intelligence, which present considerable financial and technical challenges, leading to more sustainable business models that encourage private-sector investment and public-private partnerships.[37]

In practice, the most common smart city implementations globally are concentrated in several sectors, e.g.,

- Smart mobility and transportation applications—such as intelligent traffic management using sensors and AI, real-time public transport information, and integrated ticketing systems—are among the most widely deployed.[38]
- Smart energy—such as smart lighting systems, smart grids and metering, and smart buildings to optimise energy consumption, integrate renewable sources, and ensure infrastructure resilience.[39]
- Smart planning—increasingly, cities have begun implementing urban data platforms and even digital twins to streamline service access, support planning and infrastructure management, and foster efficiency and engagement, though these remain unevenly distributed across regions and income levels.[40]

The literature outlines a range of potential benefits associated with smart city initiatives when they are effectively designed and implemented. These include,

- Improved service efficiency and responsiveness.[41]
- Optimising services and public resources.[42]
- Enhanced capacity for real-time monitoring and early intervention, especially during crises.[43]
- Supporting environmental sustainability and enhancing urban resilience

32 Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, *22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092; Hollands, R. G. (2008). Will the real smart city please stand up? *City*, *12*(3), 303–320. https://doi.org/10.1080/13604810802479126

33 UNESCO. (2021). *DDS: De Digitale Stad / The Digital City - Memory of the World*. Memory of the World. https://www.unesco.org/en/memory-world/dds-de-digitale-stad/digital-city

34 Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, *22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092; Hollands, R. G. (2008). Will the real smart city please stand up? *City*, *12*(3), 303–320. https://doi.org/10.1080/13604810802479126

35 Angelidou, M., Politis, C., Panori, A., Bakratsas, T., & Fellnhofer, K. (2022). Emerging smart city, transport and energy trends in urban settings: Results of a pan-European foresight exercise with 120 experts. *Technological Forecasting and Social Change*, *183*, 121915. https://doi.org/10.1016/j.techfore.2022.121915

36 Angelidou, M., Politis, C., Panori, A., Bakratsas, T., & Fellnhofer, K. (2022). Emerging smart city, transport and energy trends in urban settings: Results of a pan-European foresight exercise with 120 experts. *Technological Forecasting and Social Change*, *183*, 121915. https://doi.org/10.1016/j.techfore.2022.121915; UN-Habitat. (n.d.). *People-centered smart cities*. Op. Cit.

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by enabling energy efficiency, emissions reduction, and more informed urban planning decisions.[44]

- At a governance level, digital platforms may increase transparency and accountability, encourage citizens to provide feedback and participate in decision-making, and contribute to improved trust in public institutions, attracting investment and creating new business opportunities.[45]

At the same time, global evidence highlights significant challenges that constrain the realisation of proposed benefits,

- Data security and privacy risks remain central concerns, particularly in contexts where regulatory frameworks and institutional capacity are weak.[46]
- Digital exclusion and divide persist as a structural issue as smart services may disproportionately benefit populations with higher levels of digital access and literacy, thereby reinforcing existing inequalities.[47]
- Cities also face risks related to significant initial investments and unpredictable long-term costs, political differences during political election cycles, and a lack of standardisation and strategic approaches, especially when smart city investments are driven by short-term pilots rather than integrated planning and operation.[48]

1.1.3 Low carbon trends

Low carbon development refers to transition pathways that aim to achieve economic growth and social well-being, thereby improving quality of life while substantially reducing reliance on carbon-intensive energy sources and avoiding long-term carbon lock-in.[49] In the face of increasing climate hazards and extreme weather events, low carbon approaches emphasise transforming energy systems, transport, buildings, land use, and consumption patterns to build climate resilience.[50] More than emissions-reduction measures, low carbon development involves economic changes, technological enablers, and policy integration with broader urban development objectives such as poverty reduction, social equity, and ecological sustainability, aiming to achieve a balance among the economy, environment, and society.[51]

Sweden was one of the earliest adopters of a formal low carbon policy, with the Swedish carbon tax enacted in 1991. It is described as one of the first comprehensive climate mitigation instruments worldwide. The policy focused on pricing carbon emissions across energy and transport sectors to decouple economic growth from greenhouse gas emissions, establishing a foundational model for subsequent low-carbon transition strategies internationally.[52] Globally, the trajectory of low carbon development has evolved from sector-specific mitigation efforts towards more comprehensive, system-level transitions. Early efforts in the 1990s and 2000s focused mainly on energy efficiency improvements and renewable energy deployment, often driven by national climate policies and international climate finance mechanisms.[53] Since the mid-2010s, particularly following the adoption of the Paris Agreement in 2015, low carbon strategies have increasingly been embedded within national development plans and visions (e.g., climate-neutral EU by 2050, carbon neutral China before 2060) and urban policies,[54] with cities recognised as transformative actors due to their concentration of population, economic activities, and political resources.[55]

More recently, the discourse has expanded to encompass net-zero targets, just transition principles, and the alignment of social policy objectives.[56] In particular, there is an emphasis on the whole-system approach, including procedural, distributive, recognition, and restorative interventions, addressing environmental and socio-

44 Hui, C. X., Dan, G., Alamri, S., & Toghraie, D. (2023). Greening smart cities: An investigation of the integration of urban natural resources and smart city technologies for promoting environmental sustainability. *Sustainable Cities and Society*, *99*, 104985. https://doi.org/10.1016/j.scs.2023.104985

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economic concerns.[57] Increasingly, policy frameworks are turning the spotlight on co-benefits, recognising that low carbon interventions can simultaneously advance air quality, public health, and economic productivity, thereby strengthening political and social support.[58] In addition, digitalisation and smart technologies are increasingly leveraged to enable low carbon transitions, supporting real-time energy management, demand response, service optimisation, and data-driven planning and management.[59]

In practice, low carbon development strategies focus on several urban sectors. For instance, there are noticeable efforts to deploy renewable energy systems and smart grids as well as to improve energy efficiency in buildings through better design, materials, and smart operational technologies.[60] The promotion of low carbon mobility through scaling up vehicle electrification, improving vehicle efficiency, and investing in public transport and micromobility infrastructure is also significant.[61] Cities also adopt low carbon urban planning and management approaches such as mixed-use and transit-oriented development, compact city and 15/20-minute neighbourhoods, and increasingly integrate with digital platforms and urban data systems to monitor emissions, optimise energy use, and support evidence-based decision-making for sustainability.[62]

The literature highlights several key benefits associated with low carbon development,

- Most directly, low carbon approaches can contribute to climate change mitigation by reducing greenhouse gas emissions and supporting progress towards local and global climate action targets.[63]
- Low carbon measures can generate significant co-benefits, including improved air quality, reduced health burdens, enhanced energy security, and long-term energy cost savings.[64]
- Integrated low carbon strategies can stimulate green economic activity and innovation, foster new industries and capital investments, and drive job creation in green sectors.[65]
- Low carbon development can potentially enhance social well-being of the citizens such as reducing poverty, promoting accessibility and inclusion, and improving urban sanitation.[66]

Substantial challenges also exist, especially in rapidly urbanising and lower-income contexts,

- Many low carbon technologies and infrastructure projects have high initial costs, which can deter investments, especially in developing countries with limited access to finance.[67]
- Governance capacity constraints, institutional fragmentation, and uncertainty around long-term policy commitments can slow the pace of transition as implementation requires coordination and collaboration across many stakeholders and sectors.[68]
- While some technologies are mature, breakthrough innovations can face conflicts over intellectual property rights and require significant time for commercialisation.[69]
- These challenges underline the importance of framing low carbon development as a long-term governance and socio-economic transformation process that requires coordinated and collaborative action across multiple levels, sectors, and actors.

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1.2 Regional trends

Urbanisation trajectories vary significantly across regions due to historical, economic, demographic, and policy contexts. High-income regions such as Europe and North America urbanised earlier—by 2014, over 70% of their populations lived in cities. Today, these regions are experiencing slower growth, with challenges centred on ageing populations, housing affordability, and retrofitting infrastructure for sustainability.[70] In contrast, Africa and Asia are now seeing the fastest rates of urban growth, fuelled by youthful populations, high fertility, and rural-to-urban migration, often without adequate planning capacity.[71] Africa's urban population is projected to double from 700 million to 1.4 billion by 2050.[72] Asia is experiencing an unprecedented, rapid urban transition, becoming the world's most urban continent with 62.9% of its population expected to live in cities by 2050.

Urbanisation is, however, not even—not just between regions but also within regions. Asia's rapid urbanisation is heavily concentrated in East and South Asia (Delhi, Shanghai, Dhaka, Beijing), driven by megacities, rising middle-class consumption, and infrastructure development. Aside from megacities, small and medium-sized cities (urban population under 1 million) are at the heart of Asia's urban transition—about 60% of the region's urban population reside in these urban areas. These smaller, often faster-growing cities are undergoing the most intense, yet frequently under-resourced, demographic shifts.

These regional disparities are compounded by national definitions of "urban", which differ widely and influence statistical interpretations of urbanisation levels.[73] For instance, towns are classified as urban in Europe but often considered rural in Asia and Africa, masking the true extent of urban living in these regions. Geographic constraints also play a role: landlocked developing countries urbanise gradually due to limited market access, while small island developing states exhibit stable, city-dominant patterns shaped by coastal concentration and climate vulnerability.[74]

Among key regional issues, housing challenges differ notably across regions. In rapidly urbanising regions such as Africa and Asia, informal settlements proliferate due to unplanned growth and inadequate housing supply, creating deficits in sanitation and basic services.[75] In contrast, high-income regions face challenges with affordability and retrofitting older housing stock for energy efficiency.[76] Circularity—closing resource loops through recycling and sustainable construction—is gaining traction in Europe and parts of Latin America, supported by policy frameworks aligned with the global New Urban Agenda, while implementation remains limited in low-income regions due to financial and technical constraints.[77] Transportation trends also diverge: African and Asian cities face congestion and limited public transit, whereas European, Australian and North American cities prioritise low carbon mobility such as electrification and active transport infrastructure.[78] Emerging global trends include the rise of secondary cities as connectors between rural and urban economies, the rapid expansion of urban built-up areas (raising sustainability concerns), and the integration of digital technologies for smart city planning.[79]

There are diverse urban forms, from rapid city expansion to instances of shrinking urban population in post-industrial places, organic, irregular, informal settlements to top-down, master-planned new towns, and the rise of new types of urban spaces like peri-urban zones urban villages, and "Cittaslow" towns. Projections indicate that urban areas will keep growing and evolving in form. 80 The implication is that infrastructure—including transport, energy, and digital systems—must be tailored to regional and local contexts to enhance competitiveness and resilience.81 Several factors influence infrastructure and urban development (Figure 1.2),

70 United Nations. (2025). *World Urbanization Prospects 2025: Summary of Results | Population Division*. United Nations Department of Economic and Social Affairs. https://www.un.org/development/desa/pd/content/world-urbanization-prospects-2025-summary-results; OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en;

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73 United Nations. (2025). *World Urbanization Prospects 2025: Summary of Results | Population Division*. United Nations Department of Economic and Social Affairs. https://www.un.org/development/desa/pd/content/world-urbanization-prospects-2025-summary-results

74 *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times* (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94). (2024). https://doi.org/10.1787/05c005d5-en; UN-Habitat. (n.d.). Annual Report 2023: Local action in a time of crises. UN-Habitat. Retrieved December 18, 2025, from https://unhabitat.org/annual-report-2023.

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76 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

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78 *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times* (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94). (2024). https://doi.org/10.1787/05c005d5-en

79 United Nations. (2025). *World Urbanization Prospects 2025: Summary of Results | Population Division*. United Nations Department of Economic and Social Affairs. https://www.un.org/development/desa/pd/content/world-urbanization-prospects-2025-summary-results

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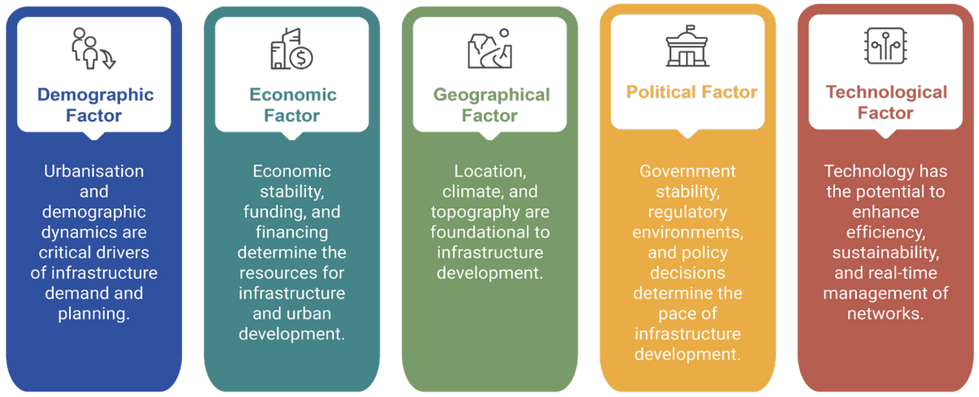
81 OECD. (2025). Strengthening regional policy for resilient places: Key issues and policy considerations. *OECD Regional Development Papers*. https://doi.org/10.1787/ea24eab5-en

Figure 1.2. Factors influencing infrastructure and urban development



- Demographic factor—urbanisation and demographic dynamics, including age, income, education, and population density—are critical drivers of infrastructure demand and planning.[82] These considerations determine infrastructure priorities—the need for services like healthcare, transportation, and housing, directly influencing investment in schools, roads, and utilities. For instance, ageing populations in high-income regions require more healthcare facilities, while rapid urbanisation trends demand, and, in some cases, overwhelm, city-level infrastructure.
- Economic factor—economic stability, funding and financing including partnerships determine the resources for infrastructure and urban development. Economic activities are strong push (eg rural poverty) - pull (eg better access to employment and amenities) factors driving the concentration of people in urban centres.
- Geographical factor—including location, climate, topography, are foundational to infrastructure development, determining the feasibility, cost, and design of services like transport, energy, and communication networks. Technology and engineering are utilised to overcome physical barriers.
- Political and institutional factor—government stability, regulatory environments, and policy decisions determine the pace of infrastructure development. Weak institutional capabilities can hinder implementation.
- Technological factor—technology has the potential to enhance efficiency, sustainability, and real-time management of networks, effectively turning telecommunication infrastructure into a "fourth utility". Digital innovations like IoT, AI, big data, and cloud computing, are moving infrastructure development into smart systems. But they are not without challenge—rapid technology evolution requires faster adaptation, integration with existing infrastructure system, among others.

82 Cristian, W., Anna,Wahba Tadros, Sameh Naguib,Baeumler, Axel E. N. ,D'Aoust, Olivia Severine,Das, Maitreyi B,Gapihan, Anne Treylane,Goga, Soraya,Lakovits, Carina,Palmarini, Nic,Restrepo Cadavid, Paula,Singh, Gayatri,Terraza, Horacio. (2021). Demographic Trends and Urbanization. World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/260581617988607640

Regions that demonstrate urban resilience tend to evolve and flourish by embracing innovation, nurturing diverse economies, supporting robust institutions, and ensuring sound governance.[83] Their strategies are holistic, integrating environmental, economic, social, and technological dimensions for maximum impact. International organisations including UN-Habitat[84], OECD[85] and the World Bank[86] are advocating the importance of spatial planning to mitigate spatially asymmetric effects of urban development. Key strategies include,

- Apply place-based policies and targeted infrastructure interventions rather than uniform, one-size-fits-all action. It is important for policies to be well-crafted and considerate of local circumstances, historic developments, and geographical attributes.
- Integrate social, economic, environmental, and technological factors when managing development asymmetry like air pollution, climate change impacts.
- Encourage cross-regional/border coordination to manage and prevent spatially uneven outcomes since natural hazards, pollution, and infrastructure often do not respect administrative boundaries.

In addition, the 17 SDGs, adopted by all UN member states in 2015, constitute the primary globally recognised framework for prosperity and planet sustainability by 2030. The SDGs, supported by 169 targets and 232 indicators, offer a universal, integrated approach to advancing economic, environmental, and social sustainability at the regional and local levels.

83 Christopherson, S., Michie, J., & Tyler, P. (2010). Regional resilience: Theoretical and empirical perspectives. *Cambridge Journal of Regions, Economy and Society*, *3*(1), 3–10. https://doi.org/10.1093/cjres/rsq004

84 UN-Habitat. (n.d.). *Annual Report 2023: Local action in a time of crises*. UN-Habitat. Retrieved December 18, 2025, from https://unhabitat.org/annual-report-2023

85 OECD & United Nations Human Settlements Programme. (2024). *Global State of National Urban Policy 2024: Building Resilience and Promoting Adequate, Inclusive and Sustainable Housing*. OECD. https://doi.org/10.1787/4db6994c-en

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1.3 Report structure

This report consists of eight chapters. Chapter 1 provides an overview of global and regional trends, challenges, and transitions towards resilient, smart, low carbon urban development. Chapters 2 through 7 detail findings from six regions: Africa and the Middle East, Asia, Europe, Latin America and the Caribbean, and North America, and Oceania respectively. Chapter 8 concludes with key urban trajectories, strategies, and learning points for achieving sustainable urban futures.

Chapter 1

Introduction to global and regional trends

Chapter 2

Africa and the Midde East

Chapter 3

Asia

Chapter 4

Europe

Chapter 5

Latin America and the Caribbean

Chapter 6

North America

Chapter 7

Oceania

Chapter 8

Global transitions and trajectories

Chapter 2

Africa and the Middle East

Chapter 2: Africa and the Middle East

2.1 Region context

Location	Africa and the Middle East
Countries	Africa: 54 countries Middle East: 14 countries (excluding Palestine)
Land Size	Total: ~35,119,793 square kilometres (2023)
Population	~ 1.85 billion (2025)
Population Ageing Trend	People over age 65: 6.8% in 2025, 16.2% by 2050
Urbanisation Level	48.9% of population live in urban areas (2025) Africa: 44.1% Middle East: 73.6%
Geographic Overview	Africa is characterised by climatic and ecological diversity, including desert, savannah, rainforest, and extensive coastline. Middle East is characterised by arid and semi-arid environments, limited freshwater availability, and high exposure to heat stress. The region spans two interconnected regions, linking Europe and Asia
Climate Risks	Extreme heat and heatwaves, drought, flooding in coastal and riverine cities
Key Urban Networks	African Union; African Development Bank; Arab League; Gulf Cooperation Council; C40; Resilient Cities Network; UN-Habitat; Cities Alliance

Source: Various Sources[87]

87 UNSD. (n.d.). *UNSD — Methodology*. Retrieved January 16, 2026, from https://unstats.un.org/unsd/methodology/m49/; UN-Habitat. (2024). *World cities report 2024: Cities and Climate Action*. United Nations Human Settlements Programme. https://unhabitat.org/wcr/; International Organization for Migration (IOM) (2024). *Sustainable Cities, Thriving Migrants: Enhancing Urban Livability for Migrants amidst Climate Challenges in MENA Cities*. https://mena.iom.int/sites/g/files/tmzbdl686/files/documents/2024-02/mena-cities_rdh.pdf; World Bank. (n.d.). *World Development Indicators*. https://databank.worldbank.org/source/world-development-indicators#; World Bank. (n.d.). *Population estimates and projections*. https://databank.worldbank.org/source/population-estimates-and-projections#

Africa and the Middle East, together constitute one of the most dynamic and consequential urban regions, accounting for a substantial share of the world's land mass, population growth, and future urban expansion. While the two regions are distinct—Africa comprising 54 sovereign states across five sub-regions, and the Middle East encompassing 14 non-African countries[88]—they are deeply interconnected through historical trade routes, contemporary labour migration systems, energy markets, and shared exposure to climate risks.[89] At the same time, they differ markedly in their demographic structures, development pathways, infrastructure provision, and institutional capacities.

The population of Africa and the Middle East is estimated at around 1.85 billion as of 2025.[90] The most populated countries include Nigeria, Egypt, Ethiopia, Iran, and Democratic Republic of the Congo (Table 2.1). Notably, Africa and the Middle East remain the world's youngest region, with only 6.8% of the population aged 65 and above in 2025 but this age segment is expected to rise to 16.2% by 2050.[91]

Table 2.1. Population of Africa and the Middle East (2000, 2025, 2050)

Country	**Population Estimates and Projections (Millions of People)**		
	2000	**2025**	**2050**
Africa and the Middle East (Region)	**1,000.6**	**1,849.9**	**2,876.5**
Algeria	30.9	47.4	59.6
Angola	16.2	39.0	74.3
Bahrain	0.6	1.6	2.1
Benin	7.2	14.8	24.4
Botswana	1.7	2.6	3.4
Burkina Faso	11.9	24.1	37.3
Burundi	6.5	14.4	24.1
Cabo Verde	0.5	0.5	0.6
Cameroon	14.9	29.9	51.1
Central African Republic	3.8	5.5	10.6
Chad	8.5	21.0	38.9

88 UNSD. (n.d.). *UNSD — Methodology*. Retrieved January 16, 2026, from https://unstats.un.org/unsd/methodology/m49/

89 NSDS Hub. (2019). *Rapid Urbanization in Africa and the Middle East*. https://thesouthernhub.org/topics/socio-economic/the-pressures-of-growth-rapid-urbanization-in-africa-and-the-middle-east.aspx

90 World Bank. (n.d.). *Population estimates and projections*. https://databank.worldbank.org/source/population-estimates-and-projections#

91 World Bank. (n.d.). *Population estimates and projections*. https://databank.worldbank.org/source/population-estimates-and-projections#

Comoros	0.5	0.9	1.3
Democratic Republic of Congo	50.5	112.8	218.2
Republic of Congo	3.2	6.5	11.0
Cote d'Ivoire	17.7	32.7	55.7
Djibouti	0.7	1.2	1.5
Arab Republic of Egypt	73.1	118.4	161.6
Equatorial Guinea	0.7	1.9	3.1
Eritrea	2.2	3.6	5.7
Eswatini	1.0	1.3	1.5
Ethiopia	67.4	135.5	225.0
Gabon	1.3	2.6	4.1
Gambia	1.5	2.8	4.3
Ghana	19.6	35.1	50.6
Guinea	8.4	15.1	23.4
Guinea-Bissau	1.2	2.2	3.4
Islamic Republic of Iran	66.4	92.4	101.9
Iraq	24.4	47.0	71.9
Israel	6.3	10.1	13.8
Jordan	5.4	11.5	16.4
Kenya	30.6	57.5	83.6
Kuwait	2.0	5.0	6.3
Lebanon	4.3	5.8	7.0
Lesotho	2.0	2.4	3.0
Liberia	2.9	5.7	8.9
Libya	5.3	7.5	9.3
Madagascar	16.5	32.7	53.2
Malawi	11.3	22.2	37.4
Mali	11.6	25.2	46.2
Mauritania	2.6	5.3	9.4
Mauritius	1.2	1.2	1.1
Morocco	28.4	38.4	43.4
Mozambique	18.1	35.6	63.5
Namibia	1.8	3.1	4.5
Niger	11.5	27.9	52.5
Nigeria	126.4	237.5	359.2
Oman	2.3	5.5	7.8
Qatar	0.6	2.9	3.9
Rwanda	8.2	14.6	22.7
Sao Tome and Principe	0.1	0.2	0.4
Saudi Arabia	16.2	35.9	49.2
Senegal	10.0	18.9	30.4
Seychelles	0.1	0.1	0.1
Sierra Leone	4.4	8.8	12.9
Federal Republic of Somalia	8.8	19.7	37.2
South Africa	47.2	64.7	79.2
South Sudan	6.0	12.2	18.3
Sudan	27.8	51.7	85.2
Syrian Arab Republic	16.6	25.6	37.8
Tanzania	34.3	70.5	129.6
Togo	5.1	9.7	15.6
Tunisia	9.8	12.3	13.1
Uganda	24.0	51.4	85.4
United Arab Emirates	3.5	11.2	15.1
West Bank and Gaza	2.9	5.4	8.1
Republic of Yemen	19.6	41.8	71.0
Zambia	10.0	21.9	38.1
Zimbabwe	11.9	17.0	25.9

Source: World Bank [92]

Urbanisation levels vary significantly across and within the region. The Middle East and North Africa are highly urbanised, with around 74% of its population living in cities.[93] This urbanisation is often driven by state-led investment and large-scale master planning. The Gulf nations like Kuwait (100%) and Qatar (99.35%) are nearly fully urban, while

92 World Bank. (n.d.). *Population estimates and projections*. https://databank.worldbank.org/source/population-estimates-and-projections#

93 International Organization for Migration (IOM) (2024). *Sustainable Cities, Thriving Migrants: Enhancing Urban Livability for Migrants amidst Climate Challenges in MENA Cities*. https://mena.iom.int/sites/g/files/tmzbdl686/files/documents/2024-02/mena-cities_rdh.pdf

Sudan has only 36% residing in urban areas.[94] While urbanisation brings economic opportunities, there are infrastructure and service challenges (e.g., health and safety provision), environmental limits and degradation (e.g., pollution), and social inequality, requiring sustainable planning, regional cooperation, and a focus on cultural heritage alongside high-tech solutions.[95] The Middle East cities are predominantly located in arid or semi-arid environments, where water scarcity and extreme heat impose significant constraints on urban form and infrastructure. Urban systems are heavily dependent on desalination, energy-intensive cooling, and imported food, resulting in some of the highest per-capita energy and water consumption levels globally, particularly in Gulf cities.[96]

Sub-Saharan Africa remains approximately 44.7% urbanised in 2025.[97] But this trend is expected to change in the coming decades. Africa is experiencing the world's fastest urbanisation, with its urban population set to double to 1.4 billion by 2050. [98] Geographically, Africa's urbanisation is shaped by a combination of coastal concentration, river systems, and resource-based development corridors. Cities along the Gulf of Guinea, the East African coast, and major river basins such as the Nile and Niger, are experiencing particularly rapid growth while facing increasing risks of rising sea levels and climate impacts.[99] Urbanisation brings both opportunities and challenges. Rapid urban growth often outpaces the capacity of planning institutions, infrastructure provision, and municipal finance systems, resulting in widespread informality and fragmented urban forms (e.g., slums) and social inequality that demand better planning, governance, and investment.[100]

Climate risk constitutes a defining urban challenge in this region. According to the Intergovernmental Panel on Climate Change's Sixth Assessment Report, Africa and the Middle East countries are among the most vulnerable globally to worsening climate change, experiencing faster warming, increased extreme weather (e.g., heatwaves, droughts, dust storms, floods), reduced food security, water stress, sea-level rise, and greater health risks, with significant impacts on development, especially for vulnerable populations.[101] In particular, North Africa is warming especially fast, creating severe water and food challenges, while shifts in rainfall patterns affect the Sahel, and bring erosion and flooding in coastal areas.[102] Urgent adaptation and mitigation are crucial to prevent further damage and loss of property and people.

From a development perspective, Africa and the Middle East together display the widest intra-regional inequality of any global macro-region. The United Nations Development Programme's Human Development Index ranks most Sub-Saharan African countries (e.g., Somalia and Sudan) within low or medium human development bands, even as several Middle East countries—including the United Arab Emirates, Qatar, and Saudi Arabia—are ranked among the highest globally (Qatar is ranked among the highest in the world for per capita income). But these growth leaders exist alongside fragile and conflict-affected states such as Yemen and Syria that rank among the bottom of global indices measuring peace, stability, and human development.[103] These rankings often obscure internal inequality, migrant labour dependence, and high ecological footprints.[104] The disparities are reflected spatially within cities, where globally competitive business districts and infrastructure megaprojects often co-exist with extensive informal settlements and underserved neighbourhoods.[105]

Institutionally, Africa and the Middle East lack a deeply embedded multilevel urban governance architecture. While regional and global urban networks—such as the African Union, African Development Bank, Arab League, Gulf Cooperation Council, and Resilient Cities Network —play an increasingly important agenda-setting and coordination roles, their capacity to enforce standards, mobilise sustained financing, or support systematic peer learning remains limited. Urban policy in the region is typically characterised by strong centralisation, with cities functioning primarily as implementation arms of

94 International Organization for Migration (IOM) (2024). *Sustainable Cities, Thriving Migrants: Enhancing Urban Livability for Migrants amidst Climate Challenges in MENA Cities*. https://mena.iom.int/sites/g/files/tmzbdl686/files/documents/2024-02/mena-cities_rdh.pdf

95 Jaad, A., & Abdelghany, K. (2021). The story of five MENA cities: Urban growth prediction modeling using remote sensing and video analytics. *Cities*, *118*, 103393. https://doi.org/10.1016/j.cities.2021.103393

96 Zaidan, E., & Abulibdeh, A. (2021). Master Planning and the Evolving Urban Model in the Gulf Cities: Principles, Policies, and Practices for the Transition to Sustainable Urbanism. *Planning Practice & Research*, *36*(2), 193–215. https://doi.org/10.1080/02697459.2020.1829278

97 World Bank. (n.d.). *Population estimates and projections*. https://databank.worldbank.org/source/population-estimates-and-projections#

98 OECD et al. (2025). *Africa's Urbanisation Dynamics 2025: Planning for Urban Expansion*. https://doi.org/10.1787/2a47845c-en

99 Africa Center for Strategic Studies. (2022). *Rising Sea Levels Besieging Africa's Booming Coastal Cities*. Retrieved January 16, 2026, from https://africacenter.org/spotlight/rising-sea-levels-besieging-africas-booming-coastal-cities-lagos-dakar-alexandria-maputo-nile/

100 OECD et al. (2025). *Africa's Urbanisation Dynamics 2025: Planning for Urban Expansion*. https://doi.org/10.1787/2a47845c-en

101 Intergovernmental Panel on Climate Change. (2022). *Climate change 2022: Impacts, adaptation, and vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama, Eds.). Cambridge University Press. https://doi.org/10.1017/9781009325844

102 Intergovernmental Panel on Climate Change. (2022). *Climate change 2022: Impacts, adaptation, and vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama, Eds.). Cambridge University Press. https://doi.org/10.1017/9781009325844

103 United Nations. (n.d.). Human Development Index. In *Human Development Reports*. United Nations. Retrieved December 26, 2025, from https://hdr.undp.org/data-center/human-development-index

104 Akasha, H., Ghaffarpasand, O., & Pope, F. D. (2024). Air pollution and economic growth in Dubai a fast-growing Middle Eastern city. *Atmospheric Environment: X*, *21*, 100246. https://doi.org/10.1016/j.aeaoa.2024.100246

105 Orkpeh, A. K., & Adedire, F. M. (2024). African urban peripheries and informal development: A review of challenges and sustainable approaches to inclusive cities. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, *78*(1), 40–53. https://doi.org/10.1080/00291951.2024.2325446; Carmody, P. R., Murphy, J. T., Grant, R., & Owusu, F. Y. (2023). *The Urban Question in Africa: Uneven Geographies of Transition*. John Wiley & Sons.

national development strategies rather than autonomous municipal policy actors.[106]

Urban systems in Africa and the Middle East are characterised by a highly uneven hierarchy of city sizes. In Africa, megacities such as Lagos, Cairo, and Kinshasa currently dominate national economies and attract global attention; By 2050, more than two-thirds of Africa's projected urban growth will take place in large cities; 17 megacities with more than 10 million inhabitants are expected.[107] Cities such as Johannesburg, Nairobi, and Cape Town serve as regional hubs and rank relatively well on governance and liveability within the continent, yet remain underrepresented in global rankings.[108] In the Middle East, urban systems are more centralised, with capital cities and a small number of metropolitan hubs—such as Riyadh[109] and Tehran[110] —concentrating population, investment, and political power, while medium-sized cities increasingly absorb migration and refugee inflows without commensurate service expansion, leaving them with increasing challenges.[111] Several Middle East cities, most notably Dubai, Abu Dhabi, and Doha,[112] have set ambitious goals to transform into global, sustainable, liveable, and diversified hubs to reduce dependence on oil by investing in technology and sustainability.

2.2 Urban challenges

Cities in Africa and the Middle East have the simultaneous task of building basic urban systems while responding to accelerating climate, social, and economic stresses. Three interrelated urban challenges are structurally significant within this region—climate vulnerability and environmental stress, housing informality and spatial inequality, and economic inequality and social pressures—requiring consideration of their scale, spatial distribution, affected populations, and possible policy responses.

106 Essien, E., & Jesse, E. E. (2025). Urban governance and political influence in contemporary urban settings of midsized cities in Nigeria. *Urban Governance*, *5*(2), 169–181. https://doi.org/10.1016/j.ugj.2025.05.003; Abubakar, I. R., & Alshammari, M. S. (2023). Urban planning schemes for developing low-carbon cities in the Gulf Cooperation Council region. *Habitat International*, *138*, 102881. https://doi.org/10.1016/j.habitatint.2023.102881

107 OECD. (2025). *Africa's Urbanisation Dynamics 2025: Planning for Urban Expansion*. https://doi.org/10.1787/2a47845c-en

108 Haffajee, F. (2025, December 29). *Global liveability index 2026: Why Cape Town and Nairobi beat Europe*. Daily Maverick. https://www.dailymaverick.co.za/article/2025-12-29-global-liveability-index-2026-why-cape-town-and-nairobi-beat-europe/; Agbetiloye, A. (2026, January 29). *Cairo and Johannesburg ranked among the most powerful cities in the world*. Business Insider Africa. https://africa.businessinsider.com/local/lifestyle/cairo-and-johannesburg-ranked-among-the-most-powerful-cities-in-the-world/b899bsl

109 Jaad, A., & Abdelghany, K. (2021). The story of five MENA cities: Urban growth prediction modeling using remote sensing and video analytics. *Cities*, *118*, 103393. https://doi.org/10.1016/j.cities.2021.103393

110 Madanipour, A. (2006). Urban planning and development in Tehran. *Cities*, *23*(6), 433-438.

111 Ahmed, S., Eklund, E., & Kiester, E. (2025). Small and mid-sized cities at the centre of climate adaptation in the global South: Planning and policy responses. *International Development Planning Review*, *47*(2), 141–151. https://doi.org/10.3828/idpr.2025.2

112 Zawya. (2025, October 20). *Gulf cities surge in global rankings on livability, innovation, say report*. https://www.zawya.com/en/economy/gcc/gulf-cities-surge-in-global-rankings-on-livability-innovation-say-report-ef0nt4dm

2.2.1 Climate vulnerability and environmental stress

Climate vulnerability and environmental stress are among the most cross-cutting urban challenges in Africa and the Middle East. According to the Intergovernmental Panel on Climate Change Sixth Assessment Report, cities in the region are among the most exposed globally to climate hazards, while simultaneously exhibiting some of the lowest adaptive capacities due to infrastructure deficits, informality, and limited fiscal resources.[113]

Coastal cities across Africa face recurrent flooding driven by sea-level rise, rapid urbanisation accompanied with overpopulation, and inadequate drainage infrastructure and poor maintenance.[114] For instance, in Lagos, the negative impacts of rising sea level and frequent flooding noticeably affect low-income neighbourhoods, where informal housing is concentrated on flood-prone land, and residents lack formal socioeconomic safety nets (e.g., insurance).[115] In Nairobi, increasingly intense rainfall events have overwhelmed drainage systems originally designed for much smaller populations, leading to repeated infrastructure failure and public health risks, especially in unplanned areas with poor physical infrastructures and social services.[116] In the Middle East, extreme heat represents the dominant risk, with summer temperatures in cities such as Riyadh and Baghdad, frequently exceeding thresholds for safe outdoor activity.[117] Urban heat island effects, combined with high reliance on air conditioning, amplify energy demand and exacerbate carbon intensity, particularly during peak periods.[118] Cities in the Arabian Peninsula have witnessed more frequent and intensified dust storms in recent decades, imposing deleterious effects on the environment, public health, and

113 Intergovernmental Panel on Climate Change. (2022). *Climate change 2022: Impacts, adaptation, and vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama, Eds.). Cambridge University Press. https://doi.org/10.1017/9781009325844

114 Dube, K., Nhamo, G., & Chikodzi, D. (2022). Flooding trends and their impacts on coastal communities of Western Cape Province, South Africa. *GeoJournal*, *87*(4), 453–468. https://doi.org/10.1007/s10708-021-10460-z

115 Adegun, O. B. (2023). Flood-related challenges and impacts within coastal informal settlements: A case from LAGOS, NIGERIA. *International Journal of Urban Sustainable Development*, *15*(1), 1–13. https://doi.org/10.1080/19463138.2022.2159415

116 Tom, R. O., George, K. O., Joanes, A. O., & Haron, A. (2022). Review of flood modelling and models in developing cities and informal settlements: A case of Nairobi city. *Journal of Hydrology: Regional Studies*, *43*, 101188. https://doi.org/10.1016/j.ejrh.2022.101188; Oluchiri, S. O. (2025). Urban Flooding in the Cities of Kisumu, Mombasa, and Nairobi, Kenya: Causes, Vulnerability Factors, and Management. *African Journal of Empirical Research*, *6*(1), 342–351.

117 El Kenawy, A. M., Aboelkhair, H., Mohamed, E. K., Gaber, I. M., Fernández-Duque, B., Peña-Angulo, D., & Abdelaal, M. M. (2024). Modes of summertime thermal urban stress over major cities in the Middle East: A comprehensive assessment of heat exposure risks. *Sustainable Cities and Society*, *102*, 105236. https://doi.org/10.1016/j.scs.2024.105236; El Kenawy, A. M., Abdelaal, M. M., Aboelkhair, H., & Mohamed, E. K. (2025). Urban comfort dynamics in major megacities in the Middle East: A spatiotemporal assessment and linkage to weather types. *Urban Climate*, *59*, 102309. https://doi.org/10.1016/j.uclim.2025.102309

118 Jaber, S. M. (2023). On the determination and assessment of the impacts of urban heat islands: A narrative review of literature in the Arab world. *GeoJournal*, *88*(2), 2365–2398. https://doi.org/10.1007/s10708-022-10706-4

economy.[119]

The Africa Adaptation Initiative (AAI) is a continent-wide platform launched by African Heads of State at COP21 in 2015 to strengthen Africa's collective response to climate change through adaptation.[120] Functioning as a networked governance mechanism, the AAI links national governments, regional economic communities, development finance institutions, and international partners to coordinate adaptation priorities, facilitate knowledge exchange, and mobilise climate finance, supporting the scaling of climate-resilient solutions across key sectors, including agriculture, water management, infrastructure, and urban development.[121] At the global city network level, C40 Cities has a growing yet still selective footprint in Africa and the Middle East: Member cities such as Johannesburg, Lagos, Nairobi, Cape Town, Addis Ababa, Durban, Dar es Salaam, Amman, and Dubai participate in thematic networks focused on heat action planning, urban flooding, and climate-resilient infrastructure.[122] C40's influence lies primarily in agenda-setting, technical guidance, and peer learning, rather than implementation at scale.

Policy responses to climate risks remain uneven. In African cities, climate adaptation efforts are frequently project-based and donor-driven, focusing on flood mitigation, early warning systems, and nature-based solutions, but rarely scaled citywide due to fragmented governance and limited municipal finance.[123] While some Middle East cities have invested heavily in climate-controlled urban environments and large-scale cooling infrastructure, these measures often prioritise commercial districts and high-income residential areas, increasing energy demand and leaving the disadvantaged communities vulnerable to extreme heat.[124]

119 Maleki, H., Sorooshian, A., Alam, K., Fathi, A., Weckwerth, T., Moazed, H., Jamshidi, A., Babaei, A. A., Hamid, V., Soltani, F., & Goudarzi, G. (2022). The impact of meteorological parameters on PM10 and visibility during the Middle Eastern dust storms. *Journal of Environmental Health Science and Engineering*, *20*(1), 495–507. https://doi.org/10.1007/s40201-022-00795-1; Al-Hemoud, A., Al-Dashti, H., Al-Saleh, A., Petrov, P., Malek, M., Elhamoud, E., Al-Khafaji, S., Li, J., Koutrakis, P., Doronzo, D., & Middleton, N. (2022). Dust storm 'hot spots' and Transport Pathways Affecting the Arabian Peninsula. *Journal of Atmospheric and Solar-Terrestrial Physics*, *238–239*, 105932. https://doi.org/10.1016/j.jastp.2022.105932

120 Africa Adaptation Initiative. (n.d.). *About AAI*. Retrieved January 21, 2026, from https://www.africaadaptationinitiative.org/about

121 Africa Adaptation Initiative. (n.d.). *About AAI*. Retrieved January 21, 2026, from https://www.africaadaptationinitiative.org/about; UNFCCC. (2021). *African Adaptation Initiative (AAI)*. GCAP UNFCCC. https://climateaction.unfccc.int/Initiatives?id=African_Adaptation_Initiative

122 *Cities Archive*. (n.d.). C40 Cities; C40. Retrieved January 21, 2026, from https://www.c40.org/cities/; C40 Cities. (n.d.). *Cities Matter: Putting cities at the centre of climate action in Africa*. Retrieved January 21, 2026, from https://www.c40.org/news/cities-at-centre-of-climate-action-africa/

123 Kiribou, R., Djene, S., Bedadi, B., Ntirenganya, E., Ndemere, J., & Dimobe, K. (2024). Urban climate resilience in Africa: A review of nature-based solution in African cities' adaptation plans. *Discover Sustainability*, *5*(1), 94. https://doi.org/10.1007/s43621-024-00275-6

124 Krishnan, M., White, O., Smit, S., Farr, A., & Chockalingam, K. (2025, December 11). *Advancing adaptation to climate hazards*. McKinsey. https://www.mckinsey.com/mgi/our-research/advancing-adaptation-mapping-costs-from-cooling-to-coastal-defenses

2.2.2 Housing informality and spatial inequality

Housing informality represents a defining structural challenge in African rapid urbanisation and a significant, though more spatially contained, issue in the Middle East. Across Africa, it is estimated that over 60% of the urban population live in informal settlements characterised by insecure tenure, inadequate access to water and sanitation, and high exposure to environmental and public health risks.[125] Informal settlements remain the primary mode of urban expansion in many African cities such as Accra, Dakar, Nairobi (Figure 2.1).[126] In the Middle East, informality is less prevalent in absolute terms but remains highly consequential in cities affected by conflict, displacement, and economic crisis. For instance, since the 2019 financial crisis and the 2020 port explosion, electricity supply in Beirut has fallen to just a few hours per day, water services have deteriorated, and housing affordability has worsened dramatically, forcing many, especially low- and middle-income households, into overcrowded and substandard accommodations, exacerbating poverty and inequality.[127] Spatial inequality in the cities of the Gulf region is also profoundly shaped by the precarious status of migrants, resulting in intense segregation between citizens and non-citizens, as well as among different classes of migrants, where migrant workers are essential for urban development yet face exclusion from the formal, luxurious city centres, often living in peripheral labour colonies or older, dense urban areas.[128]

125 Pashayan, A. R. (2024, February 29). Informal settlements and climate change in the 'last mile of urbanization.' *Brookings*. https://www.brookings.edu/articles/informal-settlements-and-climate-change-in-the-last-mile-of-urbanization/

126 OECD/SWAC, AfDB, Cities Alliance, & UCLG Africa. (2025). *Africa's Urbanisation Dynamics 2025: Planning for Urban Expansion*. https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/03/africa-s-urbanisation-dynamics-2025_005a8aa0/2a47845c-en.pdf

127 Simet, L. (2023). "Cut Off From Life Itself." *Human Rights Watch*. https://www.hrw.org/report/2023/03/09/cut-life-itself/lebanons-failure-right-electricity

128 Uddin, M. (2022, January 11). Metropolisation and Spatial Segregation in Gulf Cities: The Case of Dubai. *Middle East Centre -London School of Economics and Political Science*. https://blogs.lse.ac.uk/mec/2022/01/11/metropolisation-and-spatial-segregation-in-gulf-cities-the-case-of-dubai/

Figure 2.1. A hotel in the slums of Nairobi, Kenya

Efforts to address housing informality and spatial inequality have largely focused on supply-side interventions, most notably state-led public housing programmes, satellite or new town development, and large-scale real estate projects often delivered through public–private partnerships, particularly in rapidly urbanising contexts where housing demand far exceeds supply.[129] However, in African cities such as Nairobi, peripheral housing schemes have struggled with low occupancy rates, as residents are unable to cover the combined costs of housing, transport, and the loss of access to informal livelihoods.[130] Similarly, in Middle East cities such as Riyadh, governments strategize large-scale housing developments, focusing on homeownership for citizens driven by Vision 2030 and investments, leading to affordability issues, and insufficient, poorly regulated rental options for lower-income groups, particularly migrant workers and refugees, who are left in precarious, overcrowded conditions despite government awareness.[131]

Satellite city development has been particularly prominent in the Middle East and parts of North Africa, e.g., Saudi Arabia's NEOM, United Arab Emirates' Burj Khalifa (Figure 2.2). These developments draw on modernist planning models and economic diversification strategies, but often reproduce spatial segregation, reinforce car dependency, and delay occupancy due to insufficient social infrastructure and weak

129 Kamana, A. A., Radoine, H., & Nyasulu, C. (2024). Urban challenges and strategies in African cities – A systematic literature review. *City and Environment Interactions*, *21*, 100132. https://doi.org/10.1016/j.cacint.2023.100132

130 Mwau, B., Sverdlik, A., & Makau, J. (2019). *Towards holistic solutions to Nairobi's affordable housing crisis*. International Institute for Environment and Development. https://www.iied.org/sites/default/files/pdfs/migrate/17729IIED.pdf

131 MEED. (2025, October 23). *Saudi Arabia's housing boom risks leaving citizens behind*. https://www.meed.com/saudi-arabias-housing-boom-risks-leaving-citizens-behind

labour-market integration.[132] By contrast, incremental upgrading of informal settlements (e.g., enhancement of basic services, drainage, road access, and community facilities), land tenure regularisation, and rental housing reform are widely recognised as more effective pathways to reduce environmental risk and improve living conditions without displacing existing communities, but remain underfunded and politically contested in the region.[133]

Figure 2.2. Burj Khalifa in Dubai, United Arab Emirates

At the regional and global levels, efforts to address housing informality and spatial equity in Africa and the Middle East are shaped by a fragmented but increasingly influential ecosystem of development institutions, city networks, and civil society organisations. The UN-Habitat plays a central normative and technical role through its work on the right to adequate housing, participatory slum upgrading, and tenure security, supporting cities such as Accra, Beirut, and Kampala in inclusive and risk-sensitive settlement planning.[134] Cities Alliance has operated in the region since 2000 as a catalytic intermediary, supporting national urban policy reform and city-level upgrading programmes, with a particular emphasis on coalition-building among municipalities, line ministries, and civil society organisations to navigate the political economy of land

132 The Economist. (2024, January 11). *Can satellite cities help solve Africa's urbanisation challenges?*. https://www.economist.com/middle-east-and-africa/2024/01/11/can-satellite-cities-help-solve-africas-urbanisation-challenges; Algumzi, A. (2022). Risks and Challenges Associated with NEOM Project in Saudi Arabia: A Marketing Perspective. *Journal of Risk and Financial Management*, *15*(9), 381. https://doi.org/10.3390/jrfm15090381

133 Chitekwe-Biti, B., Dodman, D., Mitlin, D., & Ouma, S. (2022, March 24). Upgrading informal settlements in African cities—ACRC. *African Cities Research Consortium*. https://www.african-cities.org/upgrading-informal-settlements-in-african-cities/

134 UN-Habitat. (n.d.). *Housing*. Retrieved January 23, 2026, from https://unhabitat.org/topic/housing

and informality and promote inclusive urban planning.[135]

Multilateral development banks—most notably the World Bank[136] and the African Development Bank[137]—provide the financial support for housing and urban upgrading, increasingly integrating informality, rental housing, and climate resilience into urban investment portfolios, though large-scale infrastructure lending still tends to dominate. At the grassroots level, transnational civil society networks such as Slum Dwellers International have been instrumental in advancing community-led data collection and co-produced upgrading solutions in African cities, strengthening the evidence base for inclusive housing policy and improving state–community engagement, albeit with more limited reach in the Middle East due to political and regulatory constraints.[138] Youth unemployment intensifies these inequalities and amplifies social pressure in urban areas. Africa's cities are absorbing millions of young people annually, yet formal job creation has not kept pace with demographic growth, resulting in widespread underemployment and precariousness among urban youth, even for those with secondary or tertiary education.

2.2.3 Economic inequality and social pressures

Economic inequality is a structural feature of urbanisation in Africa and the Middle East and a key driver of social pressures in cities, closely intertwined with formal labour market exclusion and youth unemployment. In African cities, income inequality is exacerbated by the dominance of informal employment, which accounts for more than 80% of urban jobs in many countries, offering limited earnings stability and little opportunity for upward mobility.[139] In Middle East cities, particularly within the Gulf Cooperation Council (GCC) states, inequality is shaped not only by income disparities but also by segmented labour markets, where migrant workers—who often constitute the majority of the urban workforce—face restricted rights, limited access to services, and exclusion from social safety nets.[140] Youth unemployment intensifies these inequalities and amplifies social pressure in urban areas. Africa's cities are absorbing millions of young people annually, yet formal job creation has not kept pace with demographic growth, resulting in widespread underemployment and informality among urban youth, even among those with secondary or tertiary education.[141] In the Middle East and North Africa, youth unemployment rates remain the highest globally with the lowest female participation in the work force—especially in countries such as Egypt, Iraq, and Lebanon—reflecting structural challenges in labour markets, reliance on public sector employment, and insufficient private-sector economic opportunities, compounded by conflicts and crises.[142] In turn, economic inequality and youth unemployment together fuel rising crime, social fragmentation, and political instability, presenting further urban governance and social cohesion challenges.[143]

Cities in Africa and the Middle East are addressing economic inequality and associated social pressures through a combination of labour-market interventions, economic diversification, and increasingly tech-driven growth, though progress remains uneven and highly context-dependent. Many African cities have prioritised skills development, vocational training, and youth entrepreneurship programmes linked to urban services, construction, and the digital economy.[144] For example, Malawi's "Technical, Entrepreneurial and Vocation and Training (TEVET)" programme and the Nigerian Npower programme specifically target youth employment in key sectors, whereas these programmes often remain limited in scale relative to demand and are vulnerable to funding volatility.[145] In the Middle East cities, especially those in the Gulf Cooperation Council countries, strategies have focused more heavily on economic diversification through investing in non-oil sectors (e.g., culture-led regeneration, Figure 2.3), particularly in response to structurally high youth unemployment and fiscal constraints, introducing national workforce localisation and skills-matching initiatives aimed at increasing youth participation in private-sector employment.[146] Urban policy in Africa and the Middle East increasingly prioritises tech-driven growth and digital entrepreneurship but inadequately integrates essential infrastructure and systemic reforms, such as affordable housing, reliable transportation, and social safety nets,

135 Cities Alliance. (n.d.). *Cities Alliance in the Middle East and North Africa*. Retrieved January 23, 2026, from https://www.citiesalliance.org/cities-alliance-middle-east-and-north-africa; Cities Alliance. (n.d.). *Cities Alliance in Sub-Saharan Africa*. Retrieved January 23, 2026, from https://www.citiesalliance.org/cities-alliance-sub-saharan-africa

136 World Bank. (n.d.). *Urban Development*. Retrieved January 23, 2026, from https://www.worldbank.org/en/topic/urbandevelopment

137 African Development Bank. (2025, December 11). *Somalia—Strengthening Urban Resilience of Displaced and Host Communities in Doolow Project (SURDHT)*. African Development Bank Group; African Development Bank Group. https://www.afdb.org/en/documents/somalia-strengthening-urban-resilience-displaced-and-host-communities-doolow-project-surdht

138 Slum Dwellers International. (n.d.). *Slum Dwellers International*. Retrieved January 23, 2026, from https://sdinet.org/

139 Guven, M., & Karlen, R. (2020, December 3). *Supporting Africa's urban informal sector: Coordinated policies with social protection at the core*. World Bank Blogs. https://blogs.worldbank.org/en/africacan/supporting-africas-urban-informal-sector-coordinated-policies-social-protection-core

140 ECDHR. (2020, May 12). *GCC Countries And Migrant Workers: Background Facts*. https://www.ecdhr.org/gcc-countries-and-migrant-workers-background-facts/

141 International Labour Organization. (2024, August 9). *Employment trends for youth in Sub-Saharan Africa*. https://www.ilo.org/publications/employment-trends-youth-sub-saharan-africa

142 Dione, O., & Gatti, R. (2025, January 30). *MENA is open to work: Tackling the jobs deficit*. World Bank Blogs. https://blogs.worldbank.org/en/arabvoices/mena-is-open-to-work--tackling-the-jobs-deficit

143 Mwangi, J. (2026, January 21). Urbanisation, Youth Bulge and Future Social Stability in Greater Eastern Africa. *Mashariki Research and Policy Centre*. https://masharikirpc.org/urbanisation-youth-bulge-and-future-social-stability-in-greater-eastern-africa/

144 Cieslik, K., Barford, A., & Vira, B. (2022). Young people not in Employment, Education or Training (NEET) in Sub-Saharan Africa: Sustainable Development Target 8.6 missed and reset. *Journal of Youth Studies*, *25*(8), 1126–1147. https://doi.org/10.1080/13676261.2021.1939287

145 UN-Habitat. (2022). *Implementation of the New Urban Agenda in the SubSaharan Africa*. https://www.urbanagendaplatform.org/sites/default/files/2022-02/NUA%20implementation_Sub-Saharan%20Africa.pdf

146 World Governments Summit in collaboration with KPMG. (2024). *Unlocking diversification in the GCC states*. KPMG. https://assets.kpmg.com/content/dam/kpmg/ae/pdf-2024/08/unlocking-diversification-en.pdf

thereby failing to tackle underlying socio-economic disparities.[147]

Efforts to address economic inequality and social pressures in Africa and Middle East cities are largely shaped by multi-actor partnerships, reflecting limited municipal fiscal capacity and the cross-sectoral nature of the challenge. From the global level, for instance, the International Labour Organisation supports urban employment diagnostics, youth labour-market programmes, and transitions from informal to formal work, particularly in African cities and fragile Middle East contexts, with a focus on strengthening social protection (e.g., narrowing gender gaps) and improving skills development.[148] Networks such as the Resilient Cities Network increasingly incorporate social equity, public health, inclusive economic growth, and low carbon development into their resilience and climate agendas and partnership programmes. Examples include the Urban Power and Urban Pulse programmes, which support member cities in the region (e.g., Lagos and Cape Town) to reframe socioeconomic inequality as core urban resilience issues.[149] Others have started to implement smart city.

Figure 2.3 Louvre in the Saadiyat Cultural District in Abu Dhabi, United Arab Emirates

147 Strong Cities Network. (2025, July 3). *MENA Regional Hub: Advancing City-Led Strategies to Prevent Hate, Violent Extremism and Polarisation in the Middle East and NorthAfrica — From Innovation to Implementation*. https://strongcitiesnetwork.org/news/article/mena-regional-hub-advancing-city-led-strategies-to-prevent-hate-violent-extremism-and-polarisation-in-the-middle-east-and-northafrica-from-innovation-to-implementation/; Lay, J., & Tafese, T. (2025). Africa's Emergent Tech Sector: Characteristics and Development Implications. *Africa Spectrum*, *60*(1), 106–126. https://doi.org/10.1177/00020397241306454

148 Kiaga, A., & Leung, V. (2020). *The Transition from the Informal to the Formal Economy in Africa*. International Labour Organization. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_emp/documents/publication/wcms_792078.pdf; International Labour Organization. (2024, August 12). *Employment trends for youth in the Middle East and North Africa*. https://www.ilo.org/sites/default/files/2024-08/MENA%20GET%20Youth%20Brief%202024.pdf

149 Resilient Cities Network. (2024). *Resilient Cities Network 2022-2023 Impact Report*. https://resilientcitiesnetwork.org/wp-content/uploads/2024/09/R-Cities-2022-23-Impact-Report.pdf

2.3 Smart city development

Smart city development in the region is rapidly evolving. Smart city development in Africa and the Middle East is primarily defined as data-driven urban ecosystems that utilise Information and Communication Technologies (ICT), AI, and the Internet of Things (IoT) to manage rapid urbanisation, diversify economies, promote sustainability, and improve the quality of life, linking an increasing adoption of people-centred principles.[150] African cities focus on the pragmatic use of digital tools (ICT, platforms, sensors, data systems) to improve basic urban service delivery and governance, which positions ICT-enabled transformation as a pathway to economic competitiveness, improved public services, and social inclusion.[151] It is reflected in African regional initiatives such as Smart Africa, launched in 2013 as a continent-wide, heads-of-state–endorsed platform to accelerate digital transformation, framing smart cities mainly around e-government, connectivity, and economic competitiveness.[152] In much of the Middle East (especially Gulf states), smart city development is more frequently highlighted as a state-led modernisation and competitiveness project, combining digital government, big data, AI, integrated mobility, and large-scale master-planned districts—often tied to national visions for economic diversification and global branding (e.g., Digital Dubai, Box 2.1).[153]

In Africa, the dominant vision is "digital leapfrogging" to address key service and infrastructure gaps by leveraging digital technologies and building innovation ecosystems (e.g., Kigali Innovation City, Box 2.2) for economic growth, job creation, and poverty reduction, which is reinforced by continent-scale agendas such as the African Union's Digital Transformation Strategy for Africa (2020–2030), developed with multiple partners (including Smart Africa, UN Economic Commission for Africa, African Development Bank, International Telecommunication Union, and the World Bank) and aiming to establish an integrated and inclusive digital society and economy by 2030.[154] In the Middle East, visions are more commonly articulated through national transformation programmes (e.g., the Saudi National Strategy for Data and AI, which aims to position the Kingdom as a global leader in AI[155]) that view smart cities as engines of productivity, global investment, and post-oil economic diversification.
There are several key collaboration initiatives and mechanisms in the region, e.g.,

150 Belaïd, F., Amine, R., & Massie, C. (2024). Smart Cities Initiatives and Perspectives in the MENA Region and Saudi Arabia. In F. Belaïd & A. Arora (Eds.), *Smart Cities: Social and Environmental Challenges and Opportunities for Local Authorities* (pp. 295–313). Springer International Publishing. https://doi.org/10.1007/978-3-031-35664-3_16

151 Bandauko, E., & Nutifafa Arku, R. (2023). A critical analysis of 'smart cities' as an urban development strategy in Africa. *International Planning Studies*, *28*(1), 69–86. https://doi.org/10.1080/13563475.2022.2137112

152 Smart Africa. (n.d.). *Who we are – Smart Africa*. Retrieved January 26, 2026, from https://smartafrica.org/who-we-are/

153 The Official Platform of the UAE Government. (n.d.). *Digital Dubai*. Retrieved January 26, 2026, from https://u.ae/en/about-the-uae/digital-uae/digital-cities/digital-dubai

154 African Union. (2020, May 18). *The Digital Transformation Strategy for Africa (2020-2030)*. https://au.int/en/documents/20200518/digital-transformation-strategy-africa-2020-2030

155 SDAIA. (n.d.). *National Strategy for Data & AI*. Retrieved February 2, 2026, from https://sdaia.gov.sa/en/SDAIA/SdaiaStrategies/Pages/NationalStrategyForDataAndAI.aspx

- Gulf cities such as Abu Dhabi, Dubai, and Riyadh have established long-term collaborations with global firms, including Microsoft[156] and Huawei,[157] to develop cloud platforms, command-and-control centres, digital identity systems, and smart mobility solutions, often embedded within national digital or AI strategies rather than municipal-led agendas.
- The Smart Africa Alliance, a partnership among African countries that was launched in 2013, has since grown to include 42 African countries, representing over 1 billion people.[158] Its impact on municipal governance, spatial inclusion, and people-centred urban outcomes has remained indirect and uneven, largely mediated through national programmes rather than city-led reforms.
- The African Smart Towns Network (ASToN) was launched in 2019 with support from the French Development Agency (AFD) as a three-year pilot programme to help African cities develop context-appropriate, people-centred smart city strategies focused on governance reform, digital public services, and institutional capacity involving peer learning, diagnostics, local action plans, and financial support.[159] However, like many project-based and donor-funded initiatives, ASToN's core funding has ended, raising concerns about the sustainability and long-term institutionalisation of its impacts, as continued progress depends on whether participating cities can absorb the lessons into enduring policies, budgets, and urban investment frameworks.

Financing for smart city development often comes through a blended landscape: national budgets, sovereign wealth funds and state investment vehicles (e.g., Saudi Arabia's National Infrastructure Fund[160]), public-private partnerships, development finance institutions (e.g., the World Bank, African Development Bank) for enabling infrastructure and digital public goods, and bilateral agencies (e.g., French Development Agency[161]) for city learning and pilots. For instance, Humain, a Saudi artificial intelligence company, was established under the Public Investment Fund in 2025.

156 Yazbeck, N. (2025, October 31). Accelerating together: Balancing urgency, intention, and partnership in the AI Era. *Source EMEA*. https://news.microsoft.com/source/emea/2025/10/accelerating-together-balancing-urgency-intention-and-partnership-in-the-ai-era/

157 Huawei. (n.d.). *Smart Cities at the Heart of a Digital Middle East*. Huawei Enterprise. Retrieved February 2, 2026, from https://e.huawei.com/en/ict-insights/global/ict_insights/ict33-digital-city/cover-story/smart-cities-at-the-heart

158 Smart Africa. (n.d.). *Who we are – Smart Africa*. Retrieved January 26, 2026, from https://smartafrica.org/who-we-are/

159 AFD - Proparco. (2024, February 5). *Implementing Smart Cities in Africa: A project framework*. https://www.proparco.fr/en/article/implementing-smart-cities-africa-project-framework

160 Reuters. (2026, January 21). *Saudi's Humain secures up to $1.2 bln to expand AI infrastructure*. https://www.reuters.com/world/middle-east/saudis-humain-secures-up-12-bln-expand-ai-infrastructure-2026-01-21/

161 AFD - Proparco. (2024, February 5). *Implementing Smart Cities in Africa: A project framework*. https://www.proparco.fr/en/article/implementing-smart-cities-africa-project-framework

Box 2.1. Dubai, United Arab Emirates: Digital Dubai

Digital Dubai represents one of the most institutionally embedded smart city governance models in the Middle East, considering digital transformation as a whole-of-government reform agenda. Established in its current form in 2021, Digital Dubai leads the city's transition towards fully integrated, data-driven public administration through initiatives such as the Dubai Paperless Strategy, interoperable digital identity systems, shared data platforms, and citywide service integration across government entities, increasingly investing in AI-facilitated technology and the economy (e.g., AI Lab). The objectives of Dubai's Digital Strategy include:

- Enhancing the outputs of the digital economy.
- Increasing the positive impact of digital wellbeing by 90 per cent.
- Achieving top rankings in the UN's Local Online Service Index.
- Launching 50 digital city experiences.
- Equipping over 50,000 professionals with advanced digital qualifications.

Its smart city approach prioritises efficiency, seamless service delivery, and global competitiveness, supported by strong central coordination, regulatory authority, and sustained public investment. However, while Digital Dubai has achieved measurable gains in administrative efficiency and user experience, its model is less explicitly oriented towards addressing urban inequality or neighbourhood-level inclusion, reflecting a broader regional tendency for smart city initiatives to emphasise productivity and state capacity.

Image source: Gulf Today.

Source: The Official Platform of the UAE Government. (n.d.). *Digital Dubai*. Retrieved January 26, 2026, from https://u.ae/en/about-the-uae/digital-uae/digital-cities/digital-dubai; Digital Dubai. (n.d.). *Home*. Retrieved February 2, 2026, from https://www.digitaldubai.ae; Gulf Today. (2025, October 15). *Dubai Police showcase AI-powered monitoring system that records five types of traffic violations*. https://www.gulftoday.ae/news/2025/10/15/dubai-police-showcase-ai-powered-monitoring-system-that-records-five-types-of-traffic-violations

Box 2.2. Kigali, Rwanda: Kigali Innovation City

Kigali Innovation City is a flagship, mixed-use, master-planned development positioned as Rwanda's anchor for a knowledge-based urban economy, integrating higher education (e.g., home to Carnegie Mellon University Africa), research, technology firms, and residential uses within a purpose-built 61-hectare district on the outskirts of Kigali, the capital and largest city of Rwanda. Ground broke in 2024 by the Government of Rwanda, Africa50 (an infrastructure investment platform founded by the African Development Bank and African states), and the Arab Bank for Economic Development in Africa (BADEA), Kigali Innovation City aspires to become "The Digital Heart of Africa", building billion-dollar companies on the continent through:

- Fostering innovation for digital-first businesses targeting fast growth.
- Complementing Rwanda's Startup Act as the country becomes a global hub for entrepreneurship, education, business and workers relocating to Africa.

Kigali Innovation City Company Limited (KICCL), a specific project company and procuring entity owned by Africa50 and governmental entity Rwanda Development Board, was established to manage the development and implementation of the US$300 million project. The project is projected to generate US$2 billion in economic value upon completion, US$150 million annually in ICT exports, and attract over US$300 million in foreign direct investment while fostering local innovation ecosystems linked to digital skills, health, and green technologies. As an urban intervention, Kigali Innovation City reflects a selective, enclave-based smart city strategy that prioritises competitiveness, talent attraction, and international partnerships. While it signals strong state commitment to innovation-led growth, its contribution to addressing broader urban challenges—such as informality, affordable housing, and employment for low-income urban residents—remains indirect and is yet to be fully realised.

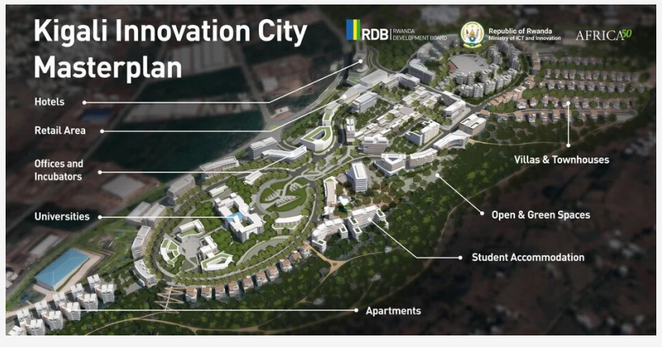

Image source: Africa50.

Source: UN-Habitat. (2017). *Smart city Rwanda Master plan*. https://unhabitat.org/smart-city-rwanda-master-plan; Rwanda Development Board. (2024, September 11). The Government of Rwanda, Africa50 and BADEA break ground on the construction of Kigali Innovation City (KIC). *Official Rwanda Development Board (RDB) Website*. https://rdb.rw/the-government-of-rwanda-africa50-and-badea-break-ground-on-the-construction-of-kigali-innovation-city/; Africa50. (n.d.). *Kigali Innovation City*. Retrieved February 2, 2026, from https://www.africa50.com/our-funds/projects/kigali-innovation-city/; World Construction Network. (2025, December 12). *Kigali Innovation City, Rwanda*. https://www.worldconstructionnetwork.com/projects/kigali-innovation-city-rwanda/

Overall progress of smart city development is polarised. In Africa, smart city development is largely emergent and pilot-based, with a subset of cities moving towards more integrated approaches through national digital strategies and city networks, while in the Middle East, many smart city programmes are ongoing and institutionally embedded (especially digital government and mobility).[162] Implementing smart city development in Africa and the Middle East generally faces fragmented governance and limited municipal autonomy, financial constraints (even the wealthy Gulf cities experience funding disruption for large-scale projects), technological infrastructure and service gaps (e.g., inconsistent electricity access and underdeveloped internet connectivity in African cities[163]), socioeconomic disparities (e.g., limited attention to affordability and digital exclusion), and increasingly extreme climate conditions.[164] Smart city development in the region has struggled to scale up, calling for urgent efforts in institutional reform, sustainable financing, and integration with climate resilience and social inclusion agendas. However, in Africa and the Middle East, several international benchmarking frameworks are widely referenced such as the U4SSC/ITU Key Performance Indicators for Smart Sustainable Cities, which serve as the standardised self-assessment across SDG-linked domains.[165]

2.4 Low carbon development

In Africa and the Middle East, a low carbon city typically refers to a city that systematically reduces greenhouse gas emissions from its core urban systems while maintaining liveability, inclusion, and resilience. African cities emphasize development with decarbonisation to expand access to energy and services through clean power, efficient public services, and affordable mobility;[166] while Middle East cities focus on linking city agendas with national net-zero strategies and economic diversification through clean electricity deployment, demand-side management, district cooling, electrified mobility, and carbon management (e.g., UAE's Net Zero 2050 Strategy).[167] Low carbon city strategies concentrate on clean electricity supply and grid decarbonisation, green buildings and cooling as a decisive mitigation lever, low-carbon mobility (e.g., public transport investment, electrification), waste and circular economy

162 Moneer, Z. (2024, June 4). Climate-smart cities in the MENA region: Promise and pitfalls. *Middle East Institute*. https://mei.edu/publication/climate-smart-cities-mena-region-promise-and-pitfalls/

163 Balashova, S. A., Reshetnikova, M. S., Kadrov, V. M., Vasilieva, G. A., & Rogozhina, N. A. (2025). A sustainable path to Modernization: Transforming African cities. *Unconventional Resources*, *7*, 100194. https://doi.org/10.1016/j.uncres.2025.100194

164 Taleb, L. (2024). *Challenges of Smart Sustainable Cities in the Middle East* (SSRN Scholarly Paper No. 4985808). Social Science Research Network. https://doi.org/10.2139/ssrn.4985808

165 ITU. (n.d.). *U4SSC KPI – United for Smart Sustainable Cities (U4SSC)*. Retrieved February 2, 2026, from https://u4ssc.itu.int/u4ssc-kpi/

166 UN-Habitat. (n.d.). *Low Carbon and Resilient Basic Services and Buildings*. https://unhabitat.org/sites/default/files/download-manager-files/Climate_Action-Sheet_4-Final.pdf

167 The UAE Government. (2025, October 6). *The UAE's Net Zero 2050 Strategy*. The Official Platform of the UAE Government. https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/environment-and-energy/the-uae-net-zero-2050-strategy

(e.g., improved collection systems), and urban planning and compact form as a long-term decarbonisation lever through highlighting density, mixed-use, transit-oriented development.[168]

Institutionally, low carbon city action is typically built on national climate commitments and shaping urban strategies through sector ministries, utilities, and municipal planning such as Ethiopia's Long-Term Low Emission and Climate Resilient Development Strategy highlighting resilient urban planning and green urban development.[169] At the city level, progress tends to be strongest where municipalities have adopted clear climate targets and implementation plans—Cape Town's carbon neutrality commitment (Box 2.3) is a notable example of city-level policy articulation.[170]

One major regional collaboration on low carbon cities is the Global Covenant of Mayors for Climate and Energy ecosystem, the largest global alliance for city climate leadership, supporting cities to develop climate and energy action plans and increasingly access technical assistance to translate plans into investments and actions.[171] ICLEI (via ICLEI Africa) is a noticeable actor for city-to-city support and capacity building in Africa to promote low-emission and resilient urban development programming and peer learning.[172] In the Middle East, collaboration is frequently framed through state-led and programme-based green initiatives—most visibly, the Saudi-led Middle East Green Initiative (MGI), inaugurated in 2021 as a regional platform for climate action through collaboration, knowledge exchange and investments in the green economy,[173] though its engagement with city-level low-carbon urban governance remains largely indirect and mediated through national programmes.

African cities face a severe financing gap, with projections indicating a need for about US$400 billion annually by 2030 to address climate change,[174] and rely heavily on a mix of development finance institutions, multilateral climate funds, and blended finance. For instance, organisations like the African Development Bank act as central pillars, using instruments such as the Urban and Municipal Development Fund[175] and the Climate Action Window[176] to support low-carbon urban development. Low-carbon urban investment in the Middle East is often driven by state-led initiatives, with sovereign wealth funds, national energy companies, and government-backed utilities, supplemented by international project finance (especially in the less developed countries) for enabling climate-resilient infrastructure and low-carbon development.[177] For example, Saudi Arabia's Public Investment Fund is committed to developing 70% of Saudi Arabia's renewable energy target by 2030 and has established its Green Finance Framework to catalyse the Kingdom's green agenda.[178]

Low carbon city progress across Africa and the Middle East is uneven. In much of Africa, progress is emergent, often taking the form of sectoral interventions (e.g., electrified transit pilots, efficient public lighting) and climate action planning supported by international networks and donors, which are frequently constrained by municipal finance and infrastructure deficits.[179] In the Middle East, many low carbon initiatives are ongoing at scale in the power, buildings, and mobility domains due to strong state capacity and large capital programmes; however, some flagship mega-district initiatives may face rescoping risks where ambitions outpace delivery capacity or fiscal constraints (a recurring issue for large master-planned projects like Saudi Arabia's NEOM, Box 2.4).[180]

168 Hafner, M., Raimondi, P. P., & Bonometti, B. (2023). Low-Carbon Energy Strategies in MENA Countries. In M. Hafner, P. P. Raimondi, & B. Bonometti (Eds.), *The Energy Sector and Energy Geopolitics in the MENA Region at a Crossroad: Towards a Great Transformation?* (pp. 175–261). Springer International Publishing. https://doi.org/10.1007/978-3-031-30705-8_4; Abubakar, I. R., & Alshammari, M. S. (2023). Urban planning schemes for developing low-carbon cities in the Gulf Cooperation Council region. *Habitat International*, *138*, 102881. https://doi.org/10.1016/j.habitatint.2023.102881

169 UNFCCC. (2023, June 21). *Ethiopia's long term low emission and climate resilient development strategy (2020-2050)*. https://unfccc.int/sites/default/files/resource/ETHIOPIA_%20LONG%20TERM%20LOW%20EMISSION%20AND%20CLIMATE%20RESILIENT%20DEVELOPMENT%20STRATEGY.pdf

170 C40. (2020, July). *The City of Cape Town's Carbon Neutral 2050 Commitment*. https://www.c40knowledgehub.org/s/article/The-City-of-Cape-Town-s-Carbon-Neutral-2050-Commitment?language=en_US

171 Global Covenant of Mayors for Climate & Energy. (n.d.). *Our Regions*. Retrieved February 2, 2026, from https://www.globalcovenantofmayors.org/our-regions/

172 ICLEI Africa. (n.d.). *Networks & initiatives*. Retrieved February 2, 2026, from https://africa.iclei.org/networks-and-initiatives/

173 Saudi Green Initiatives. (n.d.). *Information About Middle East Green Initiative*. Retrieved February 2, 2026, from https://https://sgi.gov.sa/about-mgi/

174 Ouattara, O. (2025, November). *Net zero in African cities: Why the next climate dollar must land in Africa's neighbourhoods*. UNU-WIDER Blog. https://www.wider.unu.edu/publication/net-zero-african-cities-why-next-climate-dollar-must-land-africas-neighbourhoods

175 African Development Bank. (n.d.). *Urban and Municipal Development Fund*. Retrieved February 2, 2026, from https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/urban-and-municipal-development-fund

176 African Development Bank. (2025, November 6). *On the road to COP 30: The African Development Bank Group is piloting several financial instruments to support African countries in tackling climate change*. https://www.afdb.org/en/news-and-events/road-cop-30-african-development-bank-group-piloting-several-financial-instruments-support-african-countries-tackling-climate-change-88381

177 Watson, C., Schalatek, L., & Evéquoz, A. (2025). Climate Finance Regional Briefing: Middle East and North Africa. *Climate Finance Fundamentals*, *9*. https://climatefundsupdate.org/wp-content/uploads/2025/03/CFF9-2025-ENG-MENA-DIGITAL.pdf

178 PIF. (n.d.). *Green Finance Framework*. Retrieved February 2, 2026, from https://www.pif.gov.sa/en/investors/green-finance-framework/

179 UN-Habitat. (n.d.). *Low Carbon and Resilient Basic Services and Buildings*. https://unhabitat.org/sites/default/files/download-manager-files/Climate_Action-Sheet_4-Final.pdf

180 Omar, A. A. (2025, October 7). Saudi Arabia's Major Projects in 'Uneven' Progress, Moody's Says. *Bloomberg.com*. https://www.bloomberg.com/news/articles/2025-10-07/saudi-arabia-s-major-projects-in-uneven-progress-moody-s-says

Box 2.3. Cape Town, South Africa: Carbon Neutrality by 2050

Cape Town has emerged as one of the most institutionally advanced African cities in articulating a low carbon urban transition, formalised through its Carbon Neutral 2050 commitment, which positions decarbonisation as a citywide governance objective. The commitment is operationalised through sectoral interventions targeting electricity decarbonisation, energy efficiency in buildings, low-carbon transport, and demand-side management, alongside interim targets embedded in the city's Climate Change Action Plan and Energy Strategy.

Cape Town's approach is notable for its municipal leadership and policy coherence, particularly in leveraging local regulatory powers to enable renewable energy procurement and efficiency measures despite a historically centralised national electricity regime. At the same time, critical challenges remain: implementation is constrained by fiscal pressures, deep socioeconomic inequality, and the city's limited ability to influence emissions from informal settlements, private vehicle use, and carbon-intensive consumption patterns. As a result, while Cape Town demonstrates how African cities can lead on climate-resilient planning, its experience also highlights the structural limits of municipal-level decarbonisation in contexts where poverty, energy insecurity, and national policy alignment remain unresolved.

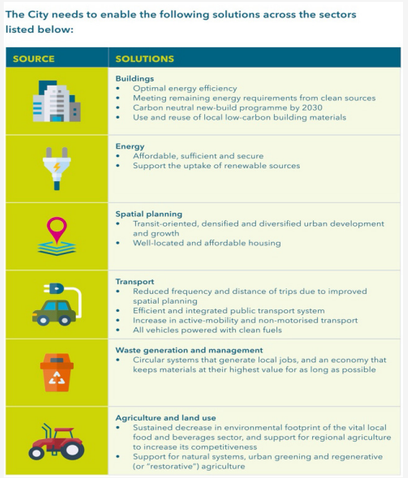

Image source: City of Cape Town carbon neutral commitment.

Source: C40. (2020, July). *The City of Cape Town's Carbon Neutral 2050 Commitment*. https://www.c40knowledgehub.org/s/article/The-City-of-Cape-Town-s-Carbon-Neutral-2050-Commitment?language=en_US; City of Cape Town. (2020). *The City of Cape Town's Carbon Neutral 2050 Commitment*. https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies,%20plans%20and%20frameworks/Carbon_Neutral_2050_Commitment.pdf; Resilient Cities Network. (2023). *Cape Town Urban Power Profile*. https://resilientcitiesnetwork.org/wp-content/uploads/2023/04/UrbanPowerProfile_CapeTown_I_4.18.pdf

Box 2.4. NEOM, Saudi Arabia: Smart and Low carbon Experiment

NEOM is Saudi Arabia's most ambitious smart and low carbon urban experiment, launched in 2017 as a central pillar of Vision 2030 and conceived as a large-scale testbed for carbon-neutral energy systems, AI-driven urban management, and car-free urban form, most prominently through the flagship linear city concept, The LINE, a cognitive city stretching across 170 kilometres with no roads, cars or emissions and 95% of land being preserved for nature. NEOM's low carbon narrative emphasises 100% renewable energy supply, integrated digital infrastructure, advanced demand-side management, and radical reductions in land take and transport emissions, positioning the project as a global exemplar of future urbanism. At the same time, NEOM illustrates the risks inherent in state-led, mega-project–driven low-carbon development, as recent rescoping and timeline adjustments have raised questions about financial viability, delivery capacity, social inclusion, and replicability at scale. NEOM functions less as a near-term urban solution and more as a frontier experimentation platform, whose long-term relevance for low carbon cities in the Middle East will depend on whether its technological and governance innovations can be translated into more inhabited urban contexts across the region.

Image source: NEOM.

Source: NEOM. (n.d.). *About us: A vision of what a new future might look like*. Retrieved February 2, 2026, from https://www.neom.com/en-us/about; Omar, A. A. (2025, October 7). Saudi Arabia's Major Projects in 'Uneven' Progress, Moody's Says. *Bloomberg.com*. https://www.bloomberg.com/news/articles/2025-10-07/saudi-arabia-s-major-projects-in-uneven-progress-moody-s-says; Downes, S. (2026, January 30). *Neom Exposes the Reality Behind Sustainable City Ambitions*. Sustainability Magazine. https://sustainabilitymag.com/news/neom-exposes-the-reality-behind-sustainable-city-ambitions

Low carbon city development in Africa and the Middle East aims to address interlinked challenges, including:[181]

- Rapid emissions growth from urbanisation, especially from transport and buildings, where early infrastructure choices create long-term lock-in.
- Energy security and affordability, shifting to cleaner, more efficient systems, offering both fiscal and resilience co-benefits.
- Climate and health vulnerability, as mitigation measures in waste, mobility,

181 UN-Habitat. (n.d.). *Low Carbon and Resilient Basic Services and Buildings*. https://unhabitat.org/sites/default/files/download-manager-files/Climate_Action-Sheet_4-Final.pdf; Lindfield, M., & Inkoom, K. B. D. (2022). Financing low carbon and resilient cities in Africa. *African Development Bank*. https://www.afdb.org/sites/default/files/2022/11/08/financing_low_carbon_and_resilient_cities_in_africa_-_sudap_paper_-_afdb_umdf_2022.pdf

and energy efficiency often reduce local air pollution, heat exposure, and service instability—benefits that are especially critical in fast-growing African cities and heat-exposed Middle East cities.

Implementing low carbon development in Africa and Middle East cities faces complex barriers, including misalignment between rapid urban growth and decarbonisation objectives; extreme energy poverty in some regions; high fossil-fuel dependency in others (especially in Gulf cities); financial constraints (more noticeably in the local levels in African cities); weak institutional governance; inadequate infrastructure; and limited technical capacity.[182] Addressing these barriers requires a holistic just transition that aligns socioeconomic growth such as inclusive job creation and green economy diversification, with climate policy and targets, shifting to system-level urban transformation through highlighting sustained financing mechanisms and tangible social co-benefits.[183] In the region, city-defined KPIs vary and global reporting and accounting standards such as Citywide GHG inventory[184] and CDP-ICLEI Track,[185] are used by leading city networks and finance partners.

182 Ouattara, O. (2025, November). *Net zero in African cities: Why the next climate dollar must land in Africa's neighbourhoods*. UNU-WIDER Blog. https://www.wider.unu.edu/publication/net-zero-african-cities-why-next-climate-dollar-must-land-africas-neighbourhoods; Roosta, M., Javadpoor, M., & Sharifi, A. (2025). Analysis of barriers to the implementation of net-zero carbon cities in Iran. *Energy for Sustainable Development*, *89*, 101855. https://doi.org/10.1016/j.esd.2025.101855.

183 Anderson, G., Zhu, L., Mirzoev, T. N., Zhunussova, K., & Ma, J. (2022). *A Low-Carbon Future for the Middle East and Central Asia: What are the Options?* https://www.elibrary.imf.org/view/journals/087/2022/018/article-A001-en.xml; Al-Sarihi, A. (2024, November 14). Gulf Transition to Low-Carbon Economies: The Role of Carbon Markets. *Middle East Council on Global Affairs*. https://mecouncil.org/publication/gulf-transition-to-low-carbon-economies-the-role-of-carbon-markets/; Lindfield, M., & Inkoom, K. B. D. (2022). Financing low carbon and resilient cities in Africa. *African Development Bank*. https://www.afdb.org/sites/default/files/2022/11/08/financing_low_carbon_and_resilient_cities_in_africa_-_sudap_paper_-_afdb_umdf_2022.pdf

184 GHG Protocol. (n.d.). *GHG Protocol for Cities*. Retrieved February 2, 2026, from https://ghgprotocol.org/ghg-protocol-cities

185 C40. (n.d.). *CDP-ICLEI Track: A climate reporting tool*. Retrieved February 2, 2026, from https://www.c40knowledgehub.org/s/article/CDP-ICLEI-Track-A-climate-reporting-tool?language=en_US

Chapter 3

Asia

Chapter 3: Asia

3.1 Region context

Location	Asia including Russia and excluding the Middle East and Caucasus Region
Countries	30 countries within Central, East, South, Southeast, and North Asia
Land Size	~44,579,000 square kilometres
Population	~4.54 billion (2025)
Population Ageing Trend	People over age 65: 10.8% in 2025, 19.2% by 2050
Urbanisation Level	~50% of population live in urban areas, ranging from 20% in Sri Lanka to 100% in Singapore (2024)
Geographic Overview	Asia spans a range of climates–from Arctic and Subarctic in North Asia to Continental across Siberia and Mongolia, Monsoonal and Temperate in East Asia, Tropical in much of Southeast Asia and parts of South Asia, Highland and Alpine climates on the Tibetan Plateau and major mountain ranges. Asia's landscape includes the world's highest mountain ranges and largest plateaus, immense plains and steppes, dense rainforests and tropical islands, and extensive coastlines along the Pacific, Indian, and Arctic Oceans.
Climate Risks	Extreme heatwaves, flooding (in tropical climate), droughts (in high-mountain Asia), sea-level rise (Indian and Pacific Ocean)
Key Urban Networks	Asian Cities Climate Change Resilience Network (ACCCRN); Resilient Cities Network; ASEAN Smart Cities Network; Global Covenant of Mayors for Climate & Energy; CityNet

Source: Various Sources[186]

186 Asian Development Bank. (2024). ***Aging well in Asia: Asian development policy report*** (2024th edn). Asian Development Bank. https://doi.org/10.22617/SGP240253-3; National Geographic. (n.d.). ***Asia: Physical geography***. Retrieved February 3, 2026, from https://education.nationalgeographic.org/resource/asia; United Nations Economic and Social Commission for Asia and the Pacific. (2026). ***Asia-Pacific disaster report 2025: Rising heat, rising risk***. United Nations. https://repository.unescap.org/server/api/core/bitstreams/e55f8a9e-2e7a-414e-8e2e-4eb004248335/content; World Bank. (n.d.). ***Population estimates and projections***. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com; United Nations Economic and Social Commission for Asia and the Pacific. (2023). ***Crisis resilient urban futures: The future of Asian and Pacific cities 2023***. United Nations. https://www.unescap.org/our-work/environment-development/cities-for-a-sustainable-future/asia-pacific-urban-forum; United Nations Human Settlements Programme. (2024). ***Cities and climate action: World cities report 2024***. https://unhabitat.org/sites/default/files/2024/11/wcr2024_-_full_report.pdf; Association of Southeast Asian Nations Secretariat. (2018). ***ASEAN smart cities framework***. https://asean.org/our-communities/asean-smart-cities-network/; Fariman, V. J. (2024, December 17). ***ASCN adds 5 more smart cities to 2024 network, 31 cities in total***. Seasia.co. https://seasia.co/2024/12/17/ascn-adds-5-more-smart-cities-to-2024-network-31-cities-in-total; Asian Development Bank. (n.d.). ***Urban development in Asia and the Pacific***. https://www.adb.org/what-we-do/topics/urban-development; United Nations Human Settlements Programme. (2024). ***World Cities Report 2024***. https://unhabitat.org/wcr/; World Bank. (2015). ***Land area***. World Bank Open Data. Retrieved February 3, 2026, from https://data.worldbank.org/indicator/AG.LND.TOTL.K2.

Asia is the largest and most diverse continent in terms of physical, demographic, and socio-economic characteristics. Spanning approximately 23,658,043 square kilometres[187], Asia covers about 30% of world's total land area and comprises 30 countries, with five of these (Russia, Kazakhstan, Turkey, Georgia, and Azerbaijan) being transcontinental countries that share the boundary with Europe.[188] The largest countries by land area are Russia (Asian portion), China, India and Kazakhstan, each featuring varied landscapes that include the world's highest mountain ranges (e.g., Himalayas), extensive river systems (e.g., Yangtze, Ganges, Mekong, Indus), vast deserts (e.g., Gobi desert), tropical archipelagos, and Arctic tundra in the north.[189]

Asia's population is estimated at approximately 4.54 billion as of 2025.[190] The most populated countries are India, China, Indonesia, Pakistan, and Bangladesh, with India and China together accounting for close to 60% of Asia's total population (Table 3.1). Notably, Asia is experiencing divergent demographic trajectories across its sub-regions. East Asia, particularly Japan, South Korea, and China, faces rapid population ageing. Japan has the world's oldest population (aged 65 and above): exceeding 29% while China and South Korea are projected to become super-aged society by/before 2030. In contrast, South Asia and Southeast Asia remain comparatively youthful, with median age of 28 and 30 respectively, offering potential demographic dividends through the 2040s.[191] This trend is expected to change. Across the region, older population (aged 60 and above) is projected to rise to one in four people by 2050 or about 1.3 billion older persons.[192]

Table 3.1. Population estimates and projections (millions of people) of Asia

Country	Population Estimates and Projections (Millions of People)		
	2000	2025	2050
Asia (Region)	**3611.6**	**4537.2**	**4856.6**
Afghanistan	20.1	43.8	76.9
Bangladesh	134.5	175.7	214.7

187 World Bank. (n.d.). ***Surface area (sq. km)***. Retrieved May 6, 2026, from https://data.worldbank.org/indicator/AG.SRF.TOTL.K2?locations=1W&most_recent_value_desc=true

188 Worlddata.info. (2025). ***Statistics and data of all countries in Asia***. Retrieved February 3, 2026, from https://www.worlddata.info/asia/index.php

189 Worlddata.info. (2025). ***Statistics and data of all countries in Asia***. Retrieved February 3, 2026, from https://www.worlddata.info/asia/index.php

190 World Bank. (n.d.). ***Population estimates and projections***. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com

191 Kirby, P. (2025, October 14). ***South Asia's outlook in five charts***. World Bank Blogs. https://blogs.worldbank.org/en/endpovertyinsouthasia/south-asia-s-outlook-in-five-charts; World Bank. (2025). ***Jobs***. World Bank, Washington, DC. https://doi.org/10.1596/978-1-4648-2295-7

192 Andersson, B. (2021, October 1). ***Is Asia-Pacific ready to age gracefully?*** World Economic Forum. https://www.weforum.org/stories/2021/10/is-asia-pacific-ready-to-be-the-world-s-most-rapidly-ageing-region/

Bhutan	0.6	0.8	0.9
Brunei Darussalam	0.3	0.5	0.5
Cambodia	12.5	17.8	21.9
China	1269.7	1414.0	1249.1
India	1057.9	1463.9	1679.6
Indonesia	216.1	285.7	320.7
Japan	126.8	123.2	105.0
Kazakhstan	15.5	20.8	26.5
Democratic People's Republic of Korea (North Korea)	23.7	26.6	25.8
Republic of Korea (South Korea)	47.0	51.7	44.4
Kyrgyz Republic	4.9	7.3	9.7
Lao PDR	5.4	7.9	9.8
Malaysia	23.0	36.0	44.3
Maldives	0.3	0.5	0.6
Mongolia	2.4	3.6	4.5
Myanmar	45.3	54.9	58.6
Nepal	24.5	29.6	34.6
Pakistan	154.9	255.2	371.9
The Philippines	79.6	116.8	134.4
Russian Federation	146.6	142.8	136.8
Singapore	4.0	6.1	6.2
Sri Lanka	19.3	22.0	23.4
Tajikistan	6.3	10.8	15.6
Thailand	63.0	71.6	66.4
Timor-Leste	0.8	1.4	1.9
Turkmenistan	4.6	7.6	9.6
Uzbekistan	24.8	37.1	52.2
Vietnam	77.2	101.6	110.0

Source: World Bank[193]

193 World Bank. (n.d.). ***Population estimates and projections***. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com

Urbanisation is a transformative force across Asia: approximately 53% of the region's population now reside in urban areas, with an urban growth rate of 1.5% per year.[194] Urban population is projected to reach 62.4% by 2050, driven by rural-to-urban migration, natural population growth, and the reclassification of peri-urban settlements.[195] But urbanisation rates vary significantly across sub-regions. North Asia (Russia) is highly urbanised at approximately 75%, a legacy of Soviet-era industrialisation. East Asia has crossed the 65% threshold, led by Japan (92%), South Korea (81%), and China (66%). In contrast, South Asia remains the least urbanised at around 36% (20% in Sri Lanka), while Southeast Asia recently passed the 50% mark, except for Singapore, which is 100% urban.[196]

There is considerable diversity in Asian cities. The region hosts more than half of the world's megacities—Jakarta, Tokyo, Delhi, Shanghai, Dhaka and Manila rank among the largest urban agglomerations globally, with many exceeding 20 million inhabitants when measured at the metropolitan scale.[197] According to the UN World Urbanisation Prospects 2025, Jakarta now ranks as the world's most populous city at nearly 42 million.[198] Aside from megacities, the majority of the region's rapid urban growth is occurring in small (50,000-200,000 population) and medium-sized (200,000 to 1.5 million population) cities. By 2030, over two-thirds of Southeast Asia's urban population is projected to reside in these smaller, rapidly developing urban areas.[199]

Asia's climate is highly varied, ranging from the Arctic and subarctic conditions of Siberia to the tropical monsoon systems of South and Southeast Asia. The region experiences some of the world's most extreme weather patterns, including intense monsoons, typhoons, and heatwaves. Central Asia is characterised by arid and semi-arid conditions, while the Himalayan and Tibetan Plateau (the Third Pole) contain

194 United Nations. (2025). ***World urbanization prospects 2025: Summary of results***. undesa_pd_2025_wup2025_summary_of_results_final.pdf; World Bank. (n.d.). ***Population estimates and projections***. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com

195 United Nations. (2018). ***68% of the world population projected to live in urban areas by 2050, says UN***. United Nations. https://www.un.org/uk/desa/68-world-population-projected-live-urban-areas-2050-says-un; World Bank. (n.d.). ***Population estimates and projections***. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com

196 World Bank. (n.d.). ***Population estimates and projections***. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com; Statista. (2025, July). ***ASEAN countries: Urbanization 2014-2024***. Statista. https://www.statista.com/statistics/804503/urbanization-in-the-asean-countries/

197 United Nations. (2025). ***World urbanization prospects 2025: Summary of results***. https://population.un.org/wup/assets/Publications/undesa_pd_2025_wup2025_summary_of_results_final.pdf

198 United Nations. (2025). ***World urbanization prospects 2025: Summary of results***. https://population.un.org/wup/assets/Publications/undesa_pd_2025_wup2025_summary_of_results_final.pdf; Ganglani, J. (2025, November 25). ***Move aside Tokyo, the world has a new largest city***. NBC News. https://www.nbcnews.com/world/asia/jakarta-worlds-largest-city-tokyo-most-populated-dhaka-new-un-report-rcna245798

199 United Nations. (2025). ***World urbanization prospects 2025: Summary of results***. https://population.un.org/wup/assets/Publications/undesa_pd_2025_wup2025_summary_of_results_final.pdf; Copernicus. (2025, April 12). ***Observer: Seven things we learned from the UN world urbanization prospects***. EU Space. https://www.copernicus.eu/en/news/news/observer-seven-things-we-learned-un-world-urbanization-prospects

the largest concentration of ice outside the North and South Poles, influencing water systems across multiple countries. The climate and topography diversity underpin a wide array of ecosystems, agricultural practices, and climate vulnerabilities that shape urban planning priorities across the region.[200]

Economically, Asia has a full spectrum of development. East Asia contains high-income economies such as Japan, South Korea, alongside upper-middle-income China. South Asia and Southeast Asia include a mix of high-income (Singapore), lower (e.g., Laos, Myanmar, Timor-Leste) to middle-income and emerging economies (e.g., Indonesia, Malaysia, Thailand, Vietnam), with India and Indonesia being the largest economies.[201] Central Asia is transitioning from post-Soviet industrial models towards trade-oriented growth.[202] According to the United Nations Human Development Index (HDI), most East Asian countries rank very high, reflecting strong education systems, robust healthcare, and high standards of living. South and Southeast Asian countries (except for Singapore), while making significant progress, tend to rank lower in HDI, highlighting ongoing challenges related to poverty reduction, infrastructure development, and social inclusion.[203]

Asia's urban development vision is shaped by a combination of national policies and regional cooperation frameworks. In Southeast Asia, the ASEAN Smart Cities Network coordinates 26 pilots across all ten member countries to advance digital transformation, sustainable infrastructure, and quality of life improvements.[204] The network has expanded to 35 cities as of 2025, with additional members joining from Thailand, Indonesia, Cambodia, Malaysia, and the Philippines.[205] South Asia lacks a comparable regional mechanism though national urban missions such as India's Smart Cities Mission (covering 100 cities) and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) provide policy direction for urban development.[206]

Across the region, UN-Habitat's regional programmes and Asian Development Bank's (ADB) urban sector strategies and the Cities Development Initiative for Asia (CDIA, a ADB-managed trust fund support secondary cities in preparing bankable infrastructure investments) provide technical and financial support.[207] In addition, bilateral partnerships support capacity building for climate adaptation, affordable housing, and resilient infrastructure.[208] City networks facilitate knowledge exchange and collective action. Examples include the CityNet (comprising over 135 municipalities, NGOs, private companies, and research centres), Asian Cities Climate Change Resilience Network (ACCCRN, spanning over 50 cities in India, Indonesia, Thailand, Vietnam, Bangladesh, and the Philippines), Resilient Cities Network (the successor to 100 Resilient Cities, now operating in nearly 100 cities globally with a formal UN-Habitat partnership), and the Global Covenant of Mayors for Climate and Energy (with over 240 signatory cities across Asia committed to emissions reduction and climate resilience).[209]

Asia's urban forms reflect these diverging economic and environmental realities. In North Asia (Russia), the dominant forms include single-industry towns and strategic Arctic outposts, where melting permafrost threatens the structural integrity of buildings and pipelines in cities like Yakutsk and Norilsk.[210] A major policy trend is the "Pivot

200 United Nations Economic and Social Commission for Asia and the Pacific. (2023). *Crisis resilient urban futures: The future of Asian and Pacific cities 2023*. United Nations. https://www.unescap.org/our-work/environment-development/cities-for-a-sustainable-future/asia-pacific-urban-forum; United Nations Human Settlements Programme. (2024). *Cities and climate action: World cities report 2024*. https://unhabitat.org/sites/default/files/2024/11/wcr2024_-_full_report.pdf; United Nations Economic and Social Commission for Asia and the Pacific. (2026). *Asia-Pacific disaster report 2025: Rising heat, rising risk*. United Nations. https://repository.unescap.org/server/api/core/bitstreams/e55f8a9e-2e7a-414e-8e2e-4eb004248335/content

201 Park, C., & Yeung, B. (2021). *An integrated and smart ASEAN: Overcoming adversities and achieving sustainable and inclusive growth* (ADBI Working Paper Series 1267). Asian Development Bank Institute. https://www.adb.org/sites/default/files/publication/705221/adbi-wp1267.pdf

202 Azhgaliyeva, D., Mogilevskii, R., & Akbar, R. (2024). *Unlocking transport connectivity in the Caucasus and Central Asia*. Asian Development Bank Institute. https://doi.org/10.56506/SLWV3183

203 Asian Development Bank. (n.d.). *Urban development in Asia and the Pacific*. Asian Development Bank. Retrieved February 3, 2026, from https://www.adb.org/what-we-do/topics/urban-development; Ellis, P., & Roberts, M. (2016). *Leveraging urbanization in South Asia*. World Bank. https://doi.org/10.1596/978-1-4648-0662-9; United Nations Development Programme. (n.d.). Human development index. In *Human Development Reports*. United Nations. Retrieved February 3, 2026, from https://hdr.undp.org/data-center/human-development-index

204 Association of Southeast Asian Nations Secretariat. (n.d.). ASEAN Smart Cities Network. *ASEAN Main Portal*. Retrieved February 3, 2026, from https://asean.org/our-communities/asean-smart-cities-network/

205 Fariman, V. J. (2024, December 17). *ASCN adds 5 more smart cities to 2024 network, 31 cities in total*. Seasia.Co. https://seasia.co/2024/12/17/ascn-adds-5-more-smart-cities-to-2024-network-31-cities-in-total

206 Ministry of Housing and Urban Affairs. (2024, December 18). *Smart Cities Mission achievements*. Press Information Bureau Research Unit. http://www.pib.gov.in/PressNoteDetails.aspx?NoteId=153581; Kumar, S., & Abhishek, K. Sa. P. (2025). *10 years of AMRUT: Transforming cities, improving lives*. Press Information Bureau Backgrounders. https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/jun/doc2025624576101.pdf

207 Asian Development Bank. (n.d.). *Cities development initiative for Asia*. Asian Development Bank. Retrieved February 3, 2026, from https://www.adb.org/what-we-do/funds/cities-development-initiative-asia; Cities Development Initiative For Asia. (n.d.). *About us*. Cities Development Initiative For Asia. Retrieved February 3, 2026, from https://cdia.asia/about-us/

208 Asian Development Bank. (n.d.). *Urban development in Asia and the Pacific*. Asian Development Bank. Retrieved February 3, 2026, from https://www.adb.org/what-we-do/topics/urban-development; United Nations Human Settlements Programme. (2024). *Cities and climate action: World cities report 2024*. https://unhabitat.org/sites/default/files/2024/11/wcr2024_-_full_report.pdf

209 CityNet Secretariat. (n.d.). *About Us*. CityNet. Retrieved February 3, 2026, from https://citynet-ap.org; United Nations Economic and Social Commission for Asia and the Pacific. (n.d.). *CityNet*. SDG Help Desk. Retrieved February 3, 2026, from https://sdghelpdesk.unescap.org/institutes/citynet; Asian Cities Climate Change Resilience Network. (n.d.). *About ACCCRN*. Retrieved January 8, 2026, from https://www.acccrn.net/; Rockefeller Foundation. (2011). *The Rockefeller Foundation initiative Asian Cities Climate Change Resilience Network: Midterm evaluation*. https://climatechange.issuelab.org/resources/27659/27659.pdf; Resilient Cities Network. (n.d.). *Our story*. Resilient Cities Network. Retrieved February 3, 2026, from https://resilientcitiesnetwork.org/about-r-cities/; Santos, B. (2025, February 19). *UN-Habitat and Resilient Cities Network formalize partnership to strengthen urban resilience*. UN-Habitat Urban Resilience Hub. https://urbanresiliencehub.org/un-habitat-and-resilient-cities-network-formalize-partnership-to-strengthen-urban-resilience/; Global Covenant of Mayors for Climate and Energy. (2024, July 11). *GCoM Asia: Climate action and achievements*. Global Covenant of Mayors for Climate and Energy. https://www.globalcovenantofmayors.org/press/gcom-asia-climate-action-achievements/

210 Laruelle, M., & Orttung, R. (2017). *Urban sustainability in the Arctic: Visions, contexts, and challenges*. https://pureportal.spbu.ru/files/28351481/Urban_Sustainability_in_the_Arctic.pdf; Orttung, R. W., Berman, M., Petrov, A., & Jull, M. (2026). *Arctic cities: Measuring Urban Sustainability in Transition (MUST)*. Navigating the New Arctic Community Office. https://nna-co.org/research/projects/arctic-cities-measuring-urban-sustainability-transition-must/

to the East", through which the Russian government is attempting to revitalise cities like Vladivostok as gateways to East Asian markets though these efforts struggle against the pull of westward migration.[211] In Central Asia, cities such as Almaty, Baku, and Tashkent are positioning themselves as logistics nodes on China's Belt and Road Initiative, modernising infrastructure to handle transcontinental trade. East Asia is defined by megacities and megalopolises such as China's Pearl River Delta (Hong Kong–Shenzhen–Guangzhou–Macao) and Yangtze River Delta (Shanghai–Nanjing–Hangzhou), and Japan's Tokyo–Osaka Tokaido corridor, where cities merge into continuous urban corridors supported by high-speed rail.[212]

A distinctive feature is peri-urbanisation, which is a rapid, transformative process where rural land on city fringes is converted to industrial, residential, and commercial zones, often in piecemeal fashion, and creating intense resource pressure, land-use conflict, and infrastructure gaps. Driven by economic growth, peri-urbanisation is the epicentre of Asian urbanisation—it is estimated that 40% of urban population growth occur in these zones, particularly in China, Southeast and South Asia.[213] For South Asia and Southeast Asia, the primary challenge remains managing rapid, often unplanned growth. South Asia's urbanisation has been characterised as "messy and hidden", with at least 130 million people living in informal settlements marked by poor construction, insecure tenure, and inadequate services.[214]

*The desakota model, an intense blend of agriculture and industry within the rural-*urban landscape, is a defining feature of peri-urban areas across Southeast Asia and challenges traditional zoning frameworks.[215] While megacities like Jakarta, Delhi, and Manila continue to dominate national urban systems, there is a strategic shift towards secondary cities. In Vietnam and India, smaller cities are emerging as specialised hubs for manufacturing and technology, offering alternatives to the congestion and inefficiencies of capital cities like Hanoi and New Delhi.[216] Secondary urban hubs such as Vietnam's Da Nang (tech and innovation) and Hai Phong (industrial and logistics) are drawing foreign direct investment (FDI), while India's Pune (automotive and IT) and Hyderabad (tech and life sciences) leverage skilled talent and lower costs.[217] Across the region, urban development priorities are converging on resilience, digital integration, and adaptation to extreme climate risks, from heat action plans in South Asian cities to flood management systems across Southeast Asia's coastal zones.[218]

3.2 Urban challenges

Asian cities face multiple interconnected urban challenges driven by rapid population growth, climate change, infrastructure deficits, and governance capacity constraints. Key issues include climate vulnerability and environmental stress, air pollution, housing informality and infrastructure gaps, and mobility and congestion.[219] While the scale and intensity of these challenges often exceed those faced by other regions due to the large populations and diversified economies, cities across Asia are deploying innovative

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217 Dahiya, B. (2014, September). *Southeast Asia and sustainable urbanization*. Global Asia. https://www.globalasia.org/v9no3/feature/southeast-asia-and-sustainable-urbanization_bharat-dahiya; Organisation for Economic Co-operation and Development. (2018). *OECD urban policy reviews: Viet Nam*. OECD Publishing. https://doi.org/10.1787/9789264286191-en; World Bank & Asian Development Bank. (2025). *Cities as growth hubs: Annexes*. https://documents1.worldbank.org/curated/en/099701112052535274/pdf/IDU-1d7b3ff7-f083-42e4-b300-450c4206840f.pdf; Asian Development Bank. (2025). *Asian Development Bank member fact sheet: Viet Nam*. Retrieved https://www.adb.org/sites/default/files/publication/27813/vie-2024.pdf; Asian Development Bank. (2025, December). *ADB in India: Partnering for development*. ADB India e-Newsletter. https://www.adb.org/sites/default/files/page/814286/india-enewsletter-volume-13.pdf

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strategies, ranging from radical relocation to integrated climate action planning.[220]

3.2.1 Climate vulnerability and environmental stress

Climate vulnerability poses existential threats to Asian cities, particularly coastal megacities facing compounding risks from sea-level rise, land subsidence, and intensifying storm.[221] The majority, 99 of the world's top 100 riskiest cities are in Asia, especially in India, China and Southeast Asia. Southeast Asia is among the world's most climate-exposed regions, with a large part of Jakarta currently below sea level, while parts of North Jakarta have sunk by 2.5 m over the past decade, with some areas subsiding 20-26 cm annually due to unregulated groundwater extraction.[222] Bangkok, Ho Chi Minh City, and Manila face comparable subsidence and flood risks, with projections suggesting that without intervention, significant portions of these cities could experience regular inundation by mid-century.[223]

Climate threats also affect inland areas, e.g., the expansive inland regions of Russia. As the world's fifth-largest emitter of CO^2, Russia is experiencing warming at a rate twice that of the global average, increasing the risks of both floods and wildfires across the country.[224] Unlike European cities, where climate adaptation focuses primarily on incremental resilience measures, several Asian governments are pursuing more radical responses. Indonesia's decision to relocate its capital from Jakarta to Nusantara, a purpose-built city in East Kalimantan on Borneo, has been framed by the government as a response to Jakarta's overcrowding, congestion, environmental degradation, and land subsidence, with total development cost officially estimated in the range of US$32-35 billion.[225] However, even after the relocation of the national capital, the greater Jakarta area will remain home to millions of residents, who continue to face recurrent flooding, increasing water stress and ageing infrastructure, raising equity concerns over who benefits from large-scale adaptation and relocation investments.[226]

In South Asia, extreme heat and erratic monsoons constitute the primary climate threats. Cities in the Indo-Gangetic Plain and Indus River basin experience heat events approaching the limits of human physiological tolerance. Jacobabad, Pakistan, has recorded wet-bulb temperatures exceeding 35°C on multiple occasions since 1979, representing a threshold beyond which the human body cannot cool itself through perspiration.[227] During the 2022 heat wave, Delhi recorded wet-bulb temperatures of 33.6°C, close to the survivability limit (around 35°C theoretically, 31°C actually as laboratory studies suggested).[228] Research from MIT indicates that by century end, without significant emissions reductions, approximately 70% of India's population could be periodically exposed to wet-bulb temperatures of 32°C or higher, with 2% experiencing the 35°C survivability threshold.[229]

Cities are responding through integrated climate action planning. Mumbai's Climate Action Plan (MCAP), launched in March 2022, represents the first comprehensive climate action plan in South Asia to set net-zero emissions targets.[230] Developed by the

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Brihanmumbai Municipal Corporation in collaboration with C40 Cities and the World Resources Institute, MCAP establishes a 30-year roadmap targeting 30% emissions reduction by 2030 and net-zero by 2050, two decades ahead of India's national commitment.[231] In 2024, Mumbai became the fourth city globally (after Oslo, London, and New York) to publish a dedicated climate budget integrating climate targets into municipal financial planning.[232] Regional cooperation frameworks support the municipal efforts in Southeast Asia. The ASEAN Smart Cities Network coordinates 35 pilots on sustainable development and urban resilience, while the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) has established a Green Cities Initiative targeting implementation of Sustainable Urban Development Frameworks in 40 cities (Figure 3.1).[233]

Another environmental concern is air pollution, which has emerged as a critical urban and transboundary problem across Asia, particularly in South Asia, where it has escalated into a public health crisis. Bangladesh, Pakistan, India, and Nepal rank among the world's five most polluted countries, with their capital cities all appearing in the top ten most polluted cities globally.[234] According to the 2024 World Air Quality Report, 74 of the 100 most polluted cities globally are in India, with New Delhi ranking as the world's most polluted capital for the sixth consecutive year.[235] New Delhi's annual average PM2.5 concentration of 108.3 micrograms per cubic metre in 2024 exceeded the WHO guidelines by more than 20 times.[236] There are several sources including industrial emissions, heavy coal combustion for power, and vehicle exhaust, compounded by agricultural crop residue burning, particularly in winter. During winter months, a persistent smog layer forms across the Indo-Gangetic Plain, driven by vehicle emissions, industrial output, construction dust, and seasonal crop stubble burning.[237] In November 2024, Lahore recorded Air Quality Index readings of over 1,000 levels (reaching 1900-2000+ in some areas), which are over 70 times above WHO annual air quality guideline limits, forcing school closures, work stoppages, and a green lockdown restricting vehicle movement.[238]

Figure 3.1. Sustainable Urban Development Frameworks of IMT-GT

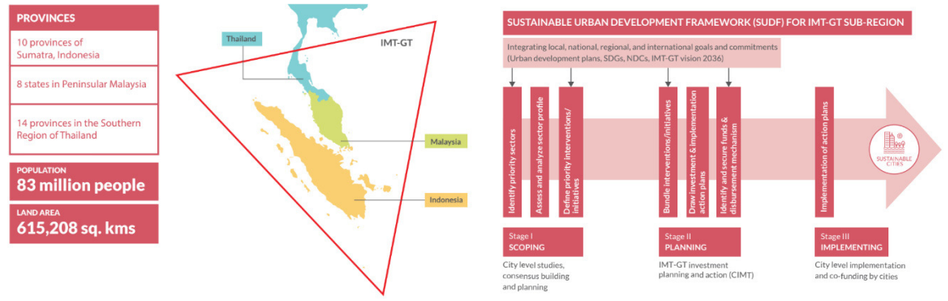

Image source: IMT-GT Joint Business Council[239]

In North Asia, Russia, especially Buryatia, Transbaikalia and Krasnoyarsk are the most affected, shaped by their industrial legacy and urban development pattern.[240] Key sources include vehicle emissions and traffic congestion, central heating systems, and, in spring, airborne suspensions of anti-icing chemicals and soil particles.[241] Air pollution occurs not just outdoor but also indoor. Indoor air pollution in Mongolia, especially in Ulaanbaatar's ger districts, where 60% of population reside, is a critical health crisis. Driven by burning raw coal and wood for heating in winter, PM2.5 levels in the ger districts range from 42–100 $\mu g/m^3$, sometimes reaching as high as 203.9 $\mu g/m^3$, which is well above the WHO annual air quality guideline of 5 $\mu g/m^3$, leading to severe

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respiratory, cardiovascular, and fatal health issues. [242]

The health and economic impacts are substantial. The WHO estimates that air pollution causes 6.7 to 7 million premature deaths each year (4.2 million from outdoor air pollution, and the rest from indoor air pollution).[243] The majority (89%) of these deaths occur in low- and middle-income countries, especially South and Southeast Asia. The Air Quality Life Index estimates that air pollution reduces life expectancy for the average Indian resident by 5.3 years, and by more than 8 years for residents in Delhi.[244] Estimates suggest that deaths linked to air pollution in Southeast Asia could increase by up to 10% by 2050, costing the region US$600 billion.[245] The crisis extends beyond health impacts to economic productivity as hazardous air quality periodically forces school closures, construction halts, and reduced outdoor labour across the region.[246] Air pollution is estimated to have a negative impact of about 2% to 4% on GDP.[247]

Response strategies vary in ambition and effectiveness. India's National Clean Air Programme (NCAP), launched in 2019, targets reductions in PM2.5 concentrations across 131 cities, though implementation has been uneven.[248] Delhi has experimented with odd-even vehicle rationing schemes and imposed bans on older diesel and petrol vehicles.[249] According to the Delhi Economic Survey 2022-23, the total number of motor vehicles on the city's roads fell by about 35% after the enforcement of age-based restrictions on over-age vehicles.[250] However, vehicle emissions remain the largest contributor to PM2.5 pollution, and enforcement challenges persist. At the regional level, coordinated action remains limited: the 2024 World Air Quality Report noted that 96% of air quality monitoring stations in cities like Lahore, Peshawar, and Dhaka are operated by private entities rather than governments, indicating insufficient public sector capacity.[251] Researchers advocate treating the Indo-Gangetic Plain as a shared airshed, since pollution routinely crosses national borders; however, no multilateral air-quality framework yet exists in contrast to cooperative regimes in Southeast Asia.[252]

In Southeast Asia, the ASEAN Agreement on Transboundary Haze Pollution (AATHP) serves as a binding framework for collective action. This agreement is supported by a roadmap that outlines joint initiatives, complemented by possible channels for support and synergy such as the Acid Deposition Monitoring Network in East Asia (EANET) for shared monitoring and assessment.[253] Evaluation of the impacts of each measure/solution analysis employs the Greenhouse gas and Air pollution Interactions and Synergies (GAINS) model[254], which identifies synergistic measures that, if fully implemented, could more than triple the population breathing "clean air" in the region by 2030, while delivering important climate co-benefits.[255] Meanwhile, Russia has adopted a federal programme "Clean Air" as part of the national project "Ecology", which aims to control the quality of air across the country and includes a reduction of at least 20% in the total amount of pollutant emissions in the most polluted cities.[256] However, the effectiveness is limited due to inadequate real-time monitoring, weak enforcement, and

242 Tsend-Ayush Sainnokhoi, Yadam Tuvshinbayar, Minjin Bat-ochir, Bettina Eck-Varanka, Katalin Hubai, Gábor Teke, Attila Trájer, Altantsetseg Tumurbus, Nora Kováts (2025). Indoor environments: Evaluating air quality in Ulaanbaatar's traditional gers, Chemosphere, 377, 144338.

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252 Khan, A. A., Kumar, P., Gulia, S., & Khare, M. (2024). A critical review of managing air pollution through airshed approach. *Sustainable Horizons*, *9*, 100090. https://doi.org/10.1016/j.horiz.2024.100090; Sriram, S., & Adhikari, S. (2025). Binding multilateral framework for South Asian air pollution control: An urgent call for SAARC-UN Cooperation. *International Journal of Environmental Research and Public Health*, *22*(11), 1628. https://doi.org/10.3390/ijerph22111628; World Bank. (2023). *Striving for clean air: Air pollution and public health in South Asia*. World Bank. https://doi.org/10.1596/978-1-4648-1831-8

253 United Nations Environment Programme. (2025). *Clean air and climate solutions for ASEAN*. United Nations Environment Programme. https://doi.org/10.59117/20.500.11822/47268

254 Amann, M., Bertok, I., Borken-Kleefeld, J., Cofala, J., Heyes, C., Höglund-Isaksson, L., Klimont, Z., Nguyen, B., Posch, M., Rafaj, P., Sandler, R., Schöpp, W., Wagner, F., & Winiwarter, W. (2011). Cost-effective control of air quality and greenhouse gases in Europe: Modeling and policy applications. *Environmental Modelling & Software*, *26*(12), 1489–1501. https://doi.org/10.1016/j.envsoft.2011.07.012

255 United Nations Environment Programme. (2025). *Clean air and climate solutions for ASEAN*. United Nations Environment Programme. https://doi.org/10.59117/20.500.11822/47268

256 Revich, B. A., Khar'kova, T. L., & Kvasha, E. A. (2020). Selected health parameters of people living in cities included into Pure air Federal Project. *Health Risk Analysis*, (2), 16–27. https://doi.org/10.21668/health.risk/2020.2.02

funding shortfalls at the implementation level.[257]

3.2.2 Housing informality and infrastructure gaps

Rapid urbanisation across Asia has outpaced formal housing supply, resulting in extensive informal settlements characterised by tenure insecurity, inadequate services, and vulnerability of displacement.[258] Asia has the world's largest urban slum population—estimated at over 60% of global slum population and projected to continue to rise in coming decades (Figure 3.2).[259] In some cities, especially in East and Southeast Asia (362 million slum dwellers), Central and South Asia (334 million slum dwellers), the concentration can increase to 85% of global slum population.[260] These settlements are usually located along flood prone waterways, steep or unstable slopes, and peripheral areas where land cost is lower.[261] But these locations add to residents' exposure to environmental and safety risks. The peripheral location of informal housing accentuates transport poverty, leaving their residents with longer and costly commutes to employment and services, in terms of time and financial resources that reinforce economic precarity.[262] Developing Asia requires an estimated US$1.7 trillion each year in infrastructure investment through 2030 for upgrading urban slums, addressing basic sanitation, and providing safe water.[263] Estimates indicate that, by 2040, Southeast Asia will need US$3 trillion in infrastructure investment to keep pace with urbanisation and demographic changes and to close infrastructure gaps in transport, energy transition, and digital infrastructure to support inclusive sustainable growth.[264]

Figure 3.2. Squatter settlement in Manila, The Philippines

The infrastructure gap remains a critical, multi-faceted challenge; the deficit is not just in informal settlements but also within formal housing and other urban sectors, involving not only new upgrades and construction but also underinvestment in maintenance. In some parts of Southeast Asia, e.g., Cambodia, the infrastructure gap is characterised by outdated, low quality, and insufficient infrastructure, resulting in high logistics costs (26% of GDP in 2020).[265] In Uzbekistan, a United Nations assessment reported that only 38% of urban households have access to a local sewer system, with significant proportions lacking safe drinking water, which further leads to poor health and environmental issues.[266]In Jakarta, excessive groundwater extraction by residents lacking piped water access has accelerated land subsidence, creating a vicious circle

257 Парамонова, Н. (2020). Кому нужен «Чистый воздух»: Может ли федеральный проект изменить качество воздуха в городах России? [Who needs "clean air": Can a federal project change air quality in Russian cities?]. *Экология и право*, (77), 26–29. Bellona. https://network.bellona.org/content/uploads/sites/4/2020/05/EiP_77_06-1.pdf; Иванцова, Ю. (2019, October 17). *Владимир Бурматов: Проект «Чистый воздух» находится под угрозой срыва* [Vladimir Burmatov: "Clean air" project is under threat of failure]. ФедералПресс. Retrieved February 3, 2026, from https://fedpress.ru/news/77/ecology/2342786

258 United Nations. (2016). *United Nations Conference on Housing and Sustainable Urban Development (Habitat III) regional report for Asia and the Pacific: Transformative urbanization for a resilient Asia-Pacific* (A/CONF.226/11). https://habitat3.org/wp-content/uploads/regional-report-asia-and-the-pacific.pdf

259 United Nations Human Settlements Programme. (2020). *World cities report 2020: The value of sustainable urbanization*. https://unhabitat.org/sites/default/files/2020/10/wcr_2020_report.pdf

260 United Nations Statistics Division. (2023). Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable. Retrieved February 4, 2026, from https://unstats.un.org/sdgs/report/2023/goal-11/#:~:text=The%20world's%20population%20reached%208,varied%20needs%20of%20urban%20residents.

261 Rahmayati, Y., Parnell, M., & Himmayani, V. (2017). Understanding community-led resilience: The Jakarta floods experience. *Australian Journal of Emergency Management*, *32*(4), 58–66. https://www.researchgate.net/publication/320796805_Understanding_community-led_resilience_The_Jakarta_floods_experience; Prakash, G. (2010). *Noir urbanisms: Dystopic images of the modern city*. Princeton University Press.; Khan, A. A., Kumar, P., Gulia, S., & Khare, M. (2024). A critical review of managing air pollution through airshed approach. *Sustainable Horizons*, *9*, 100090. https://doi.org/10.1016/j.horiz.2024.100090; Cortez, F. S. (2024). Informal settlers in the Municipality of Concepcion, Tarlac: A basis for housing development programs. *International Journal of Creative Research Thoughts (IJCRT)*, 12(12), 660–692. https://ijcrt.org/papers/IJCRT2412509.pdf

262 World Bank. (2022). *Integrated corridor management Dhaka North project (P177702)* (Project Information Document No. PIDC33491). World Bank. https://documents1.worldbank.org/curated/en/099300006232222667/pdf/P1777020b38220040a9490dbfb31f656f5.pdf; Niger, M. (2013). Deficiencies of existing public transport system and a proposal for integrated hierarchical transport network as an improvement options: A case of Dhaka city. *IOSR Journal of Mechanical and Civil Engineering*, *5*(5), 42–53. https://doi.org/10.9790/1684-0554253; Gallagher, R. (2016). *Cost-benefit analysis: Dhaka's future urban transport*. Copenhagen Consensus Center. https://copenhagenconsensus.com/sites/default/files/gallagher_urban_transport.pdf

263 Asian Development Bank. (2017). Meeting Asia's infrastructure needs. https://www.adb.org/sites/default/files/publication/227496/special-report-infrastructure.pdf

264 *Global Infrastructure Outlook—A G20 INITIATIVE*. (n.d.). Retrieved 17 April 2026, from https://outlook.gihub.org/

265 International Development Association. (2024). *Project paper on a proposed additional credit in the amount of SDR 26.40 million (US$35 million equivalent) to the Kingdom of Cambodia for the Road Connectivity Improvement Project* (Report No. PAD5563). World Bank Group. https://documents1.worldbank.org/curated/en/099022724170550961/pdf/BOSIB1d68b7a1e0771bbb41c672100dc23a.pdf

266 United Nations. (2016). *Country profiles on housing and land management: Uzbekistan*. UN. https://doi.org/10.18356/6c4e2157-en

between infrastructure deficits and informal housing.[267] In many parts of developing Asia, the infrastructure gap is complicated by weak urban planning systems (e.g., weak implementation and enforcement of urban plans, weak planning capacity in skilled personnel, data and mapping, lack of long-term strategic planning), and lack of clear legislative and institutional frameworks.[268]

Many cities have started to address the urban slum and infrastructure deficits. Various approaches are implemented, from large scale public housing in Hong Kong and Singapore to site and service kampong improvement programme in Jakarta and community-led, demand-driven solutions like Baan Mankong ("secure housing") slum upgrading programme in Bangkok. Instead of imposing standardised projects, the Baan Mankong programme supports community organisations in finding their own solutions to secure land and improve housing conditions.[269] Multilateral development banks, bilateral cooperation (e.g., Cambodia and Australia) and regional partnerships and networks like CDIA and South Asia Subregional Economic Cooperation, are working with cities to address the infrastructure investment deficits.[270] Increasingly, the focus is not only on capital city but also on secondary cities that are rapidly becoming new growth centres. Countries are recognising the importance of closing the infrastructure gap and have started to review and strengthen their investment environment. For example, the Cambodian government has enacted new laws to attract private sector investment: the Industrial Development Policy, the updated law on Investment in the Kingdom of Cambodia of 2023 (Law on Investment) and the Law on Public and Private Partnership (the "PPP Law") enacted in 2021. The PPP Law aims to promote the management and implementation of public and private partnership (P3) projects in an effective, efficient, sustainable, transparent, and accountable manner.

3.2.3 Mobility and congestion

A related challenge is traffic congestion. Across Asia, motor vehicle fleets are doubling every 5 to 7 years, causing severe congestion, air pollution, and economic costs to cities. Registered automobiles in Dhaka doubled from 73,000 to 140,000 between 2011 and 2017, yet road capacity expanded minimally.[271] Average vehicle speeds on Dhaka's main roads have declined from 21 km/h in 2005 to 4.8 km/h by 2023.[272] The resultant traffic congestion is costing the economy an estimated US$6.5 billion annually in lost productivity, wasted fuel, and health impacts—estimates indicate that 6% to 10% of Bangladesh's GDP is lost to congestion-related costs.[273]

Traffic congestion is compounded by historical planning failures, geographic constraints, ageing vehicle fleets, and lack of alternate public transport. In Almaty, Kazakhstan, where 38% of residents are reliant on private cars and over 80% of fleet is older than 10 years, average driving speeds at 19 km/h, despite the introduction of a bus rapid transit line in 2018.[274] Similar congestion occurs in Russia, where Moscow registers peak road demand at twice its network capacity, limiting speeds to about 10 km/h[275] and costing drivers 127 hours annually in delays.[276] The problem is in part historical: the road system was underdeveloped during Soviet times. But despite growing attention to the development of the road network, its density and quality are still below the needs of rapidly increasing motorisation.[277]

While motorisation rates are rising, public transit infrastructure in many developing Asian cities has not kept pace. Many Asian cities lack foundational transit infrastructure, particularly for public transport. In Dhaka, bus service is fragmented, underregulated,

267 World Bank. (2021). *Pathways to integrated urban water management for Greater Jakarta*. World Bank. https://documents1.worldbank.org/curated/en/099230103072290487/pdf/P17075703872a603a085b004de6ca21efb7.pdf; Ng, D., & Rivai, I. (2020, February 28). Why Jakarta is the fastest sinking city in the world. *Channel News Asia*. https://www.channelnewsasia.com/cnainsider/why-jakarta-is-world-fastest-sinking-city-floods-climate-change-781491

268 United Nations Development Programme. (2025, October). Rethinking urban governance. https://www.undp.org/sites/g/files/zskgke326/files/2025-10/rethinking_urban_governance_single_pages_compressed.pdf; Asian Development Bank. (n.d.). *Urban development*. Retrieved April 17, 2026, from https://www.adb.org/what-we-do/topics/urban-development

269 Boonyabancha, S. (2009). Land for housing the poor — by the poor: Experiences from the Baan Mankong nationwide slum upgrading programme in Thailand. *Environment and Urbanization*, *21*(2), 309–329. https://doi.org/10.1177/0956247809342180

270 South Asia Subregional Economic Cooperation. (n.d.). *What is SASEC?* SASEC. Retrieved February 4, 2026, from https://www.sasec.asia/index.php?page=what-is-sasec

271 World Bank. (2022). *Integrated corridor management Dhaka North project (P177702)* (Project Information Document No. PIDC33491). World Bank. https://documents1.worldbank.org/curated/en/099300006232222667/pdf/P1777020b38220040a9490dbfb31f656f5.pdf

272 Islam, M. J. (2025, February 21). *Beyond flyovers and expressways: What can solve Dhaka's traffic crisis? | The Business Standard*. The Business Standard. https://www.tbsnews.net/features/panorama/beyond-flyovers-and-expressways-what-can-solve-dhakas-traffic-crisis-1074471; Ali, Md. M., Didar, Md. A. H., Hosna, A.-U., Moni, S. A., & Nobi, Md. N. (2022). Traffic jam in Bangladesh: An analysis focusing the economic impact. *Global Mainstream Journal of Business, Economics, Development & Project Management*, *1*(4), 39–43. https://www.researchgate.net/publication/366511815_Traffic_Jam_in_Bangladesh_An_Analysis_Focusing_the_Economic_Impact.; Fattah, Md. A., Morshed, S. R., & Kafy, A.-A. (2022). Insights into the socio-economic impacts of traffic congestion in the port and industrial areas of Chittagong city, Bangladesh. *Transportation Engineering*, *9*, 100122. https://doi.org/10.1016/j.treng.2022.100122

273 Liaquat, Z. B. (2022, March 16). *The economic cost of Dhaka's insane traffic*. Dhaka Tribune. https://www.dhakatribune.com/business/265726/the-economic-cost-of-dhaka%E2%80%99s-insane-traffic; Hossan, S. (2022, November 19). *Economic impact of traffic jam in Bangladesh*. Business Inspection. https://businessinspection.com.bd/economic-impact-of-traffic-jam-in-bd/

274 Nugmanova, A., Arndt, W.-H., Hossain, M. A., & Kim, J. R. (2019). Effectiveness of ring roads in reducing traffic congestion in cities for long run: Big Almaty ring road case Study. *Sustainability*, *11*(18), 4973. https://doi.org/10.3390/su11184973

275 Kolik, A., Radziwill, A., & Turdyeva, N. (2015). *Improving transport infrastructure in Russia* (OECD Economics Department Working Papers No. 1193; OECD Economics Department Working Papers, Vol. 1193). https://doi.org/10.1787/5js4hmcs3mxp-en

276 Аузан, В. (2015). *Стимулы. Парадоксы. Провалы. Город глазами экономистов* [Incentives. Paradoxes. Failures. The city through the eyes of economists] (pp. 1–224). Стрелка Пресс. https://publications.hse.ru/books/https:/publications.hse.ru/books/151970302

277 Kolik, A., Radziwill, A., & Turdyeva, N. (2015). *Improving transport infrastructure in Russia* (OECD Economics Department Working Papers No. 1193; OECD Economics Department Working Papers, Vol. 1193). https://doi.org/10.1787/5js4hmcs3mxp-en

and inefficient, operating on roads largely unsuitable for formal transit operations.[278] Recent regional assessments in Asia estimate that 1.37 billion urban residents lack efficient access to urban public transport.[279] Mass transit expansion is being aggressively pursued to address these deficits. Dhaka's Metro Rail, Jakarta's mass rapid transit system, and Delhi's expanding metro network represent major investments in electrified rail systems aimed at shifting commuters from private vehicles to low carbon transit.[280] Regional frameworks support these efforts: the South Asia Subregional Economic Cooperation (SASEC) programme has implemented 50 transport projects, approximately US$14.6 billion as of March 2025, focusing on multimodal connectivity and cross-border economic corridors.[281] The transport sector accounts for the majority of SASEC investment, affirming that efficient urban mobility underpins economic productivity and regional integration.

Elsewhere, sustained investment is translating into tangible mode shifts. Public transport mode shares in Hong Kong, Singapore (Figure 3.3), Seoul, and Tokyo exceed 50%.[282] The most rapid growth has occurred in China, where 23 cities have built new transit lines between 2003 and 2014, and the number of urban rail transit projects is increasing.[283] Attention is not just on system expansion but also towards low carbon development.

278 World Bank. (2022). *Integrated corridor management Dhaka North project (P177702)* (Project Information Document No. PIDC33491). World Bank. https://documents1.worldbank.org/curated/en/099300006232222667/pdf/P1777020b38220040a9490dbfb31f656f5.pdf

279 Gota, S., & Huizenga, C. (2022). *Asian transport 2030 outlook*. https://asiantransportobservatory.org/documents/11/Asian_Transport_2030_Outlook_Nov_2022.pdf

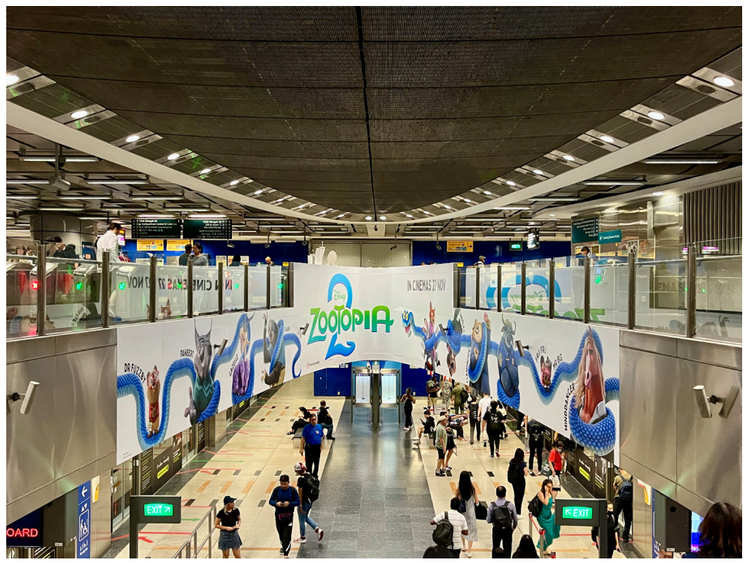
280 Alam, S. A. S. (2024, October 7). *Trapped in Dhaka's traffic: How to overcome this crisis?* The Daily Star. https://www.thedailystar.net/opinion/views/news/trapped-dhakas-traffic-how-overcome-crisis-3722041; Institute for Transportation and Development Policy. (2012). *Implementing Low Carbon Public Transport in Jakarta Project* (Technical Specification on Cleaner Fuel Buses for Direct Service No. 1; Institute for Transportation and Development Policy. *Renewable Energy & Energy Efficiency Project 108010494)*. https://itdp-indonesia.org/wp-content/uploads/2012/10/reeep-1-fleet-specification-report.pdf; Sharma, N., Singh, A., Dhyani, R., & Gaur, S. (2014). Emission reduction from MRTS projects – A case study of Delhi metro. *Atmospheric Pollution Research*, *5*(4), 721–728. https://doi.org/10.5094/APR.2014.081; Mowri, S., & Bailey, A. (2025). Choreographing mobilities & urban imaginaries: Case study of Dhaka Mass Rapid Transit (MRT). *Cities*, *163*, 106039. https://doi.org/10.1016/j.cities.2025.106039; Kornik, J. (2021, October 25). *MRT Jakarta CEO: Massive metro project will make the city more mobile, modern and sustainable*. Vision by Protiviti. https://vision.protiviti.com/insight/mrt-jakarta-ceo-massive-metro-project-will-make-city-more-mobile-modern-and-sustainable

281 South Asia Subregional Economic Cooperation. (n.d.). *What is SASEC?* SASEC. Retrieved February 4, 2026, from https://www.sasec.asia/index.php?page=what-is-sasec

282 Choi, C. C., & Loh, N. (2013). Transport policies and patterns: A comparison of five Asian cities. *Geography, Political Science, Economics*. https://www.semanticscholar.org/paper/Transport-Policies-and-Patterns:-A-Comparison-of-Cheong-Loh/4e081be85e61c385ba776f6825e1bc356d9621eb

283 Zhang, X., Liu, X., Hang, J., Yao, D., & Shi, G. (2016). Do urban rail transit facilities affect housing prices? Evidence from China. *Sustainability*, *8*(4), 380. https://doi.org/10.3390/su8040380; Chang, Z., & Phang, S.-Y. (2017). Urban rail transit PPPs: Lessons from East Asian cities. *Transportation Research Part A: Policy and Practice*, *105*, 106–122. https://doi.org/10.1016/j.tra.2017.08.015

Figure 3.3. HarbourFront Mass Rapid Transit Station in Singapore



Shenzhen nearly doubled its number of buses in a decade through massive investment, while its subway network expanded from 22 km in 2005 to 284 km by 2016.[284] With transport emissions becoming a leading source of pollution, responsible for about 41% of haze events in the city, Shenzhen has pursued an aggressive decarbonisation strategy. Since its designation as one of China's pilot cities for new energy vehicles in 2008, Shenzhen has promoted the electrification of public buses, achieving a 100% electric bus fleet by 2017 (Figure 3.4).[285]

284 Shenzhen Municipal Bureau of Statistics. (2016). *Shenzhen Statistical Yearbook 2015*.

285 Dong, D., Duan, H., Mao, R., Song, Q., Zuo, J., Zhu, J., Wang, G., Hu, M., Dong, B., & Liu, G. (2018). Towards a low carbon transition of urban public transport in megacities: A case study of Shenzhen, China. *Resources, Conservation and Recycling*, *134*, 149–155. https://doi.org/10.1016/j.resconrec.2018.03.011

Figure 3.4. Electric Bus in Shenzhen, China

3.2.4 Ageing population

Asia is undergoing the world's fastest demographic transition, with the aged 60+ population expected to triple to about 1.3 billion by 2050. Driven by falling fertility and rising life expectancy, this shift is creating immense pressure on healthcare, labour markets, and the need for age-friendly infrastructure.[286] East Asia is experiencing acute demographic ageing, often accompanied by depopulation, driven by a combination of fewer marriages, ultra-low births, high cost of living, and changing social and cultural norms. Japan, the world's first super-aged society, has seen its total population fall to 123.8 million as of October 2024, the fourteenth consecutive year of decline, and is projected to shrink to 97 million (24% reduction) by 2050.[287] Nearly two in five Japanese are projected to be aged 65 or older by mid-century.[288] South Korea followed Japan into super-aged status in December 2024, reaching this threshold in just seven years compared to Japan's eleven and Europe's nineteen years.[289] The country holds the world's lowest fertility rate at 0.72 children per woman in 2023, rising marginally to 0.74 in 2024, still far below the 2.1 replacement level needed to sustain population.[290] China faces similar trajectories: its population is projected to shrink by half from the current 1.4 billion to 600–770 million in the next 75 years, by 2100. China's working-age population has been contracting since 2014, while the aged 65 and above population is projected to increase from 15.2% in 2025 to approximately 30% by 2050.[291] Russia's population is also expected to age significantly, with its working-age population projected to decrease by up to 14% over the next decades.[292] In Central Asia, Kazakhstan and Uzbekistan are experiencing declining fertility rates and have begun to age as well.[293]

These demographic shifts carry profound urban—social and economic—implications. In South Korea, the government has declared a national demographic emergency in June 2024, recognising that without intervention, the economy could begin contracting by 2040. The country spent approximately 280 trillion Korean won over two decades attempting to raise fertility rates but with limited success.[294] China faces a similar fiscal burden, with pension expenditure rising to 6.3% of GDP in 2024 from 4.1% a decade earlier, while the contributor-to-retiree ratio has fallen from 5:1 in 2000 to 2.8:1 in 2024.[295] In September 2024, China announced that it would raise retirement age over a 15-year period, increasing for men from age 60 to 63 and for women from age 50-55 to 55-58, depending on occupation.[296]

286 United Nations. (2025). *Urban transformation in Asia and the Pacific: From growth to resilience*. Economic and Social Commission for Asia and the Pacific. https://repository.unescap.org/server/api/core/bitstreams/6d0bb795-45ea-4827-8764-43a7c43b30b2/content

287 Statistics Bureau of Japan. (n.d.). *Current population estimates as of October 1, 2024*. Ministry of Internal Affairs and Communications. Retrieved February 4, 2026, from https://www.stat.go.jp/english/data/jinsui/2024np/index.html

288 National Institute of Population and Social Security Research. (2023). *Population projections for Japan (2023 revision): 2021 to 2070*. https://www.ipss.go.jp/pp-zenkoku/e/zenkoku_e2023/pp2023e_Summary.pdf

289 Seo, Y., & Lau, C. (2024, December 24). *South Korea becomes 'super-aged' society, new data shows*. CNN. https://www.cnn.com/2024/12/24/asia/south-korea-super-aged-society-intl-hnk; Jeong, H.-H. (2026, January 4). People 65 or older now make up more than 21% of Korea's population. *Korea JoongAng Daily*. https://koreajoongangdaily.joins.com/news/2026-01-04/national/socialAffairs/People-65-or-older-now-make-up-more-than-21-of-Koreas-population/2492384

290 Nakatani, H. (2023). Aging and shrinking population: The looming demographic challenges of super-aged and super-low fertility society starting from Asia. *Global Health & Medicine*, *5*(5), 257–263. https://doi.org/10.35772/ghm.2023.01057.

291 World Bank. (n.d.). *Population estimates and projections*. Retrieved February 3, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections.com; Myers, J. (2016, July 25). *China's working age population will fall 23% by 2050*. World Economic Forum. https://www.weforum.org/stories/2016/07/china-working-ageing-population/

292 Hansl, B., Levin, V., & Shaw, W. (2015). *Searching for a new silver age in Russia: The drivers and impacts of population aging - Overview report (English)* (Working Paper No. 99487). World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/851101467995634363

293 Dyson, E., Bermange, A., Aliga, D., Agyeman, N., Srivastava, A., Karani, L., & Lievens, T. (2025). *Generation 2050 in Central Asia—Regional report*. Genesis Analytics & UNICEF. https://www.unicef.org/eca/media/42726/file/Generation%202050%20in%20Central%20Asia.pdf

294 The Straits Times. (2024, June 20). South Korea declares full-fledged war to combat low birth rate. *The Straits Times*. https://www.straitstimes.com/asia/east-asia/south-korea-declares-full-fledged-war-to-combat-low-birth-rate; Kim, S. (2024, June 19). Yoon declares 'demographic emergency' in Korea as birthrate fall continues. *Korea JoongAng Daily*. https://koreajoongangdaily.joins.com/news/2024-06-19/national/politics/Yoon-declares-demographic-emergency-in-Korea-as-birthrate-fall-continues/2072357

295 Wu, H., & Wang, E. (2024, September 14). *China is raising its retirement age in response to aging workforce and declining population*. PBS News. https://www.pbs.org/newshour/world/china-is-raising-its-retirement-age-in-response-to-aging-workforce-and-declining-population

296 The State Council Information Office of the People's Republic of China. (2025, January 2). *China implements gradual retirement age increase to address population aging*. Xinhua. https://english.scio.gov.cn/m/chinavoices/2025-01/02/content_117641102.html

In Japan, Yubari, a former coal-mining city in Hokkaido declared de facto bankruptcy in 2007 with over 35 billion yen in debt. The city experienced severe depopulation (falling from its peak of over 100,000 around 1960 to under 10,000 residents in 40 years), with a very large majority aged 65 or older.[297] A worrying trend is the growing crisis of "kodokushi" (solitary death), where people die alone and undiscovered for extended periods. In 2024, Japan experienced a significant rise in kodokushi; over 76,000 deaths, with 70% aged 65 and older.[298] In response, Japan has pioneered "smart shrinkage" planning approaches, with cities like Yubari developing centralised service nodes and focusing on quality of life for existing residents rather than pursuing growth.[299] In addition, Japan has established a Ministry of Loneliness and Task Force in 2021, appointing a Minister for Loneliness[300] and creating a dedicated task force to combat social isolation. The Cabinet Office has also convened specialised working groups to define and measure kodokushi to create better policy while local municipalities introduce community support programmes and campaigns to check on older residents.

Regional responses increasingly emphasise age-friendly urban environments and technological adaptation to support ageing in place. Singapore has implemented a healthy precinct framework and age-friendly neighbourhood planning, with research developing evidence-based guidelines for health-enabling environments that support ageing in place.[301] In September 2024, the WHO Regional Office for the Western Pacific convened representatives from eight countries, including Brunei Darussalam, China, Japan, South Korea, Malaysia, the Philippines, Singapore, and Vietnam, to exchange strategies for creating age-friendly environments, emphasising cross-sector collaboration that spans transportation, housing, and urban planning.[302]

297 Lloyd, G. (2021, March 8). *Yubari may offer Japan a taste of things to come*. Japan Today. https://japantoday.com/category/features/lifestyle/yubari-may-offer-japan-a-taste-of-things-to-come

298 Khalil, H. (2024, August 30). Japan: Nearly 4,000 people found more than month after dying alone, report says. *BBC*. https://www.bbc.com/news/articles/cwyx6wwp5d5o; Xinhua, Over 76,000 people die alone in Japan in 2024, 11 April 2025, https://english.news.cn/20250411/31fba0c6730e486286c8f96143639321/c.html#:~:text=Police%20officials%20noted%20that%20many,address%20loneliness%20and%20social%20isolation.

299 Ortiz-Moya, F., & Sieloff, S. (2025). Urban planning responses to population decline in Japan's shrinking cities: Growth strategies vs. decline management. *Geografiska Annaler: Series B, Human Geography*, 1–24. https://doi.org/10.1080/04353684.2025.2554367

300 The world's first Minister for Loneliness was appointed in UK in 2018, see Pimlott, N. (2018). The ministry of loneliness. *Canadian Family Physician*, *64*(3), 166. https://pmc.ncbi.nlm.nih.gov/articles/PMC5851382/; The Mainichi. (2021, May 14). *Japan's "minister of loneliness" in global spotlight as media seek interviews*. Retrieved April 17, 2026, from https://mainichi.jp/english/articles/20210514/p2a/00m/0na/051000c

301 National Population and Talent Division. (n.d.). *Longevity*. National Population and Talent Division. Retrieved February 4, 2026, from https://www.population.gov.sg/our-population/population-trends/longevity/; National Population and Talent Division. (2025). *Ageing population*. National Population and Talent Division. Retrieved February 4, 2026, from https://www.population.gov.sg/our-population/population-trends/ageing-population/

3.3 Smart city development

Smart city development in Asia presents an ambitious urban transformation agenda, with initiatives spanning centralised national missions to regional collaborative networks, and city-level innovations. Its development integrates resource-driven infrastructure (e.g., AI-optimised utilities and transportation) with socially focused services (e.g., e-governance) to enhance urban efficiency, citizen well-being, and sustainability through data analytics, citizen-centric design and partnerships. A growing number of countries are developing smart cities, from Singapore's Smart Nation initiative in November 2014 to India's Smart Cities Mission (SCM) in June 2015, and AI-powered cities and services in Hong Kong and Vietnam.[303] Singapore, consistently ranked among the world's leading smart cities, has pioneered comprehensive smart district development in its Smart Nation programme (Box 3.1). [304] At the same time, it is developing Virtual Singapore, a high-resolution 3D digital twin of the entire city-state that integrates real-time data on buildings, infrastructure, population movements, and environmental factors to simulate urban scenarios and optimise planning decisions.[305]

Southeast Asia has set up the ASEAN Smart Cities Network (ASCN) at the 32nd ASEAN Summit in April 2018 to facilitate cooperation, broker and secure funding for smart city development projects using the ASEAN Smart City Framework (Figure 3.5).[306] In addition, the ASCN Action Plan (2026-2035) provides a long-term strategic blueprint for harmonised urban development.[307] The ASCN operates through National Representatives

302 World Health Organization. (2024, November 13). *Fostering age-friendly environments through national leadership and multisectoral partnerships*. https://www.who.int/westernpacific/newsroom/feature-stories/item/fostering-age-friendly-environments-through-national-leadership-and-multisectoral-partnerships; Xu, W., Lee, S., & Okayasu, H. (2023). Promoting healthy ageing in the Western Pacific: A mini review of good practices and policy responses. *Global Health & Medicine*, *5*(5), 264–270. https://doi.org/10.35772/ghm.2023.01005

303 Smart Nation Singapore. (2025, October 6). *The Smart Nation vision*. Retrieved February 4, 2026, from https://www.smartnation.gov.sg/about/our-vision/smart-nation-vision/; Prime Minister's Office Singapore. (2014, November 24). *Transcript of Prime Minister Lee Hsien Loong's speech at Smart Nation launch*. https://www.pmo.gov.sg/newsroom/transcript-prime-minister-lee-hsien-loongs-speech-smart-nation-launch-24-november/; Ministry of Housing and Urban Affairs. (2015). *Smart Cities Mission*. Government of India. Retrieved February 4, 2026, from https://indiaai.gov.in/missions/smart-cities-mission

304 Smart Nation Singapore. (2025, October 6). *The Smart Nation vision*. Retrieved February 4, 2026, from https://www.smartnation.gov.sg/about/our-vision/smart-nation-vision/

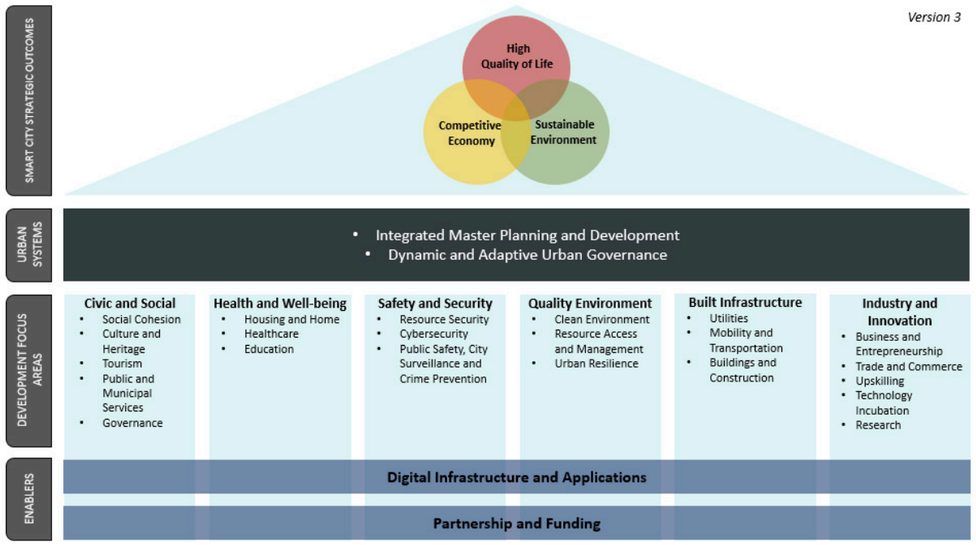
305 Observatory of Public Sector Innovation. (2024, November 5). *Virtual Singapore—Singapore's virtual twin*. https://oecd-opsi.org/innovations/virtual-twin-singapore/

306 Association of Southeast Asian Nations Secretariat. (n.d.). *ASEAN Smart Cities Network*. ASEAN Main Portal. Retrieved February 3, 2026, from https://asean.org/our-communities/asean-smart-cities-network/

307 Kementerian Perumahan dan Kerajaan Tempatan. (2025). *Promotional narrative for the 8th ASEAN Smart Cities Network (ASCN) Annual Meeting 2025*. https://www.kpkt.gov.my/kpkt/resources/user_1/PROGRAM%20KPKT/ASEAN_2025/PDF/NARATIF-ASCN-BI.pdf

designated by each member state and Chief Smart City Officers appointed by each participating city, with the ASEAN Secretariat's Integration Monitoring Directorate coordinating annual progress reports.[308] The financing relies largely on international development assistance and bilateral partnerships (e.g., United States, Japan, Australia), with the ADB Urban Financing Partnership Facility receiving total donor commitments of US$250.61 million as of December 2023 across multiple trust funds.[309]

Figure 3.5. ASEAN Smart City Framework



Source: Association of Southeast Asian Nations Secretariat.[310]

The ASCN has expanded from 26 pilot cities in 2018 to 35 cities by 2025 and has supported the implementation of 108 smart city projects across six focus areas: civic and social development, built infrastructure, quality environment, health and wellbeing, safety and security, and industry and innovation.[311] Southeast Asia smart cities emphasise digital services, climate resilience, and tourism management, with flood monitoring systems in Thailand and the Philippines, digital payment infrastructure across the region, and tourism management platforms in heritage cities like Luang Prabang and Siem Reap.[312] Geo-Informatics and Space Technology Development Agency (GISTDA) of Thailand provides the Sphere platform, offering high-resolution satellite imagery and geospatial services that enable municipalities to conduct granular urban planning, environmental monitoring, and disaster response.[313]

Box 3.1. Singapore: Smart Nation Initiative and Punggol Digital District

Singapore's Smart Nation initiative represents one of Asia's most comprehensive national-scale smart city programmes. The city-state allocated SG$2.4 billion in financial year 2017 alone to support the initiative, which is anchored on three pillars: Digital Economy, Digital Government, and Digital Society. Unlike project-based approaches elsewhere in the region, Singapore's strategy integrates technology across all domains of urban life through centralised coordination under the Smart Nation and Digital Government Office (SNDGO) and the Government Technology Agency (GovTech). The Punggol Digital District (PDD), Singapore's first smart district, operationalises these capabilities at precinct scale. Opened progressively from 2024, PDD co-locates business park facilities with the Singapore Institute of Technology campus, creating an integrated ecosystem for digital economy firms in cybersecurity, IoT, and AI. The Open Digital Platform (ODP), co-developed by JTC and GovTech, serves as the district's digital backbone, managing district cooling, security, parking, and robotic automation through an integrated digital twin. The ODP is projected to achieve 50% reduction in operational manpower and 30% lower energy consumption compared to conventional developments, while reducing carbon emissions by an estimated 1,700 tonnes annually. In September 2024, SIT integrated its Living Lab Network with the ODP, enabling students and researchers to test robotics and AI solutions in real-world conditions.

Source: Smart Nation Singapore. (n.d.). *Smart Nation vision*. https://www.smartnation.gov.sg/about/our-vision/smart-nation-vision/; JTC Corporation. (2025, September 29). *Open Digital Platform — the digital backbone of Punggol Digital District.* JTC. https://www.jtc.gov.sg/punggoldigitaldistrict/story-articles/open-digital-platform-the-digital-backbone-of-pdd

308 Association of Southeast Asian Nations Secretariat. (n.d.). *ASEAN Smart Cities Network*. ASEAN Main Portal. Retrieved February 3, 2026, from https://asean.org/our-communities/asean-smart-cities-network/

309 Asian Development Bank. (2024). *Urban financing partnership facility annual report 2023*. Asian Development Bank. https://www.adb.org/sites/default/files/institutional-document/959616/ufpf-annual-report-2023.pdf

310 Association of Southeast Asian Nations. (2018). *ASEAN smart cities framework*. https://asean.org/wp-content/uploads/2021/09/ASEAN-Smart-Cities-Framework.pdf

311 Association of Southeast Asian Nations Secretariat. (2025). *ASEAN smart cities monitoring and evaluation report 2025*. Retrieved https://asean.org/wp-content/uploads/2025/11/2025-ASCN-ME-Report-Final_30Sep2025-for-public.pdf

312 Asian Development Bank. (2024). *Urban financing partnership facility annual report 2023*. Asian Development Bank. https://www.adb.org/sites/default/files/institutional-document/959616/ufpf-annual-report-2023.pdf

313 Geo-Informatics and Space Technology Development Agency. (n.d.). *GISTDA Sphere platform*. Retrieved February 4, 2026, from https://sphere.gistda.or.th/

South Asia, particularly India, follows a top-down lighthouse strategy led by the central government (Ministry of Housing and Urban Affairs) with smart city project implementation through city-level Special Purpose Vehicles.[314] The Special Purpose Vehicles are each invested with a board, comprising state and municipal representatives and a Chief Executive Officer, typically drawn from the Indian Administrative Service,[315] with a 50:50 cost-sharing arrangement between central and state governments, supplemented by urban local body contributions and public-private partnerships.[316] India's smart Cities Mission seeks to transform 100 cities into sustainable, citizen-friendly and economically viable hubs, The priority centres on retrofitting core infrastructure such as smart water, sanitation and waste management, energy efficient buildings and intelligent transport, overlaid with digital monitoring systems like Supervisory Control and Data Acquisition systems[317] and Integrated Command and Control Centres to enhance real-time urban management (Box 3.2).[318] Environmental performance is assessed using the Climate Smart Cities Assessment Framework 2.0, while the annual Swachh Survekshan rankings assess cleanliness and sanitation across more than 4,500 cities using 10 parameters and 54 indicators.[319]

India's smart city programme has formally concluded in March 2025 with over 7800 projects and investment exceeding US$2.2 billion All 100 smart cities have operational Integrated Command and Control Centres, extensive surveillance networks, and improved service delivery systems, though only 18 cities declared full completion of all planned projects by end of programme.[320] The future of Special Purpose Vehicles remains uncertain, with possibilities ranging from dismantlement to integration into regular municipal functions or evolution into platforms for subsequent urban development programmes. The Special Purpose Vehicles governance model has received sustained criticism for bypassing elected local councils and the 74th Constitutional Amendment provisions on urban decentralisation. Critics argue that Special Purpose Vehicles consolidate power in the hands of bureaucrats over locally elected councillors, with one analysis noting that "the five words 'there is no political interference' were repeated like a mantra" by Special Purpose Vehicles executives to signify reduced roles for local politicians.[321] Others argue that its area-based development approach concentrated resources, with one study finding that the approach covered only 7% of average city area and serving 9% of the population while receiving 80% of smart city funding.[322]

In Russia, the website "gosuslugi.ru" operates across the nation and helps meet many goals of smart communication. It served as the primary communication tool between the government and citizens during the COVID-19 pandemic.[323] However, only 209 out of 1,117 cities participated in the national digitalisation programme including Moscow (Box 3.3).

Central Asia has also begun to engage with smart city as a strategic response to rapid urbanisation and deteriorating infrastructure and is rapidly accelerating through massive, new-build projects that focus on integrating AI, IoT, 5G, and green technologies to manage urban growth, enhance digital governance, improve infrastructure and quality of life, and attract investment. [324] Kazakhstan has introduced "Digital Kazakhstan" in 2018, focusing on smart transport, AI, and driverless light rail in Astana and Almaty.[325] In the following year, it implemented the Reference Standard of Smart Cities, which lists the priority development areas for smart cities: safety, transport, housing and communal services, education, healthcare and city management.[326] Kazakhstan has declared 2026 as the "Year of Digitalization and Artificial Intelligence". Uzbekistan is developing New Tashkent with sustainable energy (trigeneration) and launching the "Khavash Smart Village" with digital governance. Despite progress, projects face challenges including the need for substantial financing, potential corruption, and the need to build digital skills among the population. In Kazakhstan, platforms like eGov.kz and E-Otinish,

314 Singo, M. (2019, July 5). *Special purpose vehicles for smart cities: A question on governance*. Ideas for India. https://www.ideasforindia.in/topics/urbanisation/special-purpose-vehicles-for-smart-cities-a-question-on-governance; Press Information Bureau. (2018, December 27). *100 smart cities selected in four rounds—SPVs incorporated in all 5,151 projects identified by cities worth more than Rs. 2 lakh crore under implementation in 100 cities*. Ministry of Housing and Urban Poverty Alleviation, Government of India https://www.pib.gov.in/newsite/printrelease.aspx?relid=186827&reg=3&lang=2; Kennedy, L., & Sood, A. (2019). Outsourced urban governance as a state rescaling strategy in Hyderabad, India. *Cities*, *85*, 130–139. https://doi.org/10.1016/j.cities.2018.09.001

315 Sinha, M. (2019, July 5). *Special purpose vehicles for smart cities: A question on governance*. IGC. https://www.ideasforindia.in/topics/urbanisation/special-purpose-vehicles-for-smart-cities-a-question-on-governance; Press Information Bureau. (2018, December 27). *100 smart cities selected in 4 rounds—SPVS incorporated in all 5,151 projects identified by cities worth more than Rs. 2 Lakh Crore under implementation in 100 Cities*. Ministry of Housing and Urban Poverty Alleviation. Government of India. https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=186827&reg=3&lang=2

316 Press Information Bureau. (2025, June 24). *10 years of Smart Cities Mission: 94% of projects completed, ₹1.64 lakh crore invested*. Government of India. http://www.pib.gov.in/PressNoteDetails.aspx?NoteId=154736

317 Mazumder, D. (2025, April 20). *Smart Cities Mission 2015: Transforming urban India for a sustainable future*. IMPRI Insights. https://www.impriindia.com/insights/smart-cities-mission-transformation/

318 Press Information Bureau. (2025, June 24). *10 years of Smart Cities Mission*. Government of India. https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=154736&ModuleId=3

319 Ministry of Housing and Urban Affairs. (2025). *Swachh Survekshan 2024–25 report*. Government of India. https://data.opencity.in/dataset/4d4028fe-afed-4b7d-a5de-3b9ff5df8662/resource/01304cbd-f6af-48f1-9dfd-54f85e1d80f0/download/e03eeb4f-35d0-4aa8-acd5-feb3a7abc268.pdf

320 Batra, A. (2025, April 29). *After a decade of its launch, only 18 out of 100 cities have completed Smart Cities Mission projects—But there are some positive takeaways*. Down To Earth. https://www.downtoearth.org.in/governance/after-a-decade-of-its-launch-only-18-out-of-100-cities-have-completed-smart-cities-mission-projects-but-there-are-some-positive-takeaways

321 Zérah, M. H. (2025, October 13). *How the Smart Cities Mission represents another nail in the coffin of local democracy in India*. Scroll.In. https://scroll.in/article/1087246/

322 Moudgil, M., & Jha, S. (2025). After a decade of India's Smart Cities Mission, gains have been unbalanced and inconsistent. *Nature India*, d44151-025-00229–5. https://doi.org/10.1038/d44151-025-00229-5

323 Yuloskov, A., Bahrami, M. R., Mazzara, M., & Kotorov, I. (2021). Smart cities in Russia: Current situation and insights for future development. *Future Internet*, *13*(10), 252. https://doi.org/10.3390/fi13100252

324 Irnazarov, F., & Kayumova, M. (2017). Toward smart city development in Central Asia: A comparative assessment. *Central Asian Affairs*, *4*(1), 51–82. https://doi.org/10.1163/22142290-00401003

325 Irnazarov, F., & Kayumova, M. (2017). Toward smart city development in Central Asia: A comparative assessment. *Central Asian Affairs*, *4*(1), 51–82. https://doi.org/10.1163/22142290-00401003

326 Electronic Government of the Republic of Kazakhstan. (2025, October 21). *Smart cities*. https://egov.kz/cms/en/articles/smart_cities

while praised for improving service efficiency, also raise critical questions about how underdeveloped data safety measures can allow digital governance tools to amplify state control rather than citizen empowerment.[327]

Box 3.2. Indore, India: Smart Waste Management and Zero-Landfill Model

Indore, the largest city in Madhya Pradesh, with a population of approximately four million, has been crowned India's cleanest city for eight consecutive years (2017-2025) in the Swachh Survekshan rankings conducted by the Ministry of Housing and Urban Affairs. This transformation began in 2016 when the Indore Municipal Corporation faced potential state takeover due to poor waste management practices. The city's response combined strict enforcement of waste segregation policies, intensive public awareness campaigns, and investment in modern waste infrastructure.

The key elements of Indore's success include mandatory source segregation of wet, dry, and hazardous waste; door-to-door collection services covering 100% of households; and waste-to-wealth conversion facilities including India's largest Bio-CNG plant, which transforms organic waste into fuel. In 2022, Indore became India's first Seven-Star Certified Waste-Free City, and in 2023 it topped national rankings for clean air among cities with populations exceeding one million. Smart monitoring systems track waste collection vehicles via GPS and RFID, while real-time data analytics optimise collection routes. Community participation has been central: residents have adopted Swachhata (cleanliness) as a cultural norm, with active involvement in cleanliness drives and social pressure against littering. The IMC spends approximately ₹200 crore annually on waste management, but the investment has generated returns through reduced environmental health costs, enhanced tourism appeal, and revenue from waste processing.

Source: Global Methane Initiative. (2023). How India's cleanest city reduces methane emissions from municipal solid waste: A case study on Indore's waste management keys to success. Global Methane Initiative. https://www.globalmethane.org/documents/Indore_Case_Study.pd; Press Information Bureau, Government of India. (2022, October 1). President of India announces results of Swachh Survekshan 2022: Indore is India's cleanest city for the sixth consecutive year, and India's first 7-star Garbage Free city. Press Information Bureau. https://pib.gov.in/PressReleasePage.aspx?PRID=1864209

327 Dyussenov, M. (2025). Digital governance or digital authoritarianism? The ambiguities of e-government in Kazakhstan. *Dialogues on Digital Society*, *1*(3), 274–277. https://doi.org/10.1177/29768640251379943

Box 3.3. Moscow, Russia: Smart City 2030 Strategy

The Smart City – 2030 strategy sets priorities, goals, and objectives for the governance and development of digital economy in Moscow to 2030. Moscow intends to create a smart city where digital technologies boost living standards, performance, and provision of services in the city, enhance competitiveness, and fulfil needs of current and future generations in economy, social services, culture, and environmental protection. The goals are:

- To use digital technologies for sustainable enhancement of citizens' living standards and favourable conditions for entrepreneurship and other activities.
- To implement centralised, comprehensive, and transparent city governance based on Big Data and Artificial Intelligence technologies.
- To boost efficiency of government expenses also through implementing public and private partnership in information and digital technologies and communications.
- To make the city greener.

Key strategies include the adoption of new green technologies to create new smart governance models, enhancing the quality of the analysis of urban system, reducing the amount of waste and emissions, and allowing the reuse of resources to the maximum extent possible. Total amount of pollution emission is one of the KPI to evaluate progress. Moscow's smart city development covers 6 domains,

- Human and social resources.
- Urban environment.
- Digital mobility.
- City economy.
- Safety and ecology.
- Digital government.

Source: Energy Smart Communities Initiative. (2019). *Moscow, Russia - Low carbon model towns*. ESCI Knowledge Sharing Platform. https://esci-ksp.org/Ksp/Show/186

Data privacy frameworks across Asia remain underdeveloped relative to the volume of data. For example, while the ASEAN Framework on Personal Data Protection (2016) and ASEAN Framework on Digital Data Governance (2018) established principles for data management, these frameworks are non-binding and implementation varies considerably across member countries.[328] The ASEAN Digital Economy Framework Agreement, currently under negotiation, aims to create the world's first regionwide binding agreement on digital economy governance, including cybersecurity, data governance, and consumer protection standards.[329] Despite progress, smart city development in Asia still faces profound governance, social, and technological

328 Association of Southeast Asian Nations Secretariat. (n.d.). *ASEAN Telecommunications and Information Technology Ministers Meeting (TelMin): Framework on Digital Governance*. https://asean.org/wp-content/uploads/2012/05/6B-ASEAN-Framework-on-Digital-Data-Governance_Endorsedv1.pdf

329 Kao, K. H. (2025, May 26). *Why ASEAN's new Digital Economy Framework Agreement is a game-changer*. World Economic Forum. https://www.weforum.org/stories/2025/05/asean-digital-economy-framework-agreement-a-gamechanger/

challenges, including, e.g., misalignment of what is a "smart" city by local governments, their reluctance to implement digitalisation, and insufficient financial support.[330]

3.4 Low carbon development

Low carbon development in Asia is accelerating through rapid renewable energy deployment, green finance, and infrastructure investments, with net-zero pledges by 2050 and an estimated US$1 trillion per year in green economy opportunities as quickly as 2030. Key trends include massive solar and/or wind expansion in China and India, renewable growth in Vietnam, and regional power grids and interconnected carbon markets in ASEAN to enhance decarbonisation efficiency.[331] Cap-and-trade systems are expanding rapidly across Asia, driven by the need to meet net-zero targets and prepare for international carbon regulations like the EU Carbon Border Adjustment Mechanism. Indonesia, Singapore, Japan, South Korea and China are advancing their own compliance or voluntary carbon markets; China hosts the world's largest emissions trading system (ETS).[332] Despite progress, various challenges hinder the efficiency and effectiveness of Asia's carbon markets to drive decarbonisation and help meet climate goals—Asia accounts for over 50% of annual global GHG emissions. Current regional prices (below US$20/$tCO_2e$) are far below the estimated US$50–100 per tonne of carbon dioxide equivalent (tCO_2e) required by 2030 to meet the targets of the Paris Agreement; low prices undermine the financial incentive to invest in clean technologies and decarbonise.

Other issues include the oversupply of allowances, leading to a market surplus and reduced prices; and the lack of comprehensive, economy-wide application—most carbon pricing systems are concentrated on the power sector, leaving significant emissions from buildings, agriculture, and transportation largely unpriced. South Korea's system covers about 70% of national emissions while China is looking to broadening its ETS to include heavy industry. The systems also differ in terms of their targets, e.g., China's national ETS uses an intensity-based cap, limiting emissions per output unit rather than setting an absolute cap on total emissions like South Korea. Compared with absolute caps, intensity-based cap increases total emissions as the economy grows, is less effective, and more costly.

The development of low carbon cities in Asia is not only a regional response to climate mitigation[333] but also a governance model that deeply integrates scaled pilot programmes, an intensity-based approach and a community-centred Eco-Model. This process effectively links urban decarbonisation to public health co-benefits and regional carbon market mechanisms using regional/bilateral partnerships and city networks to drive systematic economic transformation. As early as 2008, Japan has established the Eco-Model City initiative, selecting six pioneering municipalities (increased to 23 cities by 2013). Japan's Eco-Model Cities focus on comprehensive emission reduction targets of 50% or more below current levels, coupled with lifestyle and community-based transformation.[334] These cities have implemented Comprehensive Assessment Systems for Building Environmental Efficiency with mandatory performance disclosure.[335] In the same year, India released its National Action Plan on Climate Change, outlining strategies to adapt to climate change and promote sustainable development through eight national missions addressing solar energy, energy efficiency, sustainable habitat, and water conservation. The latest effort includes India's Long-Term Strategy for Low Carbon Development (LT-LEDS), which was submitted at COP27 in 2022, outlining sector-specific pathways for power, industry, transport, buildings, and urban systems aligned with the country's 2070 net zero target.[336]

Through government-to-government partnership with Singapore, China started the development of Tianjin Eco-city, with the aim to transform 30 square kilometres of former saline-alkali wasteland into a green, smart, and low carbon city for a population of 350,000 residents, with focus on ecological restoration, water management, and renewable energy (Figure 3.6). By 2024, about 22 square kilometres are built-up,

330 Kuznetsova, O. N., Kovaleva, N. N., Dvoretskaya, J. A., Melgui, A. E., & Ermakova, L. V. (2022). Smart cities in Russia: Experience, problems, and solutions. In A. V. Bogoviz & E. G. Popkova (Eds), *Digital Technologies and Institutions for Sustainable Development* (pp. 103–108). Springer International Publishing. https://doi.org/10.1007/978-3-031-04289-8_17

331 Ahmedabad Municipal Corporation. (2023). *Ahmedabad climate resilient city action plan—Towards a net zero future*. ICLEI South Asia. https://www.cities-and-regions.org/wp-content/uploads/2023-ahmedabad-climate-resilient-city-action-plan-compressed.pdf; Hess, J. J., Lm, S., Knowlton, K., Saha, S., Dutta, P., Ganguly, P., Tiwari, A., Jaiswal, A., Sheffield, P., Sarkar, J., Bhan, S. C., Begda, A., Shah, T., Solanki, B., & Mavalankar, D. (2018). Building resilience to climate change: pilot evaluation of the impact of India's first heat action plan on all-cause mortality. *Journal of Environmental and Public Health*, *2018*, 1–8. https://doi.org/10.1155/2018/7973519; Shahid, S. (2026, January 14). *IEA Report Reveals What's Next for the Global Car Industry*. ArabWheels. https://www.arabwheels.sa/blog/en/global-car-industry-ev-china-trends/; Asian Development Bank. (2024). *Asia-Pacific climate report 2024: Catalyzing finance and policy solutions*. https://doi.org/10.22617/SGP240498-2; Ministry of the Environment. (2025, December 26). *2050 zero carbon cities in Japan*. Government of Japan. https://www.env.go.jp/en/earth/cc/2050_zero_carbon_cities_in_japan.html

332 NEASPEC Secretariat. (2021). *Comparative study on low carbon city development in China, Japan, and the Republic of Korea*. North-East Asia Low Carbon City Platform. https://www.neaspec.org/sites/default/files/Compartive_Study_On_LCC-final.pdf; Sandalow, D., Meidan, M., Andrews-Speed, P., Hove, A., Qiu, S. Y., & Downie, E. (n.d.). 4: Climate goals. In *Guide to Chinese Climate Policy 2022*. Retrieved February 5, 2026, from https://chineseclimatepolicy.oxfordenergy.org/book-content/domestic-policies/climate-goals/

333 Nikolova, A. (2025). *Regional review of climate ambition and SDG implementation in Asia and the Pacific: From ambitions to results—Sectoral solutions and integrated action*. United Nations. https://unosd.un.org/sites/default/files/day_1_session_1_escap.pdf

334 *'FutureCity' Initiative*. (n.d.). JFS Japan for sustainability. Retrieved February 5, 2026, from https://www.japanfs.org/en/projects/future_city/../../index.html; Sandalow, D., Meidan, M., Andrews-Speed, P., Hove, A., Qiu, S. Y., & Downie, E. (n.d.). 4: Climate goals. In *Guide to Chinese Climate Policy 2022*. Retrieved February 5, 2026, from https://chineseclimatepolicy.oxfordenergy.org/book-content/domestic-policies/climate-goals/

335 Baker McKenzie. (n.d.). *Green certification*. Baker McKenzie Resource Hub. Global Sustainable Buildings Guide. Retrieved February 5, 2026, from https://resourcehub.bakermckenzie.com/en/resources/global-sustainable-buildings/asia-pacific/japan/topics/green-certification

336 Ministry of Environment, Forest and Climate Change. (2022). *India's long-term low-carbon development strategy*. Government of India. https://unfccc.int/sites/default/files/resource/India_LTLEDS.pdf

featuring industrial parks, residential areas, and an Eco-Island district. Eco-city projects in China have expanded, especially following the 2010 National Development and Reform Commission Low Carbon Pilot Province and City Programme, which selected the 1st batch of five provinces and eight cities to develop and implement local low carbon development plans. China has one of the world's most aggressive eco-city development programmes, with more than 200-300 eco-cities planned, under construction, or already established. In 2024, China's new green buildings accounted for 98% of all new urban construction, and energy-saving buildings comprising over 66% of existing buildings in urban areas.[337]

Figure 3.6. Saltpans and polluted wastewater ponds transformed into eco-city, Tianjin, China

Elsewhere, in South and Southeast Asia, e.g., Sri Lanka, Indonesia and Vietnam, have explored eco-city projects under the World Bank Eco2Cities Programme (initiated in 2009), which helps cities to achieve ecological and economic sustainability through integrated urban planning and stakeholder collaboration.[338] These early initiatives laid the foundation for what has become the world's most dynamic region for low carbon urban experimentation. Estimates indicate that a green recovery from the COVID-19 pandemic in ASEAN can generate 30 million jobs by 2030; the ASEAN region requires an estimated US$210 billion in annual renewable energy investment to meet its climate goals.[339]

In India, Ahmedabad has demonstrated how climate adaptation and mitigation can be integrated through its pioneering Heat Action Plan and subsequent Net-Zero Climate Resilient City Action Plan, with measurable mortality reductions and a framework now being scaled nationally (Box 3.4).[340]

Over the past decade, the development of low carbon cities in Asia has increasingly shifted from isolated local projects towards deeper regional and international collaboration, and from voluntary target-setting to structured, compliance-based, and technology-driven partnerships. This shift is characterised by formalised city-to-city partnerships, joint regional action plans, and integration of carbon-neutrality goals with technological transfer through transnational platforms such as the UNESCAP North-East Asia Low Carbon City Platform,[341] C40 Cities network,[342] and ICLEI.[343] The collaborative approach aims to align local actions with national targets and global Sustainable Development Goals, overcoming the limitations of independent local efforts. The focus is on developing multi-level collaboration that combines vertical coordination between national and local governments with horizontal networks across cities through partnerships and activities, e.g.:

- Cross-regional knowledge transfer: The Japan-ASEAN cooperation offers people to people exchange and partners for co-creation of economy and society for the future, peace and stability, where e.g., Kitakyushu has implemented over 192 environmental cooperation projects in 78 cities across 16 countries through its Asian Centre for Low Carbon Society, on

337 State Council Information Office of the People's Republic of China. (2025, November 8). *Full text: Carbon peaking and carbon neutrality—China's plans and solutions*. Xinhua. https://english.www.gov.cn/archive/whitepaper/202511/08/content_WS690ee812c6d00ca5f9a076cd.html

338 Dastur, Arish; Suzuki, Hiroaki; Moffatt, Sebastian; Yabuki, Nanae; Maruyama, Hinako. 2010. Eco2 Cities : Ecological Cities as Economic Cities. Washington DC, The World Bank.

339 Reuters. (2022, September 15). *Southeast Asia needs $210 bln annual investment on renewables—IRENA*. Reuters. https://www.reuters.com/business/energy/southeast-asia-needs-210-bln-annual-investment-renewables-irena-2022-09-15/; Organisation for Economic Co-operation and Development. (2025). *Financing sustainable cities in Southeast Asia: Diversifying instruments and leveraging private investment*. OECD Publishing. https://doi.org/10.1787/d3a921ca-en

340 Kumar, S. (2024, September 19). *National workshop on multi-level action for climate resilient cities* [Press release]. Press Information Bureau, Government of India. https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2056793&reg=3&lang=2

341 North-East Asian Subregional Programme for Environmental Cooperation Secretariat. (n.d.). *About NEASPEC*. https://www.neaspec.org/about-neaspec

342 C40 Cities. (n.d.). *Member cities*. Retrieved February 5, 2026, from https://www.c40.org/cities/

343 C40 Cities Climate Leadership Group. (2017, December 12). *ICLEI, Global Covenant of Mayors, and C40 announce One Planet Charter to accelerate local implementation of the Paris Agreement* [Press release]. https://www.c40.org/news/iclei-global-covenant-of-mayors-and-c40-announce-one-planet-charter-to-accelerate-local-implementation-of-the-paris-agreement/; Granados Alcalá, J., Monteiro, H., Kerim, M., Almeida da Vila, A., Abuassba, A., & Bilgen, N. (2025). *Empowering cities and financing climate-resilient urban futures: Insights from the Gap Fund's partnerships with GCoM and ICLEI*. City Climate Finance Gap Fund. https://www.citygapfund.org/wp-content/uploads/2025/08/5.-Gap-Fund-Report.pdf

waste management, water treatment, and pollution control (Box 3.5).[344] In the area of carbon pricing, China has agreed to join Brazil and the European Union in a coalition aimed at improving collaboration on carbon markets at COP30 (2025), signalling cross-regional cooperation on carbon pricing.[345] The IEA-ASEAN Roadmap for Energy-Efficient Buildings and Construction outlines pathways towards net zero-carbon buildings in Southeast Asia through efficiency improvements, electrification, and renewable integration.[346]

- Combining international technical expertise with local implementation capabilities: Malaysia's Iskandar blueprint demonstrates international research-to-action partnerships linking Japanese and Malaysian institutions with local government implementation (Box 3.6).[347] India's CapaCITIES programme, supported by Swiss development cooperation, pairs international technical expertise with municipal capacity building across eight cities.[348] Another aspect is financing. The Asian Development Bank (ADB) has committed US$100 billion in cumulative climate finance from 2019 to 2030, with 75% of its projects supporting climate change mitigation and adaptation.[349] Since 2015, ADB has issued US$13 billion in green bonds and US$425 million in blue bonds to finance sustainable transportation, coastal protection, and clean energy projects.[350] The ASEAN Catalytic Green Finance Facility (ACGF), a US$2 billion initiative under the ASEAN Infrastructure Fund established in 2019, supports Southeast Asia governments in preparing and financing green infrastructure projects, with US$1.7 billion in co-financing pledged and over 25 projects.[351]
- National level domestic demonstration and vertical governance models**:** Each country has their own characteristics. China's low carbon pilot programme operates through a lighthouse model where successful interventions in pilot cities are documented and disseminated for broader replication.[352] Japan's Eco-Model City network facilitates peer learning and technology sharing among participating municipalities, while the 2011 FutureCity Initiative (cities by 2015) focuses on creating human-centred sustainable cities that improve quality of life through ageing society solutions, environmental sustainability, economic vitality, and post-disaster reconstruction.[353] By 2015, 34 cities were selected as part of these initiatives, comprising 11 "Future Cities" and 23 "Eco-Model Cities".

Progress and achievements are, however, uneven while challenges remain. Research suggests that though China's Low-Carbon Pilot Programme has expanded across three batches (2010, 2012, and 2017) to cover 81 cities and six provinces, the pilot cities have achieved lower annual growth rates in carbon footprint and net carbon footprint compared to non-pilot cities.[354] Central Asia's documents rarely specify urban or regional responsibilities for climate adaptation, mitigation, and funding, resulting in a lack of administrative and financial capacity to carry out low carbon development.[355] In South Asia, the implementation and financing gaps remain,[356] and in Southeast Asia, green finance has expanded but not yet at the required scale or pace,[357] all of which hinders the sustainable development of low carbon cities.

344 United Nations Environment Programme. (2019, August 12). *A model city in Japan is helping Asian cities go green*. United Nations Environment. https://www.unep.org/news-and-stories/story/model-city-japan-helping-asian-cities-go-green; Akagi, J. (2023, August 29). *Kitakyushu's initiatives for realizing a zero-carbon city*. 3rd International Forum on Low Carbon Cities, Incheon, Republic of Korea. NEASPEC. https://www.neaspec.org/sites/default/files/2023-08/Session%202_2.%20Kitakyushu%20%28Ms.%20Junko%20Akagi%29.pdf

345 Song, S., Fong, W. K., & Barbarà, L. (2025, November 11). *Uniting Asia's carbon markets: 5 steps for regional integration*. World Economic Forum. https://www.weforum.org/stories/2025/11/uniting-asia-s-carbon-markets-5-steps-for-regional-integration/

346 International Energy Agency. (2022). *Roadmap for energy-efficient buildings and construction in ASEAN: Timelines and actions towards net zero-carbon buildings and construction*. OECD. https://doi.org/10.1787/bda80fad-en

347 Ho, C. S., Matsuoka, Y., Chau, L. W., Teh, B. T., Simson, J. J., & Gomi, K. (2013). Blueprint for the development of low carbon society scenarios for Asian regions- case study of Iskandar Malaysia. *IOP Conference Series: Earth and Environmental Science*, *16*, 012125. https://doi.org/10.1088/1755-1315/16/1/012125

348 Kumar, S. (2024, September 19). *National workshop on multi-level action for climate resilient cities* [Press release]. Press Information Bureau, Government of India. https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2056793&reg=3&lang=2

349 Asian Development Bank. (2017). Climate change operational framework 2017–2030: Enhanced actions for low greenhouse gas emissions and climate-resilient development. https://www.adb.org/sites/default/files/institutional-document/358881/ccof-2017-2030.pdf

350 Asian Development Bank. (2025). *ADB green and blue bonds newsletter 2025*. https://www.adb.org/sites/default/files/publication/297141/adb-green-blue-bonds-newsletter-2025.pdf

351 Asian Development Bank. (2021, July 2). *Q&A: Funding green recovery in Southeast Asia*. https://www.adb.org/news/features/qa-funding-green-recovery-southeast-asia/

352 State Council Information Office of the People's Republic of China. (2025, November 8). *Full text: Carbon peaking and carbon neutrality—China's plans and solutions*. Xinhua. https://english.www.gov.cn/archive/whitepaper/202511/08/content_WS690ee812c6d00ca5f9a076cd.html; 应对气候变化司. (2010, August 10). 关于开展低碳省区和低碳城市试点工作的通知(发改气候*[2010]1587*号). 国家发展和改革委员会. https://www.ndrc.gov.cn/xxgk/zcfb/tz/201008/t20100810_964674.html

353 Ministry of the Environment, Government of Japan. (2025, September 30). *2050 zero carbon cities in Japan*. https://www.env.go.jp/en/earth/cc/2050_zero_carbon_cities_in_japan.htm; FutureCity Initiative. (n.d.). *Concept of "FutureCity" initiative - Detail*. https://future-city.go.jp/en/about/futurecity/

354 Jiang, B., He, Z., Xue, W., Yang, C., Zhu, H., Hua, Y., & Lu, B. (2022). China's low-carbon cities pilot promotes sustainable carbon emission reduction: Evidence from quasi-natural experiments. *Sustainability*, *14*(15), 8996. https://doi.org/10.3390/su14158996

355 Huang, C. Y., Eisenberg, R. M., & Velasco, G. (2024). *Reimagining Central Asian cities for a resilient and low-carbon future*. World Bank. https://documents1.worldbank.org/curated/en/099020525094063731/pdf/P178094-54b5c2d0-0be0-45ac-848a-584494de67e3.pdf

356 Singhal, M. (2025, November 4). India's climate policy after COP28: Net zero 2070 — a fair promise or a risky postponement? *South Asia Times*. https://southasiatimes.org/indias-climate-policy-after-cop28-net-zero-2070-a-fair-promise-or-a-risky-postponement/

357 Asian Development Bank Institute. (2017). Climate change operational framework 2017–2030: Enhanced actions for low greenhouse gas emissions and climate-resilient development. https://www.adb.org/sites/default/files/institutional-document/358881/ccof-2017-2030.pdf

Box 3.4. Ahmedabad, India: Heat Action Plan and Net-Zero Climate Resilient City Action Plan

Ahmedabad has emerged as a leader in urban climate action in South Asia through two initiatives: South Asia's first Heat Action Plan (HAP) launched in 2013, and India's first Net-Zero Climate Resilient City Action Plan (CRCAP) released in 2023. The HAP was developed in response to a 2010 heatwave that caused over 1,300 deaths. The Ahmedabad Municipal Corporation partnered with the Indian Institute of Public Health-Gandhinagar, the Natural Resources Defence Council, and international experts to create an early warning system and preparedness framework. It employs a colour-coded alert system triggered by 7-day probabilistic temperature forecasts, coordinating responses across government agencies, healthcare facilities, and community organisations when maximum temperatures exceed 41°C. Key interventions include public awareness campaigns in multiple languages, capacity building for healthcare workers to recognise and treat heat illness, and the Cool Roofs Programme promoting affordable heat-reflective roofing in low-income neighbourhoods. The model has been replicated across India, with the National Disaster Management Authority working with 23 heat-prone states and over 100 cities to develop similar plans.

Building on this, Ahmedabad released its Net-Zero CRCAP 2070 in July 2023 during the U20 Mayoral Summit, becoming the first Indian city to adopt a comprehensive net-zero action plan aligned with the national 2070 target. The plan addresses baseline GHG emissions of 15.1 million tCO2e (2021-22), projected to increase to 99.5 million tCO2e by 2070 under business-as-usual scenarios. Key objectives include: all buildings green and energy-efficient by 2050; 85% of commercial and industrial energy from renewables by 2070; 100% circular waste management by 2030; and 90% vehicle electrification by 2070.

Source: Ahmedabad Municipal Corporation. (2023). *Ahmedabad Climate Resilient City Action Plan: Towards A Net Zero Future*. ICLEI South Asia.; Hess, J. J., LM, S., Knowlton, K., Saha, S., Dutta, P., Ganguly, P., Tiwari, A., Jaiswal, A., Sheffield, P., Sarkar, J., Bhan, S. C., Begda, A., Shah, T., Solanki, B., & Mavalankar, D. (2018). Building Resilience to Climate Change: Pilot Evaluation of the Impact of India's First Heat Action Plan on All-Cause Mortality. *Journal of Environmental and Public Health*, *2018*(1), 7973519. https://doi.org/10.1155/2018/7973519

Box 3.5. Kitakyushu, Japan: Transformation into Green Growth Model City

Kitakyushu's transformation from an industrial centre with severe pollution to an internationally recognised model of low carbon urban development that offers knowledge exchange with cities across Asia through its Asian Centre for Low Carbon Society. In the 1960s, the city's Dokai Bay registered near-zero dissolved oxygen levels due to untreated wastewater from factories and chemical plants. The transformation began with citizen activism, particularly a women's association campaign in the 1950s demanding action to restore blue skies. Local officials partnered with businesses, research institutions, and community groups to develop environmental solutions. By 1990, Kitakyushu became the first Japanese city to receive the UN Environment Programme's Global 500 award. The city was designated an Eco-Town in 1997, an Eco-Model City in 2008, an SDGs Future City in 2018, and a Decarbonization Leading Area in 2022.

Kitakyushu's current climate targets include a 47% GHG reduction by 2030 (from 2013 levels) and net zero by 2050, supported by its Green Growth Strategy emphasising private-public-academia-citizen partnership, environmental technology accumulation, and ESG investment attraction. The city has pioneered initiatives including green bond issuance (SDGs sustainability bonds in 2021) and green transformation support for small and medium enterprises. Through the Asian Centre for Low Carbon Society, established in 2010, Kitakyushu has implemented 192 environmental cooperation projects in 78 cities across 16 countries, covering waste management, water supply, wastewater treatment, and air pollution control. A 2019 cooperation agreement with UN Environment channels Kitakyushu's expertise towards addressing plastic pollution in Southeast Asia, supporting local governments in Thailand and Cambodia to implement waste management plans.

Source: City of Kitakyushu. (2022, January 19). *Global expansion of decarbonization by Kitakyushu through intercity collaboration*. Japan International Cooperation Agency. https://www.jica.go.jp/Resource/english/our_work/thematic_issues/management/jcci/dbil86000000oo4i-att/220119_01_13.pdf

Box 3.6. Iskandar, Malaysia: Low Carbon Society Blueprint 2025

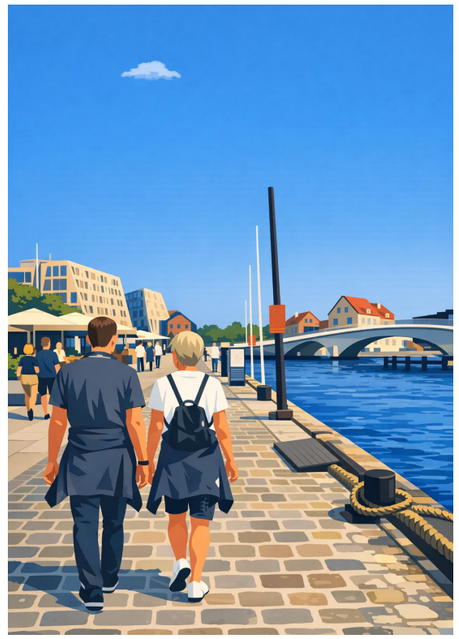
Iskandar Malaysia, a 2,217 km^2 economic corridor established in 2006 in southern Peninsular Malaysia, represents Southeast Asia's pioneering effort to integrate low-carbon development into regional economic planning. The Low Carbon Society Blueprint for Iskandar Malaysia 2025 (LCSBPIM2025), adopted by the Iskandar Regional Development Authority in 2012, sets a target of 58% carbon intensity reduction by 2025 compared to 2005 levels, exceeding the national target of 40%. The LCSBPIM2025 identifies 12 Major Actions under a Triple Bottom Line framework of Green Economy, Green Community, and Green Environment:

- Integrated green transportation.
- Green industry.
- Low carbon urban governance.
- Green building and construction.
- Green energy system and renewable energy.
- Low carbon lifestyle.
- Community engagement and consensus building.
- Walkable, safe and liveable city design.
- Smart urban growth.
- Green and blue infrastructure.
- Sustainable waste management.
- Clean air environment.

These 12 actions are further divided into 52 sub-actions, 97 measures, and 281 programmes. Action 1, 5, and 6 ae identified as the highest priority, together comprising 57% of projected emission reductions. Specific targets include increasing walking from 7% to 20% of all trips by 2025, cycling from 3% to 5%, and implementing polycentric smart urban growth connected by public transportation. The blueprint is developed through a bottom-up stakeholder engagement approach, consisting of detailed programme structure and updated regularly; the current is the Low Carbon Society Blueprint for Iskandar Malaysia 2030 Climate Action Plan, which includes both climate adaptation and mitigation actions: 9 Mitigation Actions, 25 Mitigation Sub-Actions, 61 Mitigation Measures, 5 Adaptation Actions.

Source: Iskandar Regional Development Authority. (n.d.). *Low carbon society*. Iskandar Malaysia Green. https://iskandarmalaysia.com.my/public/green/low.html; Low Carbon Asia Research Center. (2012). *Low carbon society blueprint for Iskandar Malaysia 2025: Summary for policymakers*. https://2050.nies.go.jp/cop/cop18/presentation/SPM_LCS%20Blueprint_IskandarMalaysia.pdf; Iskandar Malaysia 2030 Climate Action Plan.

Chapter 4



Europe

Chapter 4: Europe

4.1 Region context

Location	Europe
Countries	48 countries within East and West Europe (counting the Vatican), 27 countries as part of the European Union (EU).
Land Size	~ 6,061,450 square kilometres
Population	~ 501 million (2025)
Population Ageing Trend	People over age 65: 22% in 2025, 29% by 2050
Urbanisation Level	69.9% of population live in urban areas (2025)
Geographic Overview	Europe spans several climates—Mediterranean in the south, Oceanic in the west, Continental in the centre and east, and Polar/Subarctic in the north. Its landscape features major mountain ranges, vast plains, and varied coastlines along multiple seas.
Climate Risks	Widespread flooding, extreme heat, and drought (2024 climate spotlight).
Key Urban Networks	EU Urban Agenda; EU Covenant of Mayors for Climate & Energy; Global Covenant of Mayors for Climate & Energy; Eurocities; Resilient Cities Network (partnership with UN-Habitat); Cities Coalition for Digital Rights

Source: Various Sources[358]

358 Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union.; United Nations. (n.d.). *Regional groups of Member States | Department for General Assembly and Conference Management*. Retrieved December 26, 2025, from https://www.un.org/dgacm/en/content/regional-groups; Britannica. (n.d.). *European countries by area | Description, Ranking, & Facts | Britannica*. Retrieved December 26, 2025, from https://www.britannica.com/topic/European-countries-by-area; UNSD. (2021). *Population by sex, annual rate of population change, surface area and density*. https://unstats.un.org/UNSDWebsite/; Division, U. N. P. (n.d.). *United Nations Data Portal*. Population Division Data Portal. Retrieved December 26, 2025, from https://population.un.org/dataportal/home?df=5e820e13-8f07-4c8e-a429-6d3547f498ae; Copernicus Climate Change Service (C3S). (2025). *European State of the Climate 2024*. Copernicus Climate Change Service (C3S). https://doi.org/10.24381/14J9-S541; *Urban Agenda for the EU | EUI*. (n.d.). Retrieved December 26, 2025, from https://www.urbanagenda.urban-initiative.eu/; *EU Covenant of Mayors | EU Covenant of Mayors*. (n.d.). Retrieved December 26, 2025, from https://eu-mayors.ec.europa.eu/en/home; *Home*. (n.d.). Global Covenant of Mayors. Retrieved December 26, 2025, from https://www.globalcovenantofmayors.org/; *Eurocities—EU Social Economy Gateway—European Commission*. (n.d.). Retrieved December 26, 2025, from https://social-economy-gateway.ec.europa.eu/eurocities_en; *UN-Habitat and Resilient Cities Network formalize partnership to strengthen urban resilience*. (n.d.). Retrieved December 26, 2025, from https://urbanresiliencehub.org/un-habitat-and-resilient-cities-network-formalize-partnership-to-strengthen-urban-resilience/; *Four cities selected to pilot a digital rights governance framework | UN-Habitat*. (n.d.). Retrieved December 26, 2025, from https://unhabitat.org/news/25-mar-2022/four-cities-selected-to-pilot-a-digital-rights-governance-framework.

Europe is a diverse continent in its physical, demographic, and socio-economic characteristics. Encompassing approximately 6,061,450 square kilometres,[359] Europe comprises 48 countries, with 27 in the European Union (EU).[360] The EU, established in November 1993, is a supranational political and economic organisation established to foster regional integration through a single market, common policies, and shared institutions aimed at promoting economic stability, political cooperation, and legal harmonisation across member countries.[361] The largest countries by land area are Ukraine, France, Spain, Sweden, and Norway, each featuring varied landscapes that include vast plains, major mountain ranges such as the Alps, Carpathians, and Scandinavian highlands, and extensive coastlines along the Baltic, North, and Mediterranean Seas.

The continent's population is estimated at around 501 million as of 2025.[362] The most populated countries include Germany, France, United Kingdom, Italy, and Spain (Table 4.1). Notably, Europe is undergoing a significant demographic shift, characterised by population ageing. The proportion of people aged 65 and over is increasing rapidly in all EU member states, with the old-age dependency ratio projected to rise from 36% in 2022 to 59% by 2070. This trend is especially pronounced in countries such as Italy, Germany, Spain, Greece, and Portugal, where the share of older citizens and the dependency ratio are expected to be among the highest in Europe.[363]

Table 4.1. Population of Europe (2000, 2025, and 2050)

Country	Population Estimates and Projections (Millions of People)		
	2000	**2025**	**2050**
Europe (Region)	**611.1**	**636.2**	**606.1**
Albania	3.1	2.4	1.8
Andorra	0.1	0.1	0.1
Armenia	3.2	3.0	2.6
Austria	8.0	9.2	8.7
Azerbaijan	8.0	10.3	11.0
Belarus	10.0	9.1	7.5
Belgium	10.3	11.9	11.9

359 UNSD. (2021). *Population by sex, annual rate of population change, surface area and density*. https://unstats.un.org/UNSDWebsite/

360 United Nations. (n.d.). *Regional groups of Member States | Department for General Assembly and Conference Management*. Retrieved December 26, 2025, from https://www.un.org/dgacm/en/content/regional-groups

361 *Key facts and figures | European Union*. (n.d.). Retrieved January 9, 2026, from https://european-union.europa.eu/principles-countries-history/facts-and-figures-european-union_en

362 UNSD. (2021). *Population by sex, annual rate of population change, surface area and density*. https://unstats.un.org/UNSDWebsite/

363 Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union

Bosnia and Herzegovina	4.2	3.1	2.5
Bulgaria	8.2	6.4	5.1
Croatia	4.5	3.8	3.2
Cyprus	0.9	1.4	1.5
Czechia	10.3	10.8	10.0
Denmark	5.3	6.0	6.1
Estonia	1.4	1.4	1.2
Finland	5.2	5.6	5.3
France	60.9	68.6	69.6
Georgia	4.1	3.7	3.6
Germany	82.2	82.8	76.9
Greece	10.8	10.4	9.1
Hungary	10.2	9.5	8.6
Iceland	0.3	0.4	0.4
Ireland	3.8	5.4	6.1
Italy	56.9	58.7	51.0
Kazakhstan	15.5	20.8	26.5
Latvia	2.4	1.8	1.5
Liechtenstein	0.0	0.0	0.0
Lithuania	3.5	2.8	2.3
Luxembourg	0.4	0.7	0.8
Malta	0.4	0.6	0.6
Moldova	2.9	2.4	1.8
Monaco	0.0	0.0	0.0
Montenegro	0.6	0.6	0.5
Netherlands	15.9	18.1	18.6
North Macedonia	2.0	1.8	1.5
Norway	4.5	5.6	5.8
Poland	38.3	36.1	31.1
Portugal	10.3	10.7	9.9
Romania	22.4	18.9	16.0
San Marino	0.0	0.0	0.0
Serbia	7.5	6.5	5.4
Slovak Republic	5.4	5.4	4.9
Slovenia	2.0	2.1	2.0
Spain	40.6	48.8	45.3
Sweden	8.9	10.6	11.2
Switzerland	7.2	9.0	9.3
Ukraine	49.6	39.0	32.0
United Kingdom	58.9	69.6	75.1

Source: World Bank [364]

Urbanisation is a defining feature of Europe: about 12.1% of the land is classified as urban area, 69.9% of the population reside in urban settings, with an urban population growth rate of 0.2% per year.[365] Urban population is projected to reach over 80% by 2050, driven by continued migration to cities and demographic shifts towards smaller households and ageing populations.[366] There is, however, significant inter-country variation. Urbanisation rates range from approximately 50% in Luxembourg, Romania, and Croatia to over 80% in Italy, the Netherlands, and United Kingdom.

There is considerable diversity in both the size and classification of European cities.[367] Within the region of Europe covered by this report,[368] only London has been identified as a megacity in the UN World Urbanisation Prospects 2025.[369] But the metropolitan regions of Paris and Milan each exceed 10 million inhabitants as well.[370] The region's urban system is highly polycentric with a spatial structure characterised by synergies between proximate, densely and functionally connected urban centres rather than a single large city; about 25% of Europe's population live in these polycentric urban regions (PURs). [371] Key polycentric regions include the Ranstad (Netherlands), connecting Amsterdam, Rotterdam, The Hague and Utrecht; the Rhine-Ruhr Region (Germany), a highly industrial, dense polycentric area including Cologne, Düsseldorf, and Essen; Flemish Diamond (Belgium) connecting Brussels, Ghent, Antwerp, and Leuven; and Midlands and Leeds-Liverpool area (United Kingdom). The importance of PURs is emphasised in key EU policy to promote balanced development and territorial competitiveness.

364 World Bank. (n.d.). *Population estimates and projections*. https://databank.worldbank.org/source/population-estimates-and-projections#

365 Division, U. N. P. (n.d.). *United Nations Data Portal*. Population Division Data Portal. Retrieved December 26, 2025, from https://population.un.org/dataportal/home?df=5e820e13-8f07-4c8e-a429-6d3547f498ae

366 Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union.; OECD. (2024). OECD Regions and Cities at a Glance 2024. OECD Publishing. https://doi.org/10.1787/f42db3bf-en.

367 European Investment Bank. (2018). *The story of your city: Europe and its urban development, 1970 to 2020.* Publications Office. https://data.europa.eu/doi/10.2867/460398

368 Istanbul, Turkey and Moscow, Russia are also megacities. However, they span overlapping regions and are therefore covered in other regional chapter of Asia.

369 United Nations. (2025). *World Urbanization Prospects 2025: Summary of Results | Population Division*. United Nations Department of Economic and Social Affairs. https://www.un.org/development/desa/pd/content/world-urbanization-prospects-2025-summary-results

370 European Investment Bank. (2018). *The story of your city: Europe and its urban development, 1970 to 2020.* Publications Office. https://data.europa.eu/doi/10.2867/460398

371 OECD. (2024). OECD Regions and Cities at a Glance 2024. OECD Publishing. https://doi.org/10.1787/f42db3bf-en; European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763

Europe's climate is varied, ranging from the Mediterranean climate in the south, with hot, dry summers and mild winters, to the Oceanic climate of the west, characterised by moderate temperatures and ample rainfall. The central and eastern parts experience a Continental climate with more pronounced seasonal variations, while the north faces Polar and Subarctic conditions. This climatic diversity underpins a wide array of ecosystems and agricultural practices across the continent.[372]

Economically, Europe is highly developed, with the EU representing one of the largest economic blocs globally.[373] The region is characterised by advanced infrastructure, high levels of productivity, and a strong focus on innovation and sustainability.[374] However, there are notable disparities in economic development between Western and Eastern Europe, with the latter generally having lower income levels[375] and human development indicators.[376] According to the United Nations Development Index, most Western and Northern European countries rank very high in human development, reflecting strong education systems, robust healthcare, and high standards of living. Eastern and some Southern European countries (eg Ukraine, Romania, Bosnia and Herzegovina, Croatia), while making significant progress, tend to rank slightly lower, highlighting ongoing challenges related to economic convergence, social inclusion, and demographic change.[377]

Europe's urban development vision is anchored in a multi-level collaborative governance framework that emphasises sustainability, resilience, and inclusivity. The EU Urban Agenda serves as a core policy platform, engaging Member States, cities, and the European Commission to advance housing, air quality, mobility, digital transition, and climate adaptation across all 27 EU countries.[378] Complementing this, the EU Covenant of Mayors for Climate and Energy mobilises over 10,500 local authorities, representing nearly 500 million people to implement ambitious mitigation and adaptation strategies[379], while the Global Covenant of Mayors extends this leadership globally with UN-Habitat support.[380] Networks such as Eurocities, comprising more than 200 major cities, advocate for climate resilience, housing, and digital transformation.[381] Initiatives like the Cities Coalition for Digital Rights, co-led by UN-Habitat and Eurocities, embed ethical and inclusive digital governance in European cities, reinforcing the region's commitment to sustainable and rights-based urban futures.[382]

Europe continues to dominate global liveability rankings; 38 of the world's top 50 liveable cities are in Western Europe, e.g., Bern, Copenhagen, Vienna. [383] These cities are distinguished by policies promoting compact urban growth, e.g., 15-minute city, green infrastructure, and integrated public transport systems, which strengthen resilience and climate adaptation.[384] Broader sustainability efforts include investments in affordable housing and climate-resilient infrastructure.[385] Sustainable land use and territorial cohesion remain priorities under EU cohesion policy, supporting green transitions and regional equity.[386] The emerging trend of depopulation is a significant, structural demographic shift characterised by shrinking populations, rapid ageing, and declining fertility rates. [387] The EU population is projected to peak around 2026 and decrease by about 5% by 2050; 22 of 27 EU countries are anticipated to have smaller working-age populations (age 20-64) by 2050. By 2100, EU population could shrink by 6% (to 419 million), assuming stable migration, and by 34% (to 295 million) without immigration. Population decline is, however, uneven, with Eastern and Southern Europe facing the most severe declines due to a combination of low birth rates and high net emigration, while Northern and Western Europe tend to maintain population levels through immigration.

4.2 Urban challenges

European cities, home to 75% of EU population (expected to rise to 78% by 2050), are experiencing complex, interconnected challenges that threaten sustainability, social cohesion, and quality of life. While acting as engines of economic growth—generating up to 85% of Europe's GDP—these urban areas are also centres of social inequality

372 Britannica. (n.d.). *European countries by area | Description, Ranking, & Facts | Britannica*. Retrieved December 26, 2025, from https://www.britannica.com/topic/European-countries-by-area

373 Bank, E. C. (2025). *Structure of the euro area economy*. https://www.ecb.europa.eu/mopo/eaec/html/index.en.html.

374 *2025: Europe in 10 snapshots*. (n.d.). Retrieved December 26, 2025, from https://ec.europa.eu/stories/2025-wrapped/

375 Neef, T., & Sodano, A. (2022). *Inequality Trends in Europe. 2022/04*.

376 United Nations. (n.d.). Human Development Index. In *Human Development Reports*. United Nations. Retrieved December 26, 2025, from https://hdr.undp.org/data-center/human-development-index

377 European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763; UNDP. (2021). *UNDP Regional Programme Document for Europe and the CIS 2022-2025*. UNDP. https://www.undp.org/eurasia/publications/undp-regional-programme-document-europe-and-cis-2022-2025.

378 *Urban Agenda for the EU | EUI*. (n.d.). Retrieved December 26, 2025, from https://www.urbanagenda.urban-initiative.eu/

379 *EU Covenant of Mayors | EU Covenant of Mayors*. (n.d.). Retrieved December 26, 2025, from https://eu-mayors.ec.europa.eu/en/home

380 *Home*. (n.d.). Global Covenant of Mayors. Retrieved December 26, 2025, from https://www.globalcovenantofmayors.org/

381 *Eurocities—EU Social Economy Gateway—European Commission*. (n.d.). Retrieved December 26, 2025, from https://social-economy-gateway.ec.europa.eu/eurocities_en=

382 *Four cities selected to pilot a digital rights governance framework | UN-Habitat*. (n.d.). Retrieved December 26, 2025, from https://unhabitat.org/news/25-mar-2022/four-cities-selected-to-pilot-a-digital-rights-governance-framework.

383 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

384 OECD. (2024). OECD Regions and Cities at a Glance 2024. OECD Publishing. https://doi.org/10.1787/f42db3bf-en; OECD. (2024). *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times* (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94). https://doi.org/10.1787/05c005d5-en

385 Department of Economic and Social Affairs. (2025). *The Sustainable Development Goals Report 2025* (1st ed). United Nations Research Institute for Social Development.

386 European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763

387 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

and environmental pressure due to demographic shifts, regional economic imbalances, climate vulnerability and digital infrastructure needs.[388]

4.2.1 Housing affordability

Housing affordability is an urgent and deep-rooted concern. Since 2010, rents have risen by 27.8% on average. [389] From 2015 to 2024, average house prices in the EU have increased by 55%, with large metropolitan areas reporting increases up to 68% higher than smaller urban areas.[390] Importantly, according to Eurostat, in 2024, 10% of households in EU cities are spending over 40% of disposable income on housing.[391] In some member states, the proportion can be higher, e.g., 29% of urban residents in Greece spent over 40% of their disposable income on housing. In some cases, the cost of purchasing a home has tripled while young people may spend 60-70% of their income to rent a starter home.

Key contributors include,

- Limited supply (e.g., 2008 global financial crisis led to major decline in new housing investment, fixed land supply in city centres for housing),
- Rising construction costs (cost of building new homes increased by 56% from 2010 to 2024)
- Demographic changes (e.g., life expectancy increases, rise of single-person households, financialisaton of housing).

The result is rising housing pressure, weakening the housing market's ability to cope, while exacerbating spatial and social inequalities.[392] The housing gap is most acute in capital cities and economically dynamic regions, where population growth, restrictive zoning and insufficient supply combine to drive costs upward. The impacts include cost overburden, overcrowded conditions and housing deprivation, affecting young people, migrants, and low-income families the most.[393] EU Parliament research indicates that over 27% of low-income households experience the highest cost overburden and severe housing deprivation while about 17% of the EU population live in overcrowded conditions, with the highest rates found in Romania and Latvia.[394]

EU and national responses to housing affordability have intensified. The European Commission has appointed its first-ever Commission for Housing to develop a European Affordable Housing Plan. Released in December 2025, the European Affordable Housing Plan includes a revised approach, allowing nations to provide more direct support for affordable housing projects and a comprehensive strategy to increase housing investment, new construction and renovation of existing buildings through, e.g., the Recovery and Resilience Facility and Cohesion Policy, and the creation of a European Investment Platform in partnership with the European Investment Bank.

National responses are increasingly moving from market-only solutions to direct intervention, increased public investment, and stricter regulation of private markets.[395] Austria has implemented the Vienna Model on "limited-profit housing", often cited as a benchmark, where public funds are linked to regulations that cap rents, ensuring a high percentage of residents live in affordable, high-quality housing (Figure 4.1). In Germany, several cities have implemented strict rent caps and caps on rent increases to prevent displacement. Frankfurt mandates 30% affordable units in new developments, while Denmark and Finland have developed strong models of social housing, often using non-profit housing associations and long-term public funding to ensure affordability. To improve energy efficiency and combat "energy poverty", many countries are adopting policies aligned with the EU Energy Performance of Buildings Directive and prioritising the renovation of existing buildings to reduce utility bills. Initiatives include Brussels' EUR 500 million renovation of 37,000 social housing units to reduce heating consumption and improve living comfort.[396] The trend is towards more integrated urban policies that combine housing affordability with climate resilience and social equity, as seen in initiatives such as the EU Renovation Wave and local strategies in Vienna, Bilbao, and Toulouse.[397] Cities are increasingly adopting innovative approaches like office-to-residential conversions, transit-oriented development, and circular economy principles to expand housing supply while promoting sustainability.

Figure 4.1. Housing Development in Seestadt Aspern, Vienna, Austria

388 European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763; Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union.

389 European Parliament. (2024, October 17). *Housing crisis: Why prices are rising and what the EU is doing about it*. Topics | European Parliament. https://www.europarl.europa.eu/topics/en/article/20241014STO24542/housing-crisis-why-prices-are-rising-and-what-the-eu-is-doing-about-it

390 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

391 Reference

392 Cristian, W., Anna,Wahba Tadros, Sameh Naguib,Baeumler, Axel E. N. ,D'Aoust, Olivia Severine,Das, Maitreyi B,Gapihan, Anne Treylane,Goga, Soraya,Lakovits, Carina,Palmarini, Nic,Restrepo Cadavid, Paula,Singh, Gayatri,Terraza, Horacio. (2021). *Demographic Trends and Urbanization*. World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/260581617988607640

393 OECD. (2024). OECD Regions and Cities at a Glance 2024. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

394 Makarevičienė, A., Skubiejūtė, G., Zakaravičiūtė, A., & Jočys, J. (2025). *Research for HOUS Special Committee—Mapping the housing needs in the EU, assessing the impacts of scarcity and providing an overview of relevant EU legislation (STUDY)*. Policy Department for Transport, Employment and Social Affairs Directorate-General for Cohesion, Agriculture and Social Policies (CASP). https://www.europarl.europa.eu/thinktank/en/document/CASP_STU(2025)759352

395 Department of Economic and Social Affairs. (2025). *The Sustainable Development Goals Report 2025* (1st ed). United Nations Research Institute for Social Development.

396 OECD. (2024). *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times* (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94). https://doi.org/10.1787/05c005d5-en

397 *OECD. (2024). Cities turning crisis into change: Post-pandemic pathways to resilience in complex times (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94)*. https://doi.org/10.1787/05c005d5-en

4.2.2 Climate vulnerability and environmental stress

Europe is the world's fastest-warming continent, with temperatures rising at twice the global average, leading to escalating and widespread severe environmental stress and high climate vulnerability—rising temperatures, heatwaves, droughts, storms and flooding increasingly affect urban areas.[398] Urban heat islands are amplifying the risks—temperatures in city centres like Paris and London can be 4°C higher than those in rural surroundings, while Athens reports differences of up to 10°C.[399] One-third of Europe's land area and population are affected by water scarcity annually, particularly in the Mediterranean region. Europe is facing a "permanent water stress" scenario, where severe droughts are increasing. Southern Europe is the most vulnerable region, facing severe risks from heat, drought, and agricultural losses. These extreme weather events disrupt infrastructure, strain energy and water systems, ecosystems, food, health and economy, and disproportionately impact low-income and marginalised communities living in poorly insulated housing or flood-prone areas.[400]

398 Copernicus Climate Change Service (C3S). (2025). *European State of the Climate 2024*. Copernicus Climate Change Service (C3S). https://doi.org/10.24381/14J9-S541

399 OECD. (2024). *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times* (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94). https://doi.org/10.1787/05c005d5-en

400 OECD. (2024). *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times* (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94). https://doi.org/10.1787/05c005d5-en

In the past 40 years, extreme weather events have resulted in 85,000 to 145,000 human fatalities across Europe; over 85% of these fatalities were due to heatwaves, with mortality risks increasing in Southern and Central Europe.[401] All warming scenarios are likely to raise risks of climate-sensitive diseases, including those spread by food, water, and vectors. Dengue is expected to pose greater threats due to longer transmission seasons and expanded geographic reach, especially in urban areas. The economic losses are substantial; from 1980 to 2023, weather- and climate-related extremes accounted for EUR738 billion economic losses in the EU, with over EUR162 billion (22%) occurring between 2021 and 2023. Coastal cities and low-lying cities face severe, escalating climate risks from sea-level rise, storm surges and flooding, with annual damages projected to rise from EUR1.25 billion to EUR93-961 billion by 2100. About 50 million people live in areas at risk from 100-year coastal flood events.[402]

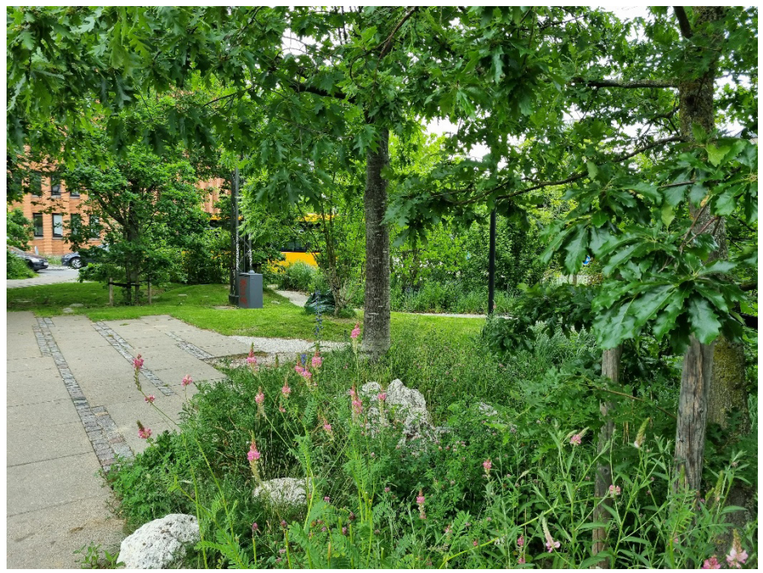
Although European cities are adopting integrated strategies to promote climate resilience (Figure 4.2), circular economy, and biodiversity protection, the European Environment Agency (EEA) warns that Europe is not prepared for rapidly growing climate risks, which are already outpacing adaptation efforts.[403] While air pollution has declined, many urban areas continue to experience levels above EU limits. The EEA advocates that more action is still needed at all levels of government across Europe to protect those most affected by climate change including children, older adults, low-income groups and people with disabilities or health problems.

401 European Environment Agency. (2026, January 19). *Climate change impacts, risks and adaptation*. https://www.eea.europa.eu/en/topics/in-depth/climate-change-impacts-risks-and-adaptation

402 Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland*. (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647

403 https://www.eea.europa.eu/en/analysis/publications/eea-signals-2023-health-and-environment-in-europe/heatwaves-and-other-climate-related-extremes-are-threatening-health-especially-for-the-most-vulnerable

Figure 4.2. Bryggervangen Climate District in Copenhagen, Denmark



4.2.3 Labour and skill shortages

Labour and skill shortages have been increasing in the past decade, becoming severe and widespread, with 31 European countries reporting shortages across both high-skilled (ICT, engineering, health) and low-skilled jobs (construction, service).[404] The Labour Market Tightness Index highlights that capitals in smaller countries such as Czechia (Prague), Hungary (Budapest), Romania (Bucharest), and Slovakia (Bratislava) have higher tightness, while those in larger or more migratory countries Belgium (Brussels), France (Ile-de-France), and Norway (Oslo) show lower levels. Amidst labour shortages, over 13 million people are unemployed in the EU. Some countries such as Spain, Austria, Latvia, Portugal, and Finland show a significant surplus of workers; women and low-skilled workers are disproportionately affected by unemployment risks.

Key drivers of labour and skill shortages include, among others, an ageing population (the working-age population is shrinking), the digital/green transition (skills required for the green/digital transition do not match existing workforce capabilities), and high replacement demand. For example, in Germany, 40% of bus and tram drivers will retire in the next few years.[405] Under-age-30 workers remain underrepresented in the labour market. High housing costs and poor transport further limit regional workforce mobility,

404 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

405 Rivera, R. (2025, July 17). Labour Shortage—Quality Jobs and Strong Unions Are Crucial. *ETF: European Transport Workers' Federation*. https://www.etf-europe.org/labour-shortage-quality-jobs-and-strong-unions-are-crucial/

affecting competitiveness and services.[406] There are significant economic and social impacts, in terms of increasing inequalities in the labour market, reducing the EU's capacity for innovation, hindering its growth potential, weakening EU's long-term competitiveness, and affecting its green and digital transitions.

The European Commission has identified the need for a comprehensive, multi-pronged approach to address the labour gaps with funding through the European Social Fund (EUR99.3 billion) and the Recovery and Resilience Facility. EU Member States are actively implementing a range of policies to address individual and structural barriers to labour market participation, and raise labour market participation through activating domestic workforce, incentives and reforms to improve recruitment and retention (e.g., EU Pay Transparency Directive, Youth Guarantee).[407] Other key action areas include labour migration and talent attraction (e.g., EU Blue Card, talent partnerships, integration support, targeted recruitment),[408] skills development and training (e.g., promote lifelong learning, vocational training, upskilling and reskilling to align skills with market and encourage longer working lives).[409] OECD analysis stresses the urgent need for training programmes for all skill levels.[410] Yet others are using place-based strategies such as improving housing affordability, enhancing transport connectivity, to make regions and countries more attractive for talent and investment.[411]

4.2.4 Digital infrastructure disparities

Digital infrastructure disparity remains a pressing urban challenge in Europe, with significant gaps between advanced metropolitan regions and rural or peripheral areas. Despite progress in narrowing the internet speed gap between rural and urban areas by 11% in 2019, urban broadband remains about 25% faster.[412] One in 6 rural residents has access to very high-speed service compared to 2 in 3 city dwellers. [413] This is compounded by slow/delayed 5G/fibre rollout in rural areas—in 2022, 41% of rural households vs 56% of all households have fibre coverage while 51% in rural area vs 81% of all population have basic 5G coverage, leading to a persistent rural-urban connectivity

406 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

407 Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union.

408 Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union.

409 Directorate-General for Economic and Financial Affairs, European Commission. (2024). *The 2024 ageing report Economic and budgetary projections for the EU member states*. Publications Office of the European Union.

410 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

411 *OECD. (2024). Cities turning crisis into change: Post-pandemic pathways to resilience in complex times (OECD Regional Development Papers No. 94; OECD Regional Development Papers, Vol. 94)*. https://doi.org/10.1787/05c005d5-en

412 OECD. (2024). *OECD Regions and Cities at a Glance 2024*. OECD Publishing. https://doi.org/10.1787/f42db3bf-en

413 European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763

divide.[414] Businesses in more developed countries are twice as likely to use e-commerce and cloud computing compared to those in less developed cities.[415] This unevenness often translates into regional literacy and economic gaps as areas with robust digital infrastructure attract more digital firms and higher returns on investment.[416]

EU investment in digital infrastructure remains less than half of that in the United States, creating a structural gap in connectivity and innovation capacity.[417] The disparity is accentuated by market fragmentation (the average European operator has 5 million subscribers compared to 107 million in the United States), cloud and data dependency on non-EU service providers and massive shortages in skilled ICT professionals. In 2024, 55.6% of Europeans possessed basic digital skills. There is a shortfall of over 9.7 million ICT specialists to reach 2030 digital targets, with significant gender disparity.

The trend of rising demand for AI and data processing is further straining capacity, particularly in the traditional "FLAP" hubs (Frankfurt, London, Amsterdam, Paris), catalysing a shift towards alternative regions. If left unaddressed, the digital infrastructure gap could hinder 2030 digital targets and cost EUR1.3 trillion in lost GDP by 2033.[418] The European Commission White Paper on Digital Infrastructure Needs, published in February 2024, stresses that a cutting-edge digital network infrastructure is the foundation for digital and green transition to a flourishing economy and society.[419] The roadmap for action is outlined in the 2023 Digital Decade Policy Programme 2030 with aims and measurable targets for universal gigabit connectivity, comprehensive 5G, and 10,000 climate-neutral edge nodes.[420]

4.3 Smart city development

Smart city development in Europe is a well-established, multi-faceted process that has evolved over the past decade. European smart city developments are characterised by holistic, city-driven visions that integrate digital transformation, sustainability, citizen engagement, and social inclusion. European smart cities leverage digital tools such as IoT, AI, digital twins, and urban data platforms to improve quality of life, enhance urban sustainability, and foster inclusive growth.[421] There is a pronounced focus on climate neutrality, with many cities aligning their smart city strategies with the European Green Deal and broader EU climate goals for 2030 and 2050.[422]

The main initiatives and strategies driving European smart cities are anchored in EU-wide policies and funding mechanisms. The EU Cities Mission and European Commission's Horizon 2020 Smart Cities and Communities (SCC) Lighthouse Programme provide the overarching vision and resources—approximately EUR400 million funding, and a framework for piloting and scaling innovative urban solutions across the continent (Box 4.1). Lighthouse cities, mainly concentrated around the north-western areas of the region, pilot large-scale projects while Fellow cities across Europe replicate these initiatives. The framework propels the consolidation of smart city implementation efforts, which began around 2014-2015.[423]

Additionally, city investment funds, digital social markets, and positive energy districts offer practical models for implementation and scaling. These initiatives are supported by a robust policy and institutional framework, including EU funding (Horizon 2020, Horizon Europe, European Investment Bank),[424]city-level digital units, participatory governance structures, and the adoption of international standards such as ISO 37122 and ISO 37120.[425] This programme, along with subsequent initiatives such as the EU C+ities Mission (aiming for 100 climate-neutral and smart cities by 2030), has driven the proliferation of smart city projects in nearly every EU member state and associated countries.[426] Since then, approximately 48-66% of municipalities and countries in Europe have prepared strategic documents (e.g. municipal vision statement, municipal strategic plan, national plan) for smart city development. This stands slightly higher than the global average of 44-61% as of 2022, with particular focus on carbon neutrality (Box 4.2), responsible use of AI technology, and e-government.[427]

414 European Comission. (2024). *WHITE PAPER How to master Europe's digital infrastructure needs?* (COM(2024) 81 final). European Comission. file:///C:/Users/francine_chan/Downloads/White_Paper__Ho_to_master_Europes_digital_infrastructure_needs_CkoePennGJi1hpdkuARxMGuH5s_102533.pdf

415 European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763

416 European Investment Bank (Ed.). (2023). Digitalisation in Europe 2022-2023: Evidence from the EIB investment Survey. EIB.

417 Lindqvist, J. (2025, January 9). *Europe can't fall further behind on digitalization and 5G | World Economic Forum*. World Economic Forum. https://www.weforum.org/stories/2025/01/europe-digitalization-5g-broadband-infrastructure/

418 European Commission. (2022). *8th Cohesion Report: Cohesion in Europe towards 2050* [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_763

419 European Commission. (2024, February 21). *White Paper: How to master Europe's digital infrastructure needs?* (COM(2024) 81 final). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52024DC0081

420 European Commission. (2024, February 21). *White Paper: How to master Europe's digital infrastructure needs?* (COM(2024) 81 final). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52024DC0081

421 Gerli, P., Mora, L., Rocha, F. N. D., & Nguyen, H. (2024). *World Smart Cities Outlook 2024* (No. HS/042/21E). UN-Habitat; OECD. (2024). *Proceedings of the 4th OECD Roundtable on Smart Cities and Inclusive Growth*. OECD. https://www.smart-city-dialog.de/system/files/media/3789/1738168634/PROCEE~1.PDF

422 Gerli, P., Mora, L., Rocha, F. N. D., & Nguyen, H. (2024). *World Smart Cities Outlook 2024* (No. HS/042/21E). UN-Habitat; OECD. (2024). *Proceedings of the 4th OECD Roundtable on Smart Cities and Inclusive Growth*. OECD. https://www.smart-city-dialog.de/system/files/media/3789/1738168634/PROCEE~1.PDF

423 European Court of Auditors. (2023). Smart cities: Tangible solutions, but fragmentation challenges their wider adoption. European Court of Auditors.

424 European Climate, Infrastructure and Environment Executive Agency (Ed.). (2024). The State of European Smart Cities: Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality. Publications Office. https://doi.org/10.2926/97950

425 OECD. (2023). *Smart City Data Governance* (1st ed). Organization for Economic Cooperation & Development.

426 European Climate, Infrastructure and Environment Executive Agency (Ed.). (2024). The State of European Smart Cities: Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality. Publications Office. https://doi.org/10.2926/97950

427 Gerli, P., Mora, L., Rocha, F. N. D., & Nguyen, H. (2024). *World Smart Cities Outlook 2024* (No. HS/042/21E). UN-Habitat.

Smart city development in Europe has a strong momentum for replication and upscaling, particularly through knowledge-sharing platforms and city-to-city learning. The Scalable Cities Secretariat, Smart Cities Marketplace, and European Innovation Partnership for Smart Cities and Communities facilitate knowledge exchange and joint action across borders.[428] Through this pipeline, eighteen Smart Cities and Communities projects have involved 120 cities testing over 550 solutions, supported by Horizon 2020.[429] Since 2015, the projects have shared knowledge Europe-wide, aided by the Scalable Cities secretariat. To date, SCC projects have achieved up to 53% energy savings, 88% CO^2 reduction, installation of 17,500+ smart meters, refurbishment of over 1 million m□, introduction of 5,270+ e-vehicles, nearly 500 charging stations, and engagement of 260,000 citizens.[430]

Three-quarters (71 to 77%) of European municipalities are involved in the planning and implementation of smart city initiatives respectively. This has put Europe as the world's leading region with the highest percentage of national public organisations involved in smart city initiatives.[431] These initiatives are supported by strong multi-stakeholder collaboration (Box 4.3), involving municipalities, businesses, academia, NGOs, and citizens, with universities being the most frequent stakeholder in 70% of the sampled municipalities.[432] This has generated more than EUR1 billion in investment for nearly-zero or positive-energy districts.

428 European Climate, Infrastructure and Environment Executive Agency (Ed.). (2024). The State of European Smart Cities: Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality. Publications Office. https://doi.org/10.2926/97950

429 European Climate, Infrastructure and Environment Executive Agency (Ed.). (2024). The State of European Smart Cities: Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality. Publications Office. https://doi.org/10.2926/97950

430 European Climate, Infrastructure and Environment Executive Agency (Ed.). (2024). The State of European Smart Cities: Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality. Publications Office. https://doi.org/10.2926/97950

431 Gerli, P., Mora, L., Rocha, F. N. D., & Nguyen, H. (2024). *World Smart Cities Outlook 2024* (No. HS/042/21E). UN-Habitat.

432 Gerli, P., Mora, L., Rocha, F. N. D., & Nguyen, H. (2024). *World Smart Cities Outlook 2024* (No. HS/042/21E). UN-Habitat.

Box 4.1. Valencia, Spain: MatchUp project

Valencia is one of three "lighthouse" cities in the EU-funded MAtchUP (Maximising Upscaling and Replication Potential) smart city project under Horizon 2020. Part of a 60-month project since 2017, it has piloted 52 innovative actions in the Poblats Marítims district—branded "El Marítim Innova"—spanning energy, mobility, and ICT to boost efficiency, sustainability, and citizen engagement. Its key initiatives include the renovation and construction of energy-efficient buildings with renewable heating, rollout of electric vehicles and charging infrastructure, installation of solar-powered digital hubs, and deployment of an urban platform to integrate real-time data for municipal services. The project aims to cut CO^2 emissions by 50%, increase renewable energy use by 50%, achieve full digitalisation, and improve air quality to drive resilient, citizen-driven urban transformation that can be replicated in other cities.

Image source: MAtchUP

Source: *MAtchUP | Smart City València—Smart City—València*. (n.d.). Smart City. Retrieved January 5, 2026, from https://www.valencia.es/web/smartcity/val/projectes/matchup; *Valencia—MatchUp—MatchUp*. (n.d.). Retrieved January 5, 2026, from https://www.matchup-project.eu/cities/valencia/

Box 4.2. Leipzig, Germany: Digital City Unit for climate-neutral and smart city projects

Leipzig's Digital City Unit, established in 2018, drives the city's transformation into a climate-neutral and smart city, spearheading strategic initiatives such as the "City Vision Leipzig 2050". This is a roadmap for achieving a carbon-neutral, digitally empowered urban environment by 2050. Developed in collaboration with Fraunhofer IMW and authored by Leipzig's Digital City Unit, the Vision outlines key ambitions from underground, municipally owned data centres that capture waste heat for district heating, to intelligent energy management systems and autonomous, climate-neutral public transport.

The Digital City Unit leads integrated initiatives such as the SPARCS (Sustainable energy Positive & zero cARbon CommunitieS) project in the Leipzig West district—transforming a former industrial area into an intelligent energy neighbourhood featuring district heating using waste heat, renewable energy integration, and smart public transport planning through an urban data platform. This work builds on earlier experience from the Triangulum project and aligns with the EU's "100 Climate-Neutral and Smart Cities" mission, for which Leipzig was officially recognised in May 2025, laying the foundation for a resilient, citizen-centric, data-driven city.

Image source: Triangulum-project.eu

Source: *English – SPARCS Leipzig*. (n.d.). Retrieved January 5, 2026, from https://sparcs-leipzig.info/english/; Riemer, A., & Kosinski, J. (2020). *City Vision Leipzig 2050* (No. LC-SC3-SCC-1-2018-2019-2020: Smart Cities and Communities). SPARCS – Sustainable energy Positive & zero cARbon CommunitieS. https://digitalesleipzig.de/wp-content/uploads/2020/11/20201002-City-Vision-Leipzig-2050-English.pdf

Box 4.3. Vienna, Austria: Smarter Together project

Vienna's Smarter Together project (2016–2021) is an EU-funded Horizon 2020 "lighthouse" initiative implemented in the Simmering district consisting of 40 individual projects, aiming to drive sustainable urban renewal through integrated energy, mobility, and ICT solutions. It refurbished three housing complexes benefiting around 1,300 residents, and retrofitted schools with zero-energy gyms, solar benches, and educational programs, while saving approximately 6,000 MWh of energy annually and reducing CO^2 emissions by about 550 tonnes. The project introduced e-mobility services, including e-car-sharing, e-cargo bikes, a multimodal Mobility Point, and a gamified awareness campaign ("Beat the Street") that engaged over 6,000 locals, and relied on an open-source FIWARE-based data platform to enable citizens and partners to co-design solutions and monitor performance. The initiative exemplifies Vienna's multi-stakeholder participatory governance and provides a replicable model of digital, citizen-centric, climate-neutral urban transformation.

Image source: European Commission

Source: European Commission. (n.d.). *Smarter Together Site Vienna | Smart Cities Marketplace*. Retrieved January 6, 2026, from https://smart-cities-marketplace.ec.europa.eu/projects-and-sites/projects/smarter-together/smarter-together-site-vienna; Fahrgastbeirat. (2018, July 16). Smarter Together. *Smart City Wien*. https://smartcity.wien.gv.at/smarter-together/

Many cities have moved from pilot projects to mainstreaming solutions, though challenges remain in scaling, financing, and integrating these innovations into broader urban systems.[433] Integrated, cross-sectoral approaches are key for future progress, along with the need for robust data governance to ensure privacy, security, and interoperability.[434] Benchmarks and indicators are central to monitoring progress. The adoption of ISO 37122 (smart city indicators), ISO 37120 (city services and quality of

433 European Court of Auditors. (2023). ***Smart cities: Tangible solutions, but fragmentation challenges their wider adoption***. European Court of Auditors.; OECD. (2023). ***Smart City Data Governance*** (1st ed). Organization for Economic Cooperation & Development.

434 OECD. (2023). ***Smart City Data Governance*** (1st ed). Organization for Economic Cooperation & Development.

life), and city-specific KPIs enables cities to track achievements in areas such as energy, mobility, digital inclusion, and citizen participation.[435] The EU SCC metrics provide additional benchmarks, including energy savings, CO^2 reduction, citizen engagement, and the deployment of smart infrastructure.[436]

4.4 Low carbon development

The concept of a Low Carbon City in Europe emphasises reducing greenhouse gas emissions across urban systems while ensuring economic competitiveness and social inclusion. Low carbon cities are defined as cities that systematically decarbonise energy, transport, and building sectors while promoting circular economy principles and resilience to climate risks.[437] Low carbon development has gained momentum in international climate talks from the late 2000s, with EU-led Low-Emission Development Strategies becoming part of key UN agreements by 2011.[438] The European Green Deal (2019) boosted EU climate goals and commits EU member states to climate neutrality by 2050 and a 55% reduction in greenhouse gas emissions by 2030, with measures spanning energy, transport, buildings, and urban planning. Cities play a central role, supported by initiatives like the EU Climate Law and Social Climate Fund.[439] The Paris Agreement, signed by the EU and its member states, reinforces these goals.[440] The European Climate Law (2021) made these targets legally binding, including interim goals like a 55% emissions cut by 2030 and 90% by 2040, pushing climate action across all sectors.[441] Programmes such as Climate-Neutral and Smart Cities and Sustainable Energy and Climate Action Plans (SECAPs) aim for 100 EU cities to achieve climate neutrality by 2030, making them leaders in the green transition.[442] At present, EU leadership for 2024–2029 has reaffirmed its commitment to SDGs and climate neutrality, calling for major breakthroughs by 2030 and net-zero emissions by 2050 by integrating climate action into urban planning, energy systems, and mobility strategies.[443]

Europe's sustained prosperity and global competitiveness rely on the implementation of an ambitious investment strategy, with the recent Draghi Report calling for additional annual investment of EUR800 billion needed to drive green and digital transformations. This scale-up is expected through collective EU action and collaboration across member states, leveraging instruments like the Multiannual Financial Framework (MFF) 2028–2035.[444] Enhancing the EU's competitive edge both in the short- and long-term, will require effectively leveraging digital technologies and playing a leading role in advancing future-oriented innovations, particularly in low carbon solutions.[445] At present, several key EU financing mechanisms support the transition to low carbon and advancing climate goals:[446]

- Just Transition Mechanism (JTM): EUR20.7 billion (1% of EU budget) for regions most affected by decarbonisation, complemented by EUR34 billion in public and private investment.
- Social Climate Fund: EUR86.7 billion starting in 2026 to support households during the expansion of emissions trading to heating and transport fuels.
- Horizon Europe: EUR95.5 billion for R&D in low carbon technologies.
- Innovation Fund: EUR40 billion for carbon capture, hydrogen, and other emerging technologies.
- RePowerEU Plan: EUR225 billion in unused loans and EUR20 billion in grants redirected to accelerate renewable energy deployment and energy security.

The availability of funding is supported by multi-level partnership models that combine municipal, regional, and EU-wide collaboration. Initiatives like the EU Covenant of Mayors with over 10 ,500 local authorities voluntarily committed to EU energy and climate targets.[447] The EU Mission for Climate-Neutral and Smart Cities engage 112 "Mission Cities" testing cross-sectoral solutions, and a Twinning Learning Programme pairs these cities with "Twin Cities" for structured peer learning, including workshops,

435 OECD. (2023). *Smart City Data Governance* (1st ed). Organization for Economic Cooperation & Development.

436 European Climate, Infrastructure and Environment Executive Agency (Ed.). (2024). *The State of European Smart Cities: Exploring and showcasing models, solutions, and financing for European replication to achieve climate neutrality.* Publications Office. https://doi.org/10.2926/97950

437 Guillaume, L., & Fuller, G. (2025*). Europe Sustainable Development Report 2025: SDG Priorities for the New EU Leadership*. SDG Transformation Centre.

438 Sustainable Development Goals Knowledge Platform. (n.d.). *Low Carbon Development .:. Sustainable Development Knowledge Platform*. Retrieved January 6, 2026, from https://sustainabledevelopment.un.org/index.php?menu=1448

439 *The European Green Deal—European Commission*. (n.d.). Retrieved January 6, 2026, from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

440 *Paris Agreement on climate change*. (n.d.). Consilium. Retrieved January 6, 2026, from https://www.consilium.europa.eu/en/policies/paris-agreement-climate/

441 *European Climate Law—Climate Action—European Commission*. (n.d.). Retrieved January 6, 2026, from https://climate.ec.europa.eu/eu-action/european-climate-law_en

442 *Local and regional climate action—Climate Action—European Commission*. (n.d.). Retrieved January 6, 2026, from https://climate.ec.europa.eu/eu-action/local-and-regional-climate-action_en

443 Guillaume, L., & Fuller, G. (2025). *Europe Sustainable Development Report 2025: SDG Priorities for the New EU Leadership*. SDG Transformation Centre.

444 Guillaume, L., & Fuller, G. (2025). *Europe Sustainable Development Report 2025: SDG Priorities for the New EU Leadership*. SDG Transformation Centre.

445 European Commission. European Political Strategy Centre. (2024). *The future of European competitiveness.Part A, A competitiveness strategy for Europe*. Publications Office. https://data.europa.eu/doi/10.2872/9356120

446 Borowiecki, M., Giménez, J. C., Giovannelli, F., & Vanni, F. (2023). *Accelerating The EU's Green Transition* (No. ECO/WKP(2023)30; ECONOMICS DEPARTMENT WORKING PAPERS No.1777). OECD. https://one.oecd.org/document/ECO/WKP%282023%2930/en/pdf

447 *Covenant of Mayors—Eurocities*. (2020, August 21). https://eurocities.eu/projects/covenant-of-mayors/

site visits, and replication planning over one-year cycles.[448] The Green Deal Going Local[449] and Urban Agenda Partnerships[450] link local authorities with EU institutions to co-create policies and access funding, complemented by Interreg Europe[451] for cross-border cooperation. These partnership models work through integrated governance, technical assistance, financial support, and knowledge-sharing networks, ensuring cities can scale renewable energy, electrify transport, and meet net-zero targets collectively.

Current progress on low carbon cities in Europe is ongoing, with many municipalities actively implementing climate-neutral strategies, though progress varies by city and region. Most efforts are advancing steadily, supported by strong policy frameworks and funding mechanisms. Europe's low carbon strategy integrates multiple sectors through the EU Green Deal and Fit for 55 packages, which strengthen climate regulations to accelerate decarbonisation. The EU Emissions Trading System (ETS), launched in 2005, is a cornerstone "cap and trade" policy to reduce greenhouse gas emissions, standardise carbon pricing, and target hard-to-decarbonise sectors. Covering around 40% of the EU's total emissions, the ETS limits emissions from power generation, energy-intensive industries, aviation and since 2024, maritime transport. Under ETS 2 in 2027, its scope will be extended to emissions from road transport and buildings. EU's green transition plans include tripling solar and wind capacity by 2030, improving electricity market integration, expanding grid infrastructure, and prioritising electrification of transport and heating. Policies prohibit new combustion vehicles by 2035, expand electric vehicle networks, support rail links, promote carbon farming and peatland restoration in agriculture, and require zero-emission building renovations by 2028 with minimum standards from 2033.[452]

Europe's transition to low carbon cities is exemplified by several notable local initiatives. CopenHill, also known as Amager Bakke, is a pioneering waste-to-energy plant in Copenhagen, Denmark, that burns 440,000 tons of waste a year to supply clean electricity and district heating to 150,000 households (Figure 4.3). Amsterdam in the Netherlands has pioneered institutional innovation by fostering urban experimentation

448 Morgan, E. (2025, January 22). Network of ambitious cities on climate neutrality grows to 184 on EU Cities Mission peer-learning programme. *NetZeroCities*. https://netzerocities.eu/2025/01/22/network-of-ambitious-cities-on-climate-neutrality-grows-to-184-on-eu-cities-mission-peer-learning-programme/

449 *Green Deal Going Local Handbook | European Committee of the Regions*. (n.d.). Retrieved January 6, 2026, from https://cor.europa.eu/en/our-work/priorities-2025-2030/resilience/green-deal-going-local/green-deal-going-local-handbook

450 *Explore the Dynamic Network of the Urban Agenda Partnerships | UAEU*. (n.d.). Retrieved January 6, 2026, from https://www.urbanagenda.urban-initiative.eu/news/explore-dynamic-network-urban-agenda-partnerships

451 *RESolution | Joint solutions with practical applications for renewable energy use in cross-border area | ROHU 103*. (n.d.). Retrieved January 6, 2026, from https://interreg-rohu.eu/en/project_library/resolution-joint-solutions-with-practical-applications-for-renewable-energy-use-in-cross-border-area-rohu-103/

452 Borowiecki, M., Giménez, J. C., Giovannelli, F., & Vanni, F. (2023). *Accelerating The EU's Green Transition* (No. ECO/WKP(2023)30; ECONOMICS DEPARTMENT WORKING PAPERS No.1777). OECD. https://one.oecd.org/document/ECO/WKP%282023%2930/en/pdf

and establishing climate labs, which drive comprehensive changes in governance and infrastructure to advance climate action (Box 4.4). Barcelona, Spain, has adopted the Barcelona Climate Plan, utilising co-production methods that actively involve civil society and business stakeholders to promote urban decarbonisation (Box 4.5). Meanwhile, Lisbon, Portugal, is advancing urban electrification through the expansion of electric vehicle charging infrastructure and the integration of renewable energy sources into the city's electrical grid. Collectively, these examples highlight a wider European trend towards electrification, innovative demand management, and the adoption of mobility solutions such as low-emission transport corridors and smart energy systems (Box 4.6).[453]

Figure 4.3. Copenhill Heat and Power Waste-to-Energy Plant in Copenhagen, Denmark

Europe has been leading in sustainability and declining greenhouse gas emissions. However, progress towards climate neutrality remains inadequate. Despite the Paris Agreement, global temperatures are on track to exceed the 1.5°C limit. This is partly due to local barriers: cities remain excluded from key decisions on resilience and lack sufficient funding to act effectively.[454] Key sectors needing major emissions cuts include buildings, transport, and the agriculture industry. Additionally, carbon sinks such as land use and forestry have worsened in the recent years.[455] Financing continues to be

453 Cities and climate action: World Citites Report 2024. (2024). UN-Habitat.

454 UN-Habitat. (2024). *Cities and climate action: World Cities Report 2024*. UN-Habitat.

455 *European Climate Law—Climate Action—European Commission*. (n.d.). Retrieved January 6, 2026, from https://climate.ec.europa.eu/eu-action/european-climate-law_en

a critical issue, as several member states struggle to mobilise sufficient investment for green technologies and just transition measures, especially in regions with high dependency on fossil fuels.[456] Implementation barriers include uneven progress among member states, regulatory complexity, and delays in integrating climate objectives into national policies. This is due to significant sectorial impact from the migration to sustainable pathways. To address this, there is a need to develop detailed migration policies to distribute the impact on existing industries, although there is currently limited data and further research is needed in that direction.[457]

Box 4.4. Amsterdam, Netherlands: Climate Resilient Cities Programme

The Climate Resilient Cities Programme at Amsterdam Institute for Advanced Metropolitan Solutions (AMS) is a multidisciplinary urban research initiative designed to prepare Amsterdam for the impacts of climate change such as extreme rainfall, heatwaves, sea-level rise, and drought by 2050. Through an integrated "urban air-water-soil-green" systems analysis, the programme employs advanced meteorological and hydrological modelling to understand rainfall, temperature, wind turbulence, water storage, and discharge across the city. These insights inform adaptive planning, guiding the design, testing, and scaling of infrastructural interventions ranging from green-blue streets to resilient quay walls and bio-receptive concrete to strengthen climate resilience. Importantly, the initiative leverages a triple-helix collaboration involving academia, government, industry, and communities to embed resilience thinking into municipal governance. This governance innovation encourages cross-sectoral experimentation and bottom-up initiatives, effectively transforming pilot projects into scalable solutions for citywide climate adaptation.

Image source: Amsterdam Institute for Advanced Metropolitan Solutions

Source: Fabrique. (n.d.). *Climate Resilient Cities*. AMS. Retrieved January 6, 2026, from https://www.ams-institute.org/urban-challenges/resilient-cities/; *Climate Resilient Cities (AMS Institute)*. (n.d.). Openresearch.Amsterdam. Retrieved January 6, 2026, from https://openresearch.amsterdam/en/page/47430/climate-resilient-cities-ams-institute

456 Borowiecki, M., Giménez, J. C., Giovannelli, F., & Vanni, F. (2023). *Accelerating The EU's Green Transition* (No. ECO/WKP(2023)30; ECONOMICS DEPARTMENT WORKING PAPERS No.1777). OECD. https://one.oecd.org/document/ECO/WKP%282023%2930/en/pdf

457 Intergovernmental Panel On Climate Change (Ipcc) (Ed.). (2023). Mitigation and Development Pathways in the Near to Mid-term. In *Climate Change 2022—Mitigation of Climate Change* (1st ed., pp. 409–502). Cambridge University Press. https://doi.org/10.1017/9781009157926.006

Box 4.5. Barcelona, Spain: Climate Plan 2018–2030

Barcelona's Climate Plan 2018–2030 was collaboratively developed with extensive involvement from local stakeholders, including citizens, NGOs, and businesses, representing a transition from hierarchical planning to integrated urban decarbonisation. The city utilised a combination of traditional workshops and a digital participation platform, allowing hundreds of contributors to submit ideas, proposals, and priorities across 18 action lines within five strategic domains. The Climate Plan also features a concise, infographic-based summary illustrating the climate-related risks Barcelona seeks to mitigate, such as escalating extreme heat, reduced water availability, increased flooding, and diminishing beaches and coastal protection due to sea level rise. For instance, the plan models heat risk under both a 'committed' scenario, aligned with the Paris Agreement, and a 'passive' business-as-usual scenario to reinforce the need for action. The inclusive process produced measurable objectives: by 2030, Barcelona intends to achieve a 45% reduction in greenhouse gas emissions compared to 2005, expand green spaces, advance solar energy adoption, and renovate existing buildings. These efforts are endorsed by 1,100 signatory organisations from public bodies, social enterprises, and private sector entities. Overall, the initiative establishes a more democratic and transparent governance framework that harmonises municipal climate policy with business and civil society interests, thereby enhancing urban stakeholder engagement and legitimacy in climate initiatives.

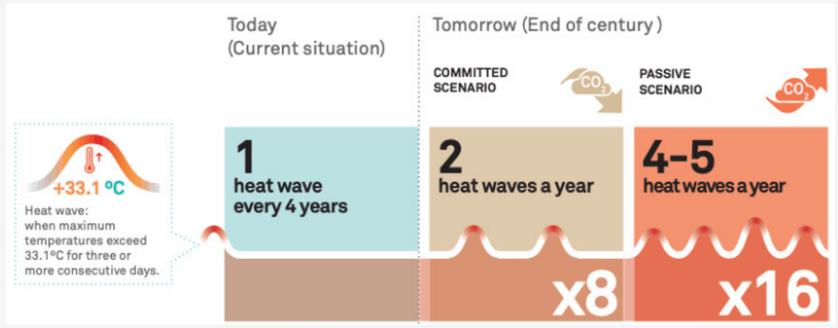


Image source: C40 Knowledge Hub

Source: *Barcelona's Climate Action Plan 2018—2030*. (n.d.). Retrieved January 6, 2026, from https://www.c40knowledgehub.org/s/article/Barcelona-s-Climate-Action-Plan-2018-2030?language=en_US; Satorras, M., Ruiz-Mallén, I., Monterde, A., & March, H. (2020). Co-production of urban climate planning: Insights from the Barcelona Climate Plan. *Cities*, *106*, 102887. https://doi.org/10.1016/j.cities.2020.102887

Box 4.6. Lisbon, Portugal: Green infrastructure and clean energy

Lisbon is transitioning to a low carbon future through a multi-pronged approach that integrates renewable energy, green infrastructure, and sustainable mobility. The city promotes solar energy adoption via rooftop installations and embeds green roofs, urban parks, and ecological corridors into its planning to reduce heat islands, improve air quality, and enhance biodiversity. Policies encourage water-efficient vegetation on green roofs to conserve resources while improving building insulation and stormwater management. Lisbon also invests heavily in sustainable transport, expanding cycling networks, introducing electric buses and trams, and implementing low-emission zones to curb fossil fuel use. Community engagement is central to these efforts, ensuring public participation in planning and implementation. Additionally, Lisbon is advancing urban electrification through projects like Siemens' smart EV charging system at the Infinity Building, which integrates renewable energy and dynamic load management, supporting Portugal's goal of deploying 15,000 EV charging stations by 2025.

Image source: Europawire.eu

Source: Editors, E. P. (n.d.). Siemens Powers Sustainable Mobility at Lisbon's Infinity Building with Innovative EV Charging Solution | EuropaWire. Retrieved January 6, 2026, from https://news.europawire.eu/siemens-powers-sustainable-mobility-at-lisbons-infinity-building-with-innovative-ev-charging-solution/eu-press-release/2024/02/15/15/02/53/129947/; Contributor. (2024, June 16). Portugal is integrating renewable energy into sustainable urban planning. Portugal Resident. https://www.portugalresident.com/portugal-is-integrating-renewable-energy-into-sustainable-urban-planning/

Europe employs a comprehensive set of tools to monitor and enforce accountability towards climate progress. The European Environment Agency (EEA) publishes annual greenhouse gas inventories and progress reports under the EU Climate Law, ensuring transparency and compliance.[458] The EU Emissions Trading System (ETS) is a market-based strategy designed to reduce emissions in energy-intensive sectors. Polluters are required to pay for their greenhouse gas emissions, creating an incentive to lower output. Established in 2005 as the world's first and one of the largest carbon markets, the ETS has contributed to decreasing EU emissions while simultaneously funding green initiatives. The system applies to electricity, heat, industrial manufacturing, aviation, and, since 2024, maritime transport, accounting for approximately 40% of EU greenhouse gas emissions. It operates across all EU member states, as well as Iceland, Liechtenstein, and Norway, and has been linked with Switzerland's ETS since 2020.[459] Broader sustainability performance is assessed through the European Sustainable Development Report, which includes the SDG Index tailored for EU member states.[460] Additionally, the EU Taxonomy for Sustainable Activities and the Fit for 55 Package provide detailed indicators for investment flows and binding targets for sectoral compliance.[461] Global benchmarks such as the Emissions Gap Report complement these efforts by highlighting Europe's contribution to closing the global emissions gap.[462]

458 European Environment Agency (Ed.). (2025). *Trends and projections in Europe 2025*. Publications Office. https://doi.org/10.2800/6474400

459 *About the EU ETS - Climate Action—European Commission*. (n.d.). Retrieved January 7, 2026, from https://climate.ec.europa.eu/eu-action/carbon-markets/about-eu-ets_en#what-is-the-eu-ets

460 Guillaume, L., & Fuller, G. (2025). Europe Sustainable Development Report 2025: SDG Priorities for the New EU Leadership. SDG Transformation Centre.

461 *Fit for 55*. (n.d.). Consilium. Retrieved January 7, 2026, from https://www.consilium.europa.eu/en/policies/fit-for-55/

462 Programme, U. N. E. (2025). *Emissions Gap Report 2025: Off Target - Continued Collective inaction puts Global Temperature Goal at Risk*. https://doi.org/10.59117/20.500.11822/48854

Chapter 5

Latin America and the Caribbean

Chapter 5: Latin America and the Caribbean

5.1 Region context

Location	Latin America and the Caribbean (LAC)
Countries	33 countries. 20 in Latin America and 13 in the Caribbean
Land Size	~ 20,042,087 square kilometres
Population	~ 668 million (2025)
Population Ageing Trend	People over age 65: 9.9% in 2024, projected to rise to 18.9% in 2050
Urbanisation Level	81% of population live in urban areas (2024) Latin America: 82% (from Uruguay 96% to Haiti 55%) The Caribbean: 62% (from Bahamas 81% to Antigua and Barbuda 24%)
Geographic Overview	LAC is a vast and physically diverse region, extending from Mexico and the Bahamas in the north to the southern tip of Argentina and Chile, encompassing 33 sovereign nations characterised by extreme geographical features like the Andes Mountains, Amazon Basin, and thousands of Caribbean islands.
Climate Risks	Extreme weather events–five of the world's top ten countries most affected by climate, particularly rising temperatures, ocean warming, increased frequency and intensity of extreme events such as heatwaves, droughts, heavy precipitation, floods, landslides and tropical cyclones. Between 1998 and 2017, 53% of global economic losses from climate-related disasters occurred in LAC.
Key Urban Networks	IDB Cities Network (Inter-American Development Bank), URBELAC (European Commission, EU), Habitat for Humanity, UN-Habitat, Urban and Cities Platform (ECLAC / UN), REDEUSLAC, GIZ, Resilient Cities Network, local government institutions

Source: Various Sources[463]

Under the UN classification, Latin America and the Caribbean (LAC) covers 33 sovereign countries (Table 5.1).[464] The region is home to two of the world's ten largest countries by land area: Brazil (top five) and Argentina (top eight).[465] For analytical and comparative purposes, the region is commonly subdivided into Latin America (though Mexico is located in North America) and the Caribbean, a distinction shaped primarily by historical trajectories, linguistic traditions, and cultural affinities.[466] Latin America generally encompasses the Spanish- and Portuguese-speaking mainland countries and several island states, while the Caribbean is composed largely of English-, French-, and Dutch-speaking island nations and coastal territories.

From an institutional standpoint, this regional configuration is reflected in the mandate of the Economic Commission for Latin America and the Caribbean (ECLAC), which includes the 33 countries of the region but also incorporates 13 additional member states—such as Spain, France, and the United States—due to historical, political, or territorial links, alongside several associate members that are non-independent territories. In contrast, the Community of Latin American and Caribbean States (CELAC) is a political forum that brings together exclusively the 33 sovereign countries of LAC.[467]

In demographic terms, Latin America and the Caribbean is currently home to approximately 668 million people, and the region's population is projected to reach 780 million by 2050 (Table 5.1). Latin America and the Caribbean is the region with the highest proportion of its population concentrated in megacities. Of the region's total population in 2018, 14.2% resided in six cities with 10 million inhabitants or more; Sao Paolo (Brazil), Mexico City (Mexico), Buenos Aires (Argentina), Rio de Janeiro (Brazil), Bogota (Colombia), and Lima (Peru). These cities are also among the world's largest populations.[468]

463 United Nations. (n.d.). *Regional groups of Member States of the United Nations*. United Nations Department for General Assembly and Conference Management. https://www.un.org/dgacm/en/content/regional-groups; World Bank. (n.d.). *Land area (sq. km) - Latin America & Caribbean* [Data set]. https://data.worldbank.org/indicator/AG.LND.TOTL.K2?locations=ZJ ; World Bank. (n.d.). *Population estimates and projections* [Data set]. https://databank.worldbank.org/source/population-estimates-and-projections; *Urban population (% of total population)—Latin America & Caribbean*. (n.d.). World Bank Open Data. Retrieved May 4, 2026, from https://data.worldbank.org; Economic Commission for Latin America and the Caribbean (ECLAC). (2024). *Demographic observatory of Latin America and the Caribbean 2024: Population prospects and rapid demographic changes in the first quarter of the twenty-first century in Latin America and the Caribbean* (LC/PUB.2024/22-P). United Nations. https://www.cepal.org/en/publications/81085-demographic-observatory-latin-america-and-caribbean-2024-population-prospects-and ; CopernicusLAC Panama. (2024). *Trends in urbanisation and population growth in the Latin America and Caribbean (LAC) region*. https://www.copernicuslac-panama.eu/blog-en/trends-in-urbanisation-and-population-growth-in-the-latin-america-and-caribbean-lac-region/ ; Global Facility for Disaster Reduction and Recovery. (n.d.). *Latin America and Caribbean (LAC)*. https://www.gfdrr.org/en/region/latin-america-and-caribbean-lac ; Cavazos, T., Bettolli, M. L., Campbell, D., Sánchez Rodríguez, R. A., Mycoo, M., Arias, P. A., Rivera, J., Reboita, M. S., Gulizia, C., Hidalgo, H. G., Alfaro, E. J., Stephenson, T. S., Sörensson, A. A., Cerezo-Mota, R., Castellanos, E., Ley, D., & Mahon, R. (2024). Challenges for climate change adaptation in Latin America and the Caribbean region. *Frontiers in Climate*, *Volume 6-2024*. https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2024.1392033

464 United Nations. (n.d.). *Regional groups of Member States of the United Nations*. United Nations Department for General Assembly and Conference Management. https://www.un.org/dgacm/en/content/regional-groups; International Organization for Migration. (n.d.). "*Region(s)" and regional players for the purpose of the GCM regional review*. https://www.iom.int/sites/g/files/tmzbdl486/files/regional_players_for_the_purpose_of_the_gcm_regional_review_english.pdf

465 Worldometer. (n.d.). *Largest countries in the world (by area)*. Retrieved January 30, 2026, from https://www.worldometers.info/geography/largest-countries-in-the-world/

466 Economic Comision for America Latina and the Caribbean, Demographic Observatory. (2019). *Population trends in Latin America and the Caribbean*. United Nations. https://www.un-ilibrary.org/content/books/9789210479578c004/read

467 Comisión Económica para América Latina y el Caribe [CEPAL]. (n.d.). *Estados miembros*. https://www.cepal.org/es/acerca/estados-miembros

468 Plataforma Urbana y de Ciudades de America Latina y el Caribe [CEPAL]. (n.d.). *Estadísticas urbanas regionales*. https://plataformaurbana.cepal.org/es/estadisticas-urbanas-regionales

Table 5.1. Population in Latin America and the Caribbean (2000, 2025 and 2050)

Country	Population Estimates and Projections (Millions of People)		
	2000	**2025**	**2050**
Latin America and The Caribbean (Region)	**521**	**668**	**780**
Argentina	37.0	47.2	54.5
Bolivia	8.3	12.3	15.0
Brazil	170.4	219.0	247.2
Chile	15.3	19.5	21.6
Colombia	40.3	53.4	61.2
Costa Rica	3.9	5.3	6.1
Cuba	11.2	11.3	10.4
Ecuador	12.5	18.3	21.7
El Salvador	5.9	6.5	6.9
Guatemala	11.5	18.0	23.8
Haiti	8.4	11.7	14.0
Honduras	6.5	10.6	13.8
Mexico	98.9	131.9	148.9
Nicaragua	5.1	7.4	9.3
Panama	3.0	4.4	5.8
Paraguay	5.2	7.5	9.6
Peru	25.7	34.6	40.6
Suriname	0.5	0.6	0.8
Uruguay	3.3	3.5	3.6
Venezuela	24.2	28.5	32.1
Antigua and Barbuda	0.07	0.1	0.11
Bahamas	0.3	0.41	0.45
Barbados	0.27	0.28	0.29
Belize	0.24	0.5	0.63
Dominica	0.07	0.07	0.07
Dominican Republic	8.5	12.3	14.6
Grenada	0.1	0.11	0.12
Guyana	0.76	0.81	0.9
Jamaica	2.6	2.7	2.8
Saint Kitts and Nevis	0.04	0.05	0.06
Saint Lucia	0.16	0.18	0.19
Saint Vincent and the Grenadines	0.11	0.11	0.12
Trinidad and Tobago	1.26	1.4	1.47

Source: World Bank [469]

While urban growth remains substantial in absolute numbers, it conceals deep structural transformations that have unfolded over recent decades. Following a period of rapid population expansion during the mid-twentieth century, driven by high fertility rates and declining mortality—the region has undergone one of the fastest demographic transitions globally. Fertility and mortality rates have fallen sharply, leading to a marked deceleration in population growth and significant transformation in age structure.[470] This demographic transition has reshaped dependency ratios and labour force dynamics, generating both opportunities such as the potential for a demographic dividend and challenges related to employment, pension systems, healthcare provision, and long-term care for an ageing population, particularly in a context of persistent socioeconomic inequality.[471]

Urbanisation has been one of the most defining features of development in Latin America and the Caribbean, occupying a central role in shaping economic and social outcomes. The region is now among the most urbanised in the developing world, and this process has generally been associated with improvements in development indicators.[472] At the same time, urban expansion has introduced significant spatial, environmental, and governance challenges. Urban areas have expanded rapidly, often outpacing population growth, resulting in declining population densities and the spread of low-density urban forms. This pattern of urban expansion has increased the costs of public service provision, complicated metropolitan governance, and intensified pressures on

469 World Bank. (n.d.). ***Population estimates and projections*** [Data set]. https://databank.worldbank.org/source/population-estimates-and-projections#

470 Economic Commission for Latin America and the Caribbean (ECLAC). (2024). ***Demographic observatory of Latin America and the Caribbean 2024: Population prospects and rapid demographic changes in the first quarter of the twenty-first century in Latin America and the Caribbean*** (LC/PUB.2024/22-P). United Nations. https://www.cepal.org/en/publications/81085-demographic-observatory-latin-america-and-caribbean-2024-population-prospects-and

471 Economic Commission for Latin America and the Caribbean (ECLAC). (2024). Demographic observatory of Latin America and the Caribbean 2024: Population prospects and rapid demographic changes in the first quarter of the twenty-first century in Latin America and the Caribbean (LC/PUB.2024/22-P). United Nations. https://www.cepal.org/en/publications/81085-demographic-observatory-latin-america-and-caribbean-2024-population-prospects-and

472 United Nations. (2016). ***Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality***. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

transport systems, land use, and environmental sustainability.[473] In several Caribbean countries, urban growth has resulted in hybrid settlement patterns in which urban and rural characteristics co-exist, blurring the distinction between the two.

Latin America and the Caribbean region is identified as one of the world's most vulnerable to extreme weather events. Recent estimates indicate that five of the ten countries most affected by climate change are located in this region.[474] Despite these risks, regional adaptation is hindered by scientific gaps, limited political support, and financial constraints.[475] Today, the region faces increasing risks such as rising sea levels, heat waves and heavy rainfall, which cause floods and landslides, as well as forest fires, heat stress, intense humid heat, and emerging infectious diseases. Between 1998 and 2017, 53% of global economic losses caused by climate-related disasters occurred in Latin America and the Caribbean.[476]

Cities in Latin America and the Caribbean have shifted from an industrial economy to a mixed economy, with significant growth in service sectors over the past 20 years. However, this growth has resulted in low productivity and high informal employment. Urbanisation has aided national economic development but also led to challenges like concentrated poverty, informal settlements, and strained infrastructure. Despite high urbanisation, persistent low incomes indicate inefficiencies in cities. The region's economic context remains unfavourable, with GDP growth slowing to an estimated 1.8% in 2024, reflecting a return to low growth patterns.[477]

Urban development in Latin America and the Caribbean is supported by a dense ecosystem of global, regional, and transregional networks that bring together governments, international organisations, academia, civil society, and the private sector to strengthen capacities and promote sustainable cities. The Inter-American Development Bank (IDB), through initiatives such as the IDB Cities Network, plays a central role by facilitating knowledge exchange and providing financial, technical, and research support to its 26 borrowing member countries, while also partnering with non-borrowing members and development organisations to scale impact.[478] These efforts are complemented by collaborations such as URBELAC, a joint initiative with the European Commission that connects cities across Europe, Latin America, and the Caribbean to share best practices on social inclusion, economic development, and environmental sustainability.[479] At the regional level, the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) advances economic and social development and, together with partners like GIZ, supports the Urban and Cities Platform for Latin America and the Caribbean to monitor SDG 11 and the New Urban Agenda.[480] Global actors such as UN-Habitat and Habitat for Humanity further reinforce this ecosystem, alongside regional and local networks like REDEUSLAC and national and municipal institutions, collectively shaping a collaborative governance framework for sustainable urban development.

5.2 Urban challenges

Urbanisation has become a defining structural feature of the region's economic, social, and environmental dynamics.[481] Urbanisation is accompanied by growth opportunities as well as challenges. The main challenges involve the profound changes in the composition of the urban population, the role of cities in national wealth creation, and climate change.[482]

5.2.1 Demographic transition

Latin America, and the Caribbean is undergoing one of the fastest demographic transitions in the world, marked by a dramatic decline in fertility and a steady increase in life expectancy. In the 1950s, women in the region had an average of 5.8 children; by 2024, this figure had fallen to around 1.8, below replacement level, a change unprecedented in

473 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

474 Global Facility for Disaster Reduction and Recovery. (n.d.). *Latin America and Caribbean (LAC)*. https://www.gfdrr.org/en/region/latin-america-and-caribbean-lac

475 Cavazos, T., Bettolli, M. L., Campbell, D., Sánchez Rodríguez, R. A., Mycoo, M., Arias, P. A., Rivera, J., Reboita, M. S., Gulizia, C., Hidalgo, H. G., Alfaro, E. J., Stephenson, T. S., Sörensson, A. A., Cerezo-Mota, R., Castellanos, E., Ley, D., & Mahon, R. (2024). Challenges for climate change adaptation in Latin America and the Caribbean region. *Frontiers in Climate*, *Volume 6-2024*. https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2024.1392033

476 Cavazos, T., Bettolli, M. L., Campbell, D., Sánchez Rodríguez, R. A., Mycoo, M., Arias, P. A., Rivera, J., Reboita, M. S., Gulizia, C., Hidalgo, H. G., Alfaro, E. J., Stephenson, T. S., Sörensson, A. A., Cerezo-Mota, R., Castellanos, E., Ley, D., & Mahon, R. (2024). Challenges for climate change adaptation in Latin America and the Caribbean region. *Frontiers in Climate*, *Volume 6-2024*. https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2024.1392033

477 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf ; Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

478 Inter-American Development Bak. (n.d.). *About the Cities Network?* https://www.iadb.org/en/topics/urban-development-and-housing/initiatives/cities-network/about-cities-network; Inter-American Development Bank. (n.d.). *We are the Inter-American Development Bank*. https://www.iadb.org/en/who-we-are/about-us

479 European Commission. (n.d.). *URBELAC: Urban European and Latin American and Caribbean cities.* https://ec.europa.eu/regional_policy/policy/cooperation/international/latin-america/urbelac_en

480 Economic Commission for Latin America and the Caribbean. (n.d.). *About ECLAC.* https://www.cepal.org/en/about; Urban and Cities Platform. (n.d.). *About*. https://plataformaurbana.cepal.org/en/about

481 Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

482 Urban Agenda Platform. (n.d.). *UN Economic Commision for Latin America and the Caribbean*. https://www.urbanagendaplatform.org/eclac

both speed and scale.[483] The region's age structure is shifting rapidly towards population ageing, with profound implications for development in a context already shaped by high inequality and uneven access to public services. Population ageing is no longer a background trend but a central factor influencing public policy, particularly through rising demand for healthcare, pensions, and long-term care systems.[484]

These demographic pressures are intensified by weak economic performance. After a brief post-pandemic rebound, regional growth has slowed sharply, with GDP growth estimated at 1.8% in 2024 and trend growth of 1.6% between 2010 and 2024—below both the global average and historical benchmarks.[485] Limited economic growth constrains job creation and public investment, precisely as ageing societies require expanded social protection and care systems. This combination of rapid ageing and low growth creates a particularly challenging scenario for sustaining inclusive and productive development.[486]

Population ageing patterns vary widely across countries and within them, especially between urban and rural areas. Countries that entered the demographic transition earlier—such as Uruguay, Chile, Argentina, and Costa Rica—already display advanced ageing profiles, with Uruguay reaching around 20% of its population aged 60 and over by 2022. In contrast, countries such as Bolivia, Honduras, and Paraguay remain younger, with close to 30% of their population under age 15 and 13% or less aged 60 and over.[487] Across all countries, urban areas are ageing faster: between 2010 and 2022, the share of children under age 15 in urban populations declined by an average of 4%, while the share of those aged 60 and over increased by 3.4%.[488] National averages often mask internal differences, which are shaped by patterns of urbanisation and selective migration, as the working-age population moves more frequently, leaving older persons in rural areas.[489] In highly urbanised countries such as Chile—where only about 12% of the population live in rural areas—ageing is clearly concentrated in cities.

At the city level, ageing is particularly pronounced. Major metropolitan areas consistently show higher proportions of people aged 60 and over than national averages. Montevideo stands out as the most aged city in the region (18-20% of population aged 60+), followed by Santiago, Buenos Aires, Medellín, and Cali (15 -18% aged 60+), with other cities such as San José, Lima, Bogotá, Caracas, São Paulo, and Rio de Janeiro also showing advanced ageing profiles (10-15% aged 60+).[490] In several cases, including Colombia and Venezuela, large cities already exceed national ageing levels by a significant margin, underscoring the growing urban concentration of older populations and the resulting pressures on housing, transport, health services, and long-term care systems.

In response, the region has made important institutional and policy advances. Since the Second World Assembly on Ageing in 2002, LAC has built a regional framework for the protection of older persons' rights, culminating in the Inter-American Convention on the Protection of the Human Rights of Older Persons adopted in 2015 under OAS auspices. This binding instrument, rooted in earlier milestones such as the 2012 Charter of San José, recognises the diversity of ageing and older age and reflects broad consensus among governments, civil society, international organizations, and academia.[491] Since 2016, nine countries have ratified the Convention, including Uruguay, Costa Rica, Argentina, Brazil, Bolivia, El Salvador, Ecuador, Peru, and Colombia. Complementing these efforts, several countries and cities have adopted age-friendly strategies aligned with the WHO Global Network of Age-Friendly Cities and Communities. Cities and communities in countries such as Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, and Uruguay are registered in the network or supported by national programmes, while broader strategies include pension reforms, expansion of non-contributory social protection, age-friendly urban planning, improved public transport accessibility, and investments in community care and inclusive public spaces (Figure 5.1).[492]

483 Economic Commission for Latin America and the Caribbean (ECLAC). (2024). *Demographic observatory of Latin America and the Caribbean 2024: Population prospects and rapid demographic changes in the first quarter of the twenty-first century in Latin America and the Caribbean* (LC/PUB.2024/22-P). United Nations. https://www.cepal.org/en/publications/81085-demographic-observatory-latin-america-and-caribbean-2024-population-prospects-and

484 Economic Commission for Latin America and the Caribbean (ECLAC). (2024). *Demographic observatory of Latin America and the Caribbean 2024: Population prospects and rapid demographic changes in the first quarter of the twenty-first century in Latin America and the Caribbean* (LC/PUB.2024/22-P). United Nations. https://www.cepal.org/en/publications/81085-demographic-observatory-latin-america-and-caribbean-2024-population-prospects-and

485 Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

486 Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

487 Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

488 Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

489 Economic Commission for Latin America and the Caribbean [ECLAC]. (2022). *Ageing in Latin America and the Caribbean: inclusion and rights of older persons* (LC/CRE.5/3), https://www.cepal.org/en/publications/48568-ageing-latin-america-and-caribbean-inclusion-and-rights-older-persons

490 Economic Commission for Latin America and the Caribbean [ECLAC]. (2022). *Ageing in Latin America and the Caribbean: inclusion and rights of older persons* (LC/CRE.5/3), https://www.cepal.org/en/publications/48568-ageing-latin-america-and-caribbean-inclusion-and-rights-older-persons

491 Economic Commission for Latin America and the Caribbean [ECLAC]. (2022). *Ageing in Latin America and the Caribbean: inclusion and rights of older persons*, https://www.cepal.org/en/publications/48568-ageing-latin-america-and-caribbean-inclusion-and-rights-older-persons

492 Economic Commission for Latin America and the Caribbean [ECLAC]. (2022). *Ageing in Latin America and the Caribbean: inclusion and rights of older persons*, https://www.cepal.org/en/publications/48568-ageing-latin-america-and-caribbean-inclusion-and-rights-older-persons

Figure 5.1 Freses Boulevard "wide street" walkability transformation in Curridabat, Costa Rica

5.2.2 Spatial inequality

Urban inequality remains high and is increasingly expressed through spatial segregation, while inefficient, low-density urban forms continue to undermine productivity, sustainability, and social cohesion. Spatial inequality in Latin America and the Caribbean is severe, defined by a deep rural-urban divide (reinforced by declining labour demand in agriculture and the expansion of industrial and service sectors in cities), extreme segregation within cities (with informal settlements and slums located near wealthy districts), and a strong concentration of resources, economic opportunities, and wealth in major cities (metropolitan bias). [493] The inequality is rooted in colonial land ownership, poor urban planning and in-situ segregation, often manifesting as marginalised slum areas, uneven access to services, and limited opportunities for residents in underserved regions compared to affluent urban centres. Informal settlements are frequently associated with labour informality—high informal employment rates, where workers lack job security while residential segregation and poor transport connectivity limit residents' opportunities to high-quality jobs, locking them in low socio-economic mobility.

493 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

Latin America and the Caribbean exhibit a paradox: despite its high levels of urbanisation, average per capita income remains well below those of developed economies; living conditions for large segments of the urban population have not improved. This phenomenon has been linked to factors such as rural displacement (driven by concentrated land acquisition by private companies), low rural productivity, insufficient urban planning and regulation, the expansion of informal settlements, and the dominance of large metropolitan areas over balanced territorial development.[494] To make matters worse, rapid urbanisation in the region has produced deep and persistent infrastructure deficits, with an estimated 117 million people—around 27% of the urban population—living in informal settlements characterised by precarious housing, limited access to basic services, environmental degradation, and weak social protection.[495] These conditions intensify spatial inequality within cities, where areas of high development co-exist alongside zones of extreme deprivation.

Urban form compounds these challenges: many cities have expanded through medium- or low-density development patterns that increase environmental pressures and raise the cost of providing inclusive access to services, a trend particularly evident in the Caribbean island-states with dispersed urban–rural settlement patterns. At the metropolitan scale, population growth in peripheral areas has often coincided with decline in historic centres, though some cities, e.g., Sao Paolo, Panam City, have pursued regeneration, repopulation, and densification strategies including nature-based solutions and transit-oriented development (Figure 5.2).[496] Cities in Mexico are adopting circular practices, where auto component recycling and waste management initiatives are being implemented.

494 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

495 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

496 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

Figure 5.2. Ciclovía weekly vehicular lane closure for active mobility in Bogota, Colombia

A growing number of countries and cities have experimented with diverse governance and planning approaches. Municipal de-concentration models—now the most widespread in the region and adopted in cities such as São Paulo, Bogotá, Quito, Rio de Janeiro, and La Paz—seek to maintain unity of command at the metropolitan level while decentralising service provision through administrative subdivisions. While this model offers coordination advantages, it often struggles to bring decision-making closer to citizens and tends to reproduce hierarchical governance structures.[497] São Paulo illustrates both the challenges and innovations of this approach: its de-concentration process introduced participatory budgeting and the Citizen Participation Council, enabling residents to elect representatives to engage directly with subprefectures, thereby strengthening democratic decision-making without creating new layers of government.[498]

Planning and regulatory reforms have also played a key role. In Colombia, the Urban Reform Law and Law 388 on Territorial Development established the social function

497 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

498 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

of property and mandated municipal responsibility for land-use planning and social housing provision. Within this framework, Bogotá's Metrovivienda initiative operates as a public land bank, acquiring and urbanising land for affordable housing and helping to curb informal growth, albeit with limited replication elsewhere in the country.[499] At the regional level, ECLAC's Urban and Cities Platform identifies National Urban Policy Guidelines in 30 of 33 countries, though only 11 are explicit and integrated; most remain partial, sectoral, and weakly coordinated across levels of government, particularly in Central America and the Caribbean.[500]

International and regional institutions have complemented national and local efforts. The Inter-American Development Bank (IDB) has supported urban development across the region for decades, financing projects in transport, water and sanitation, housing, public sector modernisation, and neighbourhood upgrading. Over the past twenty years alone, the IDB has provided approximately US$7 billion in financial and technical support for city-focused initiatives, ranging from historic centre renewal to sustainable public transport and citizen security.[501]

5.2.3 Climate vulnerability and environmental stress

The region has long been exposed to natural hazards such as hurricanes, floods, droughts, and coastal storm surges. Rapid motorisation has worsened congestion and pollution, while poor land-use planning and informal settlements heighten vulnerability to flooding and climate-related health risks. Climate change is intensifying these risks while introducing new challenges through rising temperatures, sea-level rise, altered precipitation patterns, and more frequent and severe extreme weather events.[502] Climate impacts are uneven across the region: hot-climate countries face declining labour productivity due to heat stress, small island states are highly vulnerable to storms and sea-level rise, and economies dependent on climate-sensitive sectors such as agriculture face heightened exposure, particularly where fiscal and institutional capacities are limited.[503] Over the past two decades, the region has experienced around

499 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

500 Aulestia, D., & Lana, B. (Eds.). (2024). *Informe urbano de América Latina y el Caribe 2024* (LC/TS.2024/109). Comisión Económica para América Latina y el Caribe (CEPAL). https://plataformaurbana.cepal.org/es/documentos/informe-urbano-de-america-latina-y-el-caribe-2024

501 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

502 Inter-American Development Bank. (2015). *Climate change risk management: Options for the energy sector*. https://publications.iadb.org/en/publications/english/viewer/Climate-Change-Risk-Management-Options-for-the-Energy-Sector.pdf

503 Marchitto, B., Conde, J., Santos, R., De Nicola, C., Ferrazzi, M., Baldini, A., Pal, R., Parigi, E., & Bermingham, C. (2023, September). *Climate risks for Latin America and the Caribbean: Are banks ready for the green transition?* European Investment Bank, Economics Department. https://www.eib.org/files/publications/20230142_climate_risks_for_latin_america_and_the_caribbean_en.pdf

1,350 climate-related disasters, affecting more than 170 million people, causing nearly 30,000 deaths, and generating economic losses exceeding USD$170 billion, with the Caribbean small island states among the most severely affected worldwide.[504] Climate change compounds the risks as climatic hazards interact with social and environmental vulnerabilities to undermine water, food, and energy security and strain urban systems, especially during severe droughts driven by the combined effects of climate variability, land-use change, urban expansion, and water management practices.[505]

Although Latin America and the Caribbean has developed substantial technical capacity to generate weather forecasts, climate scenarios, and historical climate data, significant gaps persist in translating this information into effective risk reduction and adaptation outcomes.[506] Vulnerability and risk exposure across the region are highly dynamic and context-specific, shaped by a combination of physical, environmental, social, economic, demographic, cultural, institutional, and governance factors. Inadequate urban planning and management limited environmental awareness, governance failures, and constrained livelihood opportunities significantly increase disaster risk. As a result, more than 80% of disaster-related losses in the region occur in urban areas, with 40-70% concentrated in cities with fewer than 100,000 inhabitants, where institutional capacity and investment in risk management tend to be weakest.[507]

Risk management and adaptation efforts in the region are largely implemented through national, subregional, and regional programmes, complemented by growing cooperation among cities through networks such as ICLEI (Local Governments for Sustainability). Most countries have established at least one national institution dedicated to climate change mitigation, adaptation, and disaster risk management in urban areas (Figure 5.3). Building on the Hyogo Framework for Action (HFA, 2005), the adoption of the Sendai Framework for Disaster Risk Reduction in 2015 reinforced a people-centred approach to disaster prevention, emphasising early warning systems, national risk reduction strategies, international cooperation, and the critical role of local governments and communities in reducing risk.[508]

Figure 5.3. Parque Barigui multi-functional urban green space, flood-control reservoir and wildlife sanctuary in Curitiba, Brazil

Regional and national initiatives illustrate how these frameworks are being operationalised. RIDASICC, for example, supports Central American and Caribbean countries in integrating disaster risk reduction and inclusive climate adaptation into public investment, strengthening capacities through training, methodological tools, pilot projects, and geographic information systems.[509] At the national level, Brazil's National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN) monitors climate-related hazards in high-risk municipalities and develops technological innovations to enhance early warning systems, contributing to the reduction of fatalities and material losses from geo-hydrometeorological disasters.[510]

504 Marchitto, B., Conde, J., Santos, R., De Nicola, C., Ferrazzi, M., Baldini, A., Pal, R., Parigi, E., & Bermingham, C. (2023, September). *Climate risks for Latin America and the Caribbean: Are banks ready for the green transition?* European Investment Bank, Economics Department. https://www.eib.org/files/publications/20230142_climate_risks_for_latin_america_and_the_caribbean_en.pdf

505 Cavazos, T., Bettolli, M. L., Campbell, D., Sánchez Rodríguez, R. A., Mycoo, M., Arias, P. A., Rivera, J., Reboita, M. S., Gulizia, C., Hidalgo, H. G., Alfaro, E. J., Stephenson, T. S., Sörensson, A. A., Cerezo-Mota, R., Castellanos, E., Ley, D., & Mahon, R. (2024). Challenges for climate change adaptation in Latin America and the Caribbean region. *Frontiers in Climate*, *Volume 6-2024*. https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2024.1392033

506 Cavazos, T., Bettolli, M. L., Campbell, D., Sánchez Rodríguez, R. A., Mycoo, M., Arias, P. A., Rivera, J., Reboita, M. S., Gulizia, C., Hidalgo, H. G., Alfaro, E. J., Stephenson, T. S., Sörensson, A. A., Cerezo-Mota, R., Castellanos, E., Ley, D., & Mahon, R. (2024). Challenges for climate change adaptation in Latin America and the Caribbean region. *Frontiers in Climate*, *Volume 6-2024*. https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2024.1392033

507 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

508 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

509 United Nations Office for Disaster Risk Reduction (2024). *Regional Assessment Report on Disaster Risk in Latin America and the Caribbean (RAR24)*. https://www.undrr.org/RAR24LAC

510 World Meteorological Organization. (2025). *State of the climate in Latin America and the Caribbean 2024*. https://library.wmo.int/records/item/69456-state-of-the-climate-in-latin-america-and-the-caribbean-2024 ; Centro Nacional de Monitoramento e Alertas de Desastres Naturais. (n.d.). *Missão do Cemaden*. http://www2.cemaden.gov.br/missao-do-cemaden/

At the same time, countries in Latin America and the Caribbean have made notable progress in climate mitigation, particularly through the expansion of renewable energy. Of the 33 countries from the region, 22 have renewable energy targets, 20 have long-term net-zero commitments, 24 have renewable energy policies in place, and more than 320 cities have adopted net-zero emission targets.[511] Between 2015 and 2020, renewable energy capacity in the region increased by 33%, with countries such as Argentina, Brazil, Chile, Colombia, Mexico, and Peru deploying renewable energy auctions that have positioned LAC as one of the world's most dynamic renewable energy markets. Achieving the scale of investment required for climate mitigation continues to demand more coordinated and comprehensive economic strategies.[512]

5.3 Smart city development

In Latin America and the Caribbean, smart city development is framed around the internationally agreed definition of smart sustainable cities adopted by the International Telecommunication Union (ITU) and the United Nations Economic Commission for Europe (UNECE). Under this approach, smart cities are understood as innovative urban systems that leverage information and communication technologies (ICT) and other digital tools to improve quality of life, enhance the efficiency of urban services and operations, and strengthen competitiveness, while balancing economic, social, environmental, and cultural sustainability for present and future generations.[513] The regional interpretation places strong emphasis on digital transformation as an enabler rather than an end in itself, recognising that technology must be embedded within participatory governance, informed citizenship, and empowered local governments.[514] Core tools include digital platforms, sensors, data analytics, cloud computing, and open data systems, with practical applications concentrated in urban mobility, public security, environmental management, energy efficiency, disaster risk management, and digital government.

Smart city development in the region is driven by a combination of city-level initiatives, multilateral support, and emerging regional strategies rather than large, unified national programmes. Eight cities—Santiago, Mexico City, Bogotá, Buenos Aires, Rio de Janeiro, Curitiba, Medellín, and Montevideo—are widely recognised as regional leaders, each pursuing sector-focused strategies tailored to local priorities.[515] Initiatives have been most prominent in smart mobility (e.g. Bogotá's TransMilenio and Medellín's Intelligent Mobility System), citizen security (e.g. Buenos Aires' CUCC, Medellín's SIES-M, Niterói's CISP), disaster risk management (e.g. Rio de Janeiro's COR-Rio), and digital government and inclusion (e.g. Rio's Data Rio and Carioca Digital platforms).[516] Multilateral institutions, particularly the Inter-American Development Bank, have played a central role in financing pilots, technical assistance, and sectoral innovations, while ECLAC's Inclusive, Sustainable, and Smart Cities (CISI) initiative provides a broader strategic framework aligned with the 2030 Agenda and the "Great Push for Sustainability", coordinating public and private investment and strengthening policy and institutional capacities.[517] Through partnerships with organisations such as IDOS and GIZ/BMZ, CISI supports pilot cities in countries including Brazil, Argentina, Mexico, and Colombia, aiming to scale integrated, low carbon, and inclusive solutions.[518]

Smart city development in the region is a governance-driven and institutionally anchored process, where technology is positioned as a public good rather than a purely technical solution. This is evident in Bogotá, where smart city policy emphasises collective intelligence and strong public leadership through the District High Council for ICT, framing connectivity as an essential public service and advancing public–private collaboration, infrastructure sharing, and open data to reduce digital divides and support inclusive, resilient, and sustainable urban development (Box 5.1).[519] A complementary model is seen in Mexico City, where smart city development is rooted in technological sovereignty through the Digital Agency for Public Innovation (ADIP), including the creation of an in-house software factory, large-scale free public Wi-Fi recognising internet access as a right, and the Llave CDMX digital identity platform

511 IRENA. (2022). *Renewables 2022 Global Status Report: Latin America Factsheet*. Abu Dhabi: International Renewable Energy Agency. https://www.ren21.net/wp-content/uploads/2019/05/GSR2022_Fact_Sheet_Latin_America-.pdf

512 Cárdenas, M., & Peña, C. (2024, July 16). *Climate action in Latin America and the Caribbean: Fiscal policies and the indispensable role of finance ministries* (IDB Technical Note No. IDB-TN-2963). Inter-American Development Bank. https://doi.org/10.18235/001306

513 United Nations. (2016). *Smart Sustainable Cities: where we are at and where we could be* [conference]. https://habitat3.org/wp-content/uploads/ITU-UNECE-ECLAC-Smart-City-flyerBios.pdf

514 United Nations. (2016). *Habitat III regional report for Latin America and the Caribbean: Sustainable cities with equality*. https://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-LAC.pdf

515 Cohen, B. (2013, December 3). *The 8 smartest cities in Latin America*. Fast Company. http://www.fastcoexist.com/3022533/the-8-smartest-cities-in-latin-america

516 Bouskela, M., Casseb, M., Bassi, S., De Luca, C., & Facchina, M. (2016). *The road toward smart cities: Migrating from traditional city management to the smart city*. Inter-American Development Bank. https://doi.org/10.18235/0012831

517 Agenda 2030 in Latin America and the Caribbean. (n.d.). *11. Sustainable cities and communities*. Retrieved from https://agenda2030lac.org/en/sdg/11-sustainable-cities-and-communities ; Economic Commission for Latin America and the Caribbean. (2020, January 1). *Ciudades inteligentes, inclusivas y sostenibles en el marco de la Agenda 2030 para el desarrollo sostenible en América Latina y el Caribe*. CISI. https://www.cepal.org/en/eclac-germany-cooperation/projects/cisi

518 Economic Commission for Latin America and the Caribbean. (n.d.). *Sustainable Mobility, The Big Pus for Sustainability.* https://plataformaurbana.cepal.org/en/sustainable-mobility ; Economic Commission for Latin America and the Caribbean. (2022). *Progress on the 2030 Agenda will be decided in cities.* https://www.cepal.org/en/notes/progress-2030-agenda-will-be-decided-cities

519 Economic Commission for Latin America and the Caribbean. (2022). *El camino de desarrollo de las ciudades inteligentes: Bogotá*. Plataforma Urbana de América Latina y el Caribe. https://plataformaurbana.cepal.org/es/buenas-practicas/el-camino-de-desarrollo-de-las-ciudades-inteligentes-bogota ; Cabello, S. (2022). *El camino de desarrollo de las ciudades inteligentes: Una evaluación de Bogotá, Buenos Aires, Ciudad de México y São Paulo* (Documentos de Proyectos, LC/TS.2022/86). Comisión Económica para América Latina y el Caribe (CEPAL). https://www.cepal.org/es/publicaciones/48000-camino-desarrollo-ciudades-inteligentes-evaluacion-bogota-buenos-aires-ciudad ; United Nations Human Settlements Programme [UN-HABITAT]. (2025). *Bogotá to host Global World Cities Day 2025 celebration.* https://unhabitat.org/news/22-jul-2025/bogota-to-host-global-world-cities-day-2025-celebration

to reduce inequality, improve services, and combat corruption (Box 5.2).[520] Further institutional maturity is demonstrated by Buenos Aires, which leads regional digital transformation through a strategy centred on data interoperability, integrated physical–digital infrastructure, and decentralised digital identity; by embedding innovation in its Future Plan and using open-source tools and predictive analytics, the city has institutionalised collective intelligence and transparency while returning greater control of data to citizens (Box 5.3).[521]

Despite high levels of urbanisation and increasing connectivity—urban internet access rising from 31% to 70% over the past decade—smart city uptake remains limited, accounting for 1% of smart cities globally.[522] Development is highly uneven: large metropolitan areas benefit from scale, stronger institutions, and higher digital capacities, while smaller cities and towns lag behind.[523] Beyond each smart city, numerous interconnected challenges remain, including education, healthcare, mobility, environmental degradation, violence, insecurity, and institutional capacity gaps. The region has 42 of the world's 50 most violent cities, making public safety a critical concern in urban liveability.[524]

520 Economic Commission for Latin America and the Caribbean. (2022). *El camino de desarrollo de las ciudades inteligentes: Ciudad de México.* Plataforma Urbana de América Latina y el Caribe. https://plataformaurbana.cepal.org/es/buenas-practicas/el-camino-de-desarrollo-de-las-ciudades-inteligentes-ciudad-de-mexico ; Cabello, S. (2022). *El camino de desarrollo de las ciudades inteligentes: Una evaluación de Bogotá, Buenos Aires, Ciudad de México y São Paulo* (Documentos de Proyectos, LC/TS.2022/86). Comisión Económica para América Latina y el Caribe (CEPAL). https://www.cepal.org/es/publicaciones/48000-camino-desarrollo-ciudades-inteligentes-evaluacion-bogota-buenos-aires-ciudad; Lee Kuan Yew World City Prize. (2024). *Mexico City – Free Wi-Fi, Llave CDMX & Procedures Digitiser*. https://www.leekuanyewworldcityprize.gov.sg/case-studies/mexico-city-digital

521 Economic Commission for Latin America and the Caribbean. (2022). *El camino de desarrollo de las ciudades inteligentes: Buenos Aires.* Plataforma Urbana de América Latina y el Caribe. https://plataformaurbana.cepal.org/es/buenas-practicas/el-camino-de-desarrollo-de-las-ciudades-inteligentes-buenos-aires ; Cabello, S. (2022). *El camino de desarrollo de las ciudades inteligentes: Una evaluación de Bogotá, Buenos Aires, Ciudad de México y São Paulo* (Documentos de Proyectos, LC/TS.2022/86). Comisión Económica para América Latina y el Caribe (CEPAL). https://www.cepal.org/es/publicaciones/48000-camino-desarrollo-ciudades-inteligentes-evaluacion-bogota-buenos-aires-ciudad

522 Calderón, M., López, G., & Marín, G. (2017). Smart cities in Latin America. In S. Ochoa, P. Singh, & J. Bravo (Eds.), *Ubiquitous computing and ambient intelligence. UCAmI 2017* (Lecture Notes in Computer Science, Vol. 10586). Springer, Cham. https://doi.org/10.1007/978-3-319-67585-5_2

523 Calderón, M., López, G., & Marín, G. (2017). Smart cities in Latin America. In S. Ochoa, P. Singh, & J. Bravo (Eds.), *Ubiquitous computing and ambient intelligence. UCAmI 2017* (Lecture Notes in Computer Science, Vol. 10586). Springer, Cham. https://doi.org/10.1007/978-3-319-67585-5_2 ; Cabello, S. (2022). *El camino de desarrollo de las ciudades inteligentes: Una evaluación de Bogotá, Buenos Aires, Ciudad de México y São Paulo* (Documentos de Proyectos, LC/TS.2022/86). Comisión Económica para América Latina y el Caribe (CEPAL). https://www.cepal.org/es/publicaciones/48000-camino-desarrollo-ciudades-inteligentes-evaluacion-bogota-buenos-aires-ciudad

524 Bouskela, M., Casseb, M., Bassi, S., De Luca, C., & Facchina, M. (2016). *The Road toward Smart Cities: Migrating from Traditional City Management to the Smart City*. https://doi.org/10.18235/0012831

Box 5.1. Bogota, Colombia: "Chatico", Bogota's Open Government (GAB)

Bogotá's Open Government (GAB) is a public management model that leverages ICT to shift from representative to collaborative democracy, grounded in transparency, participation, and collaboration. Within the smart city framework, it prioritises digital governance over physical infrastructure, using tools such as open data platforms and the "Chatico" AI agent to expand access to public services, strengthen citizen oversight, and improve administrative efficiency. Available via web and WhatsApp, Chatico simplifies procedures, supports participatory budgeting, and facilitates citizen engagement through an accessible, low-data interface, helping bridge the digital divide and fostering a more responsive, inclusive relationship between the city administration and residents.

Image source: OPSI

Source: Government of Bogotá. (n.d.). *Gobierno Abierto Bogotá*. https://gobiernoabiertobogota.gov.co/gab ; Organisation for Economic Co-operation and Development [OPSI]. (2022). *Chatico: Virtual agent*. OECD Observatory of Public Sector Innovation. https://oecd-opsi.org/innovations/chatico-virtual-agent/

Box 5.2. Mexico City, Mexico: App CDMX

The CDMX App is a unified digital platform created by the Mexico City Government's Digital Agency for Public Innovation (ADIP) to streamline access to procedures, services, and security tools. It serves as a citizen "master key", enabling users to manage their digital identity, mobility, and security from one location, with the aim of enhancing technology access and reducing bureaucracy. Key features include:

- Integrated Mobility**:** A virtual card for topping up and accessing Metro, Metrobús, and Cablebús via NFC, along with maps and route planning.
- Digital Wallet: Securely stores official documents like the Digital Driver's License and Vehicle Registration Card.
- 360 Security**:** Verifies taxi drivers' identities, allows real-time trip sharing, and has a panic button for emergency connection to the C5 monitoring center.
- Urban Services: Facilitates immediate reporting of issues like potholes, broken streetlights, or water leaks through the Unified Citizen Service System (SUAC).

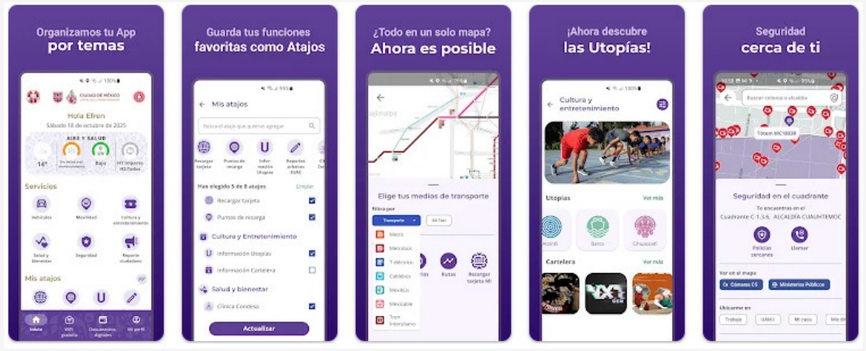


Image source: Google Play

Source: Secretaría de Innovación y Transformación Digital de la Ciudad de México. (n.d.). *App CDMX*. Google Play. https://play.google.com/store/apps/details?id=mx.gob.cdmx.adip.apps&hl=es ; Agencia Digital de Innovación Pública. (2025). *Lanzan actualización de App CDMX y estrenan tarjeta virtual de movilidad integrada. Gobierno de la Ciudad de México.* https://adip.cdmx.gob.mx/comunicacion/nota/lanzan-actualizacion-de-app-cdmx-y-estrenan-tarjeta-virtual-de-movilidad-integrada

Box 5.3. Buenos Aires, Argentina: Ciudad3D (3D City)

Ciudad 3D is an open-source digital platform created by the Government of Buenos Aires that simplifies the Urban Planning Code through an interactive 3D map. It acts as a "digital twin," enabling residents, architects, and developers to visualize the building capacity, maximum heights, and authorized land uses for each plot. This tool revolutionises urban planning by replacing manual processes with a transparent, automated system, making information accessible and streamlining construction procedures. Users can instantly obtain the Urban Planning Certificate online, providing legal clarity to property owners and reducing processing times. Key features include:

- Regulatory Visualization**:** Illustrates permitted building volumes for each lot.
- Streamlined Procedures: Enables online access to basic data and Urban Planning Certificates for permit applications.

Image source: gtbi.net

Source: Organisation for Economic Co-operation and Development. (2021). *Buenos Aires 3D city. OECD Observatory of Public Sector Innovation*. https://oecd-opsi.org/innovations/buenos-aires-3d-city/ ; Global Tech Based Initiative. (n.d.). *Ciudad 3D Buenos Aires*. https://gtbi.net/ciudad-3d-buenos-aires/

To help address these challenges, the IDB has developed action plans for municipalities in the region to support their transition to smart cities through the Emerging and Sustainable Cities Initiative (ESCI). This initiative, first launched in 2010, focuses on environmental/climate, urban and fiscal/governance sustainability in cities with 100,000 to 2 million people. The IDB provides technical assistance to help cities prepare and implement rapid action plans. The approach is multidisciplinary and collaborative, involving 2 stages: first to identify and diagnose urban issues using over 120 indicators and a public opinion survey to reflect citizens' perceptions, and then prioritise these

action areas, engaging public authorities, civil society, and the private sector.[525] The ESCI also assesses the needs of municipalities, viable broadband technologies, and urban management challenges, while identifying ICT opportunities. These assessments often involve collaboration with member governments and key stakeholders. Smart city projects include integrated solutions for security, traffic, emergency response, and governance in cities across Brazil, Colombia, Uruguay, Jamaica, Chile, the Bahamas, and Mexico.[526]

5.4 Low carbon development

Low carbon city development in Latin America and the Caribbean is present but remains emergent and uneven, evolving primarily through national climate commitments rather than as a clearly articulated urban policy framework. The regional approach is anchored in the definition of net-zero emissions established by the 2015 Paris Climate Agreement, which calls for balancing greenhouse gas emissions to limit global warming to 1.5°C, requiring a 45% reduction in emissions by 2030 and net-zero by mid-century.[527] Since 2015, most countries in the region have integrated mitigation and climate-neutrality objectives into their Nationally Determined Contributions, reinforced at COP26 in Glasgow.[528] Although Latin America and the Caribbean contribute less than 10% of global greenhouse gas emissions, emissions have increased significantly over the past two decades, with urban areas emerging as the main sources due to fossil fuel–based energy use, transport systems, and inefficient waste management.[529] Low carbon urban interventions are most visible in large metropolitan areas in countries such as Brazil, Mexico, Chile, Argentina, and Colombia, where emissions are concentrated and institutional capacity is stronger, while smaller cities and many Caribbean countries face greater structural and financial constraints.[530]

In the region, low carbon cities are not defined through a unified urban concept but are instead understood as cities that contribute to national climate-neutrality goals by reducing emissions in key urban sectors, particularly transport, energy, waste, and land use. Transport represents the most critical challenge, accounting for 35% of fuel-related emissions—the highest share globally—driven by rapid motorisation, ageing vehicle fleets, and the dominance of road transport, which represents 92% of total transport activity.[531] Urban energy consumption further contributes to emissions and air pollution through reliance on low quality fuels and pressure on local natural resources, while the water and waste sector has become a growing source of methane emissions due to weak regulatory frameworks and rising waste generation linked to income growth.[532] Within this context, low carbon city development prioritises decarbonising energy supply, improving fuel efficiency, promoting renewable electricity, shifting to cleaner transport systems, and integrating nature-based solutions, particularly forestry, where mitigation aligns closely with development objectives.[533]

National strategies strongly shape urban low carbon pathways. Chile illustrates a renewable energy-driven approach, with cities benefiting from large-scale solar deployment and emerging geothermal, wave, and tidal energy potential, supported by international cooperation and European investment (Box 5.4).[534] Costa Rica represents a systemic low carbon model in which cities operate within a national framework that generates nearly 100% of electricity from renewable sources and prioritises electric mobility to decarbonise transport, while also leveraging forest-based carbon sequestration and results-based climate finance from the Green Climate Fund and the World Bank (Box 5.5). [535]

Brazil demonstrates a biofuel-centred transition that directly influences urban transport, supported by policies such as RenovaBio, which established a decarbonisation credit market, and the Mover initiative, which aims to reduce transport emissions by 50% by 2030, reinforced by the "Fuels of the Future" legislation mandating higher biofuel blending and sustainable aviation fuels (Box 5.6).[536] Across the region, institutional frameworks for low carbon cities are primarily national, with cities acting as implementation arenas

525 Bouskela, M., Casseb, M., Bassi, S., De Luca, C., & Facchina, M. (2016). *The Road toward Smart Cities: Migrating from Traditional City Management to the Smart City*. https://doi.org/10.18235/0012831

526 Bouskela, M., Casseb, M., Bassi, S., De Luca, C., & Facchina, M. (2016). *The Road toward Smart Cities: Migrating from Traditional City Management to the Smart City*. https://doi.org/10.18235/0012831

527 Parra, C., Mejia, A. (2022). *La oportunidad de las emisiones cero en América Latina y el Caribe*. Inter-American Development Bank Invest. https://idbinvest.org/es/blog/cambio-climatico/la-oportunidad-de-las-emisiones-cero-en-america-latina-y-el-caribe

528 OECD (2023), *Hacia la Resiliencia y Neutralidad Climática en América Latina y el Caribe: Prioridades políticas clave*. OECD Publishing, Paris, https://doi.org/10.1787/a73c1364-es

529 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

530 United Nations Human Settlements Programme. (2012). *State of Latin American and Caribbean cities 2012: Towards a new urban transition*. https://unhabitat.org/sites/default/files/download-manager-files/State%20of%20Latin%20American%20and%20Caribbean%20cities.pdf

531 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

532 Bonet, J. A., Acevedo-Daunas, R. M., Alvarado, N., Barco, C., Brakarz, J., Contreras, F., Cuenin, F., Doyle, M., Doherty-Bigara, J., Fretes Cibils, V., Hori, T., Lacambra Ayuso, S., Ludeña, C. E., Méndez, P., Miralles-Wilhelm, F., Mojica, C., Rueda, F., Sabo, R., Stevenson, C., ... Wilk, D. (2012). *Sostenibilidad Urbana en América Latina y el Caribe*. https://doi.org/10.18235/0012772

533 Acero, N. (2013). *What does low-carbon resilience look like in Latin America?* International Institute for Environment and Development. https://www.iied.org/what-does-low-carbon-resilience-look-latin-america

534 European Union Institute for Security Studies. (2017). *Low carbon development in Latin America*. European Union Institute for Security Studies. https://data.europa.eu/doi/10.2815/05137.

535 Arora, R. (2024). *Latin America's road to net zero*. S&P Global. https://www.spglobal.com/energy/en/news-research/blog/energy-transition/120524-latin-americas-road-to-net-zero; Jover, N. (2020). *Costa Rica receives USD 54 million from the Green Climate Fund for its leadership in conservation*. UN-REDD Programme. https://www.un-redd.org/news/costa-rica-receives-54-million-green-climate-fund-its-leadership-conservation

536 Arora, R. (2024). *Latin America's road to net zero*. S&P Global. https://www.spglobal.com/energy/en/news-research/blog/energy-transition/120524-latin-americas-road-to-net-zero

rather than autonomous climate governance actors. International collaboration plays a decisive role, particularly with the EU, which supports renewable energy deployment, technology transfer, and investment, while multilateral institutions provide climate finance and technical assistance.[537]

Box 5.4. Chile: Clean Technology Fund plan

The Clean Technology Fund (CTF) operates within the Climate Investment Funds (CIF) framework, providing concessional financing to middle-income developing countries to promote low carbon technologies. By taking on risks that deter private investors, the CTF focuses on renewable energy, energy efficiency, and clean transport to reduce greenhouse gas emissions. In Chile, the CTF has helped overcome barriers to clean energy through a pioneering financial model in collaboration with IDB Invest and Engie. This model links loan interest rates to CO^2 emission reductions, reducing financing costs as fossil fuel generation is replaced with clean energy, thus encouraging the early closure of coal-fired power plants. Overall, the CTF's financing has transformed the market in Chile by lowering technology costs and boosting investor confidence. It has catalysed significant private investment, positioning Chile as a leader in clean energy and supporting its goal of carbon neutrality.

Image source: SolarPACES.

Source: BloombergNEF. (2019). *The Clean Technology Fund and concessional finance*. United Nations Climate Change Learning Partnership. https://www.uncclearn.org/wp-content/uploads/library/bnef_the-clean-technology-fund-and-concessional-finance-2019-report.pdf; SolarPACES. (2022). *CSP potential — solar thermal energy by country: Chile*. https://www.solarpaces.org/worldwide-csp/csp-potential-solar-thermal-energy-by-country/chile/

537 European Union Institute for Security Studies. (2017). *Low carbon development in Latin America*. European Union Institute for Security Studies. https://data.europa.eu/doi/10.2815/05137.; Alfonso, M., Bagolle, A., Baptista, D., Bos, M. S., Fazekas, A., Schwartz, L., Vogt-Schilb, A., & Urquidi, M. (2023). *Advancing a Just Transition in Latin America and the Caribbean*. https://doi.org/10.18235/0005216 ; EY. (2024, June). *Renewable energy country attractiveness index 63: Normalized index ranking*. https://www.ey.com/content/dam/ey-unified-site/ey-com/en-gl/insights/energy-resources/documents/ey-gl-recai-63-normalized-index-ranking-06-2024.pdf

Box 5.5. Costa Rica: REDD+ national *strategy*

The Forest Carbon Partnership Facility (FCPF) is a global alliance involving governments, civil society, and private sector, aimed at operationalising REDD+ (Reducing Emissions from Deforestation and Forest Degradation). Managed by the World Bank and collaborating with 47 developing countries, it focuses on reducing emissions, conserving forest carbon stocks, sustainably managing forests, and enhancing carbon reserves. Since its 2008 launch, Costa Rica has become the first country in Latin America to receive performance-based payments from the FCPF, obtaining US$16.4 million in 2022 for reducing 3.28 million tons of carbon emissions from 2018 to 2019. This is part of a larger agreement to unlock up to US$60 million for sequestering 12 million tons of CO^2 by 2025, showcasing its successful conservation monetization. This progress stems from decades of policy efforts, including the Payment for Environmental Services (PES) programme and laws against forest conversion, which has helped reverse deforestation trends and achieve a net gain in forest cover from 1986 to 2013. Costa Rica invested nearly US$200 million from 1998 to 2011 in these initiatives, effectively linking rural development with biodiversity protection and setting an example for low carbon development globally.

Image Source: Green Climate Fund

Source: Bank. (2022). *Costa Rica receives first emission reductions payment from Forest Carbon Partnership Facility*. https://www.worldbank.org/en/news/press-release/2022/08/16/-costa-rica-receives-first-emission-reductions-payment-from-forest-carbon-partnership-facility; Green Climate Fund. (n.d.). *FP144: Costa Rica REDD-plus Results-Based Payments for 2014 and 2015*. https://www.greenclimate.fund/project/fp144

Box 5.6. Brazil: RenovaBio

RenovaBio (National Biofuels Policy) is Brazil's primary legal framework for decarbonising its transport sector. Established by Law 13.576/2017, the policy aims to fulfil the country's commitments under the Paris Agreement and is recognized by some experts as the largest decarbonisation programme in the world. The policy operates through a market-based mechanism centred on Decarbonisation Credits (CBIOs), where each credit represents one ton of avoided CO^2—certified based on a rigorous "well-to-wheel" life-cycle analysis and accompanied by enforcing aggressive targets—aiming for a cumulative reduction of 620 million tons of CO^2 equivalent by 2030; those with more efficient, low carbon production processes are awarded more credits. To drive demand, the government sets mandatory annual decarbonization targets that fossil fuel distributors must meet by purchasing these CBIOs on the open market. The programme has established a long-term trajectory to reduce the carbon intensity of national fuel mix by 11.8% by 2035 (relative to 2018 levels). In its first five years alone, RenovaBio has prevented the release of over 147 million tons of CO^2.

Source image: Agência Brasil

Source: União da Indústria de Cana-de-Açúcar. (n.d.). ***RenovaBio***. https://unica.com.br/en/initiatives/renovabio/; Agência Brasil. (2019). ***Brasil estima producir 31,6 mil millones de litros de etanol este año***. https://agenciabrasil.ebc.com.br/es/economia/noticia/2019-08/brasil-estima-producir-316-mil-millones-de-litros-de-etanol-este-ano

Overall, low carbon city development has been strongest where national energy transitions directly benefit urban systems, while city-led low carbon strategies remain fragmented and sector-specific. Even as the low carbon transition seeks to address the many urban challenges, including rising urban emissions, air pollution, energy insecurity, and climate vulnerability, it also exposes deep structural constraints linked to dependence on carbon-intensive sectors, regulatory uncertainty, limited technological capacity, and persistent social and territorial inequalities.[538] Achieving Paris Agreement goals is estimated to require investments equivalent to 2–8% of GDP, with uneven impacts projected across labour markets, households, and regions, underscoring the need for just-transition policies.[539] At present, there is no unified regional framework of low carbon city benchmarks or indicators. Instead, targets are embedded within national (nationally determined contributions) and sectoral metrics related to transport emissions, renewable energy shares, fuel standards, methane reduction, and land-use change, which cities indirectly contribute to rather than formally manage.[540]

538 European Union Institute for Security Studies. (2017). ***Low carbon development in Latin America***. European Union Institute for Security Studies. https://data.europa.eu/doi/10.2815/05137.; Alfonso, M., Bagolle, A., Baptista, D., Bos, M. S., Fazekas, A., Schwartz, L., Vogt-Schilb, A., & Urquidi, M. (2023). ***Advancing a Just Transition in Latin America and the Caribbean***. https://doi.org/10.18235/0005216

539 Alfonso, M., Bagolle, A., Baptista, D., Bos, M. S., Fazekas, A., Schwartz, L., Vogt-Schilb, A., & Urquidi, M. (2023). ***Advancing a Just Transition in Latin America and the Caribbean***. https://doi.org/10.18235/0005216

540 Parra, C., Mejia, A. (2022). ***La oportunidad de las emisiones cero en América Latina y el Caribe***. Inter-American Development Bank Invest. https://idbinvest.org/es/blog/cambio-climatico/la-oportunidad-de-las-emisiones-cero-en-america-latina-y-el-caribe; OECD (2023), ***Hacia la Resiliencia y Neutralidad Climática en América Latina y el Caribe: Prioridades políticas clave***, OECD Publishing, Paris, https://doi.org/10.1787/a73c1364-es

Chapter 6

North America

Chapter 6: North America

6.1 Region context

Location	North America, excluding Mexico
Countries	2 countries: United States of America and Canada
Land Size	~19,400,000 square kilometres
Population	~383 million (2025)
Population Ageing Trend	People over age 65: 18.6% in 2025, 23.4% by 2050
Urbanisation Level	80.5% of population live in urban areas (2025) Canada: 82.9% United States: 80.2%
Geographic Overview	North America spans a diverse geography including Arctic tundra, temperate forests, Great Plains, major mountain ranges (e.g., Rockies, Appalachians), and extensive coastlines. Climates range from polar to subtropical.
Climate Risks	Frequent wildfires, hurricanes, flooding, and heatwaves; heightened vulnerability in coastal and western regions.
Key Urban Networks	C40 Cities Climate Leadership Group, Resilient Cities Network, Local Governments for Sustainability (ICLEI) North America, Global Covenant of Mayors for Climate & Energy, US Conference of Mayors, National League of Cities, Federation of Canadian Municipalities

Source: Various Sources.[541]

North America in this report comprises Canada and the United States of America (or simply United States). The two countries cover roughly 19.4 million square kilometres and form one of the most economically integrated regions in the world, linked through trade, investment, and labour market connections.[542] Their territories span Arctic and sub-Arctic environments in northern Canada, extensive plains and prairies, temperate forests, large inland water systems such as the Great Lakes, and densely settled coastal corridors on the Atlantic and Pacific coasts.[543] The region's combined population is around 383 million people as of 2025 (Table 6.1), with the United States accounting for the large majority.[544] Both countries are undergoing significant demographic ageing, with the share of people aged 65 and over growing as longevity increases and fertility remains relatively low, reshaping population age structures and the demand for health and social services.[545] While population ageing in Canada and the United States is less advanced than in many European countries, both countries are projected to experience a sustained increase in old-age dependency ratios over the coming decades, reflecting similar long-term demographic dynamics observed across high-income region.[546]

Table 6.1. Population, North America (2000, 2025 and 2050)

Country	Population Estimates and Projections (Millions of People)		
	2000	2025	2050
North America (Region)	**312.8**	**383.4**	**419.9**
Canada	30.7	41.6	46.6
United States	282.2	341.8	373.3

Source: World Bank [547]

Climatically, the region spans polar and tundra climates in the far north, continental conditions across much of the interior, and temperate to subtropical climates in southern and coastal zones, supporting a wide range of ecosystems and agricultural systems.[548] This diversity exposes cities and settlements to multiple climate-related risks, including more frequent and intense heatwaves, wildfires in western and northern regions, strong hurricanes and storm surges along the Atlantic and Gulf coasts, and riverine and pluvial

541 World Bank. (2024). *Land area (sq. km) – North America.* https://data.worldbank.org/indicator/AG.LND.TOTL.K2; World Bank. (n.d.). *Population estimates and projections.* https://databank.worldbank.org/source/population-estimates-and-projections#; World Bank. (n.d.). *Population estimates and projections.* https://databank.worldbank.org/source/population-estimates-and-projections#; Britannica. (2024). *North America | Description, Geography, & Facts.* https://www.britannica.com/place/North-America; Intergovernmental Panel on Climate Change. (2023). *AR6 synthesis report: Climate change 2023.* https://www.ipcc.ch/report/ar6/syr/; U.S. Global Change Research Program. (2023). *Fifth National Climate Assessment (NCA5).* https://www.ipcc.ch/report/ar6/wg2/chapter/chapter-14/; C40 Cities. (2024). *Member cities.* https://www.c40.org/cities/; Resilient Cities Network. (2024). *Our network.* https://resilientcitiesnetwork.org/; ICLEI – Local Governments for Sustainability. (2024). *ICLEI North America.* https://iclei.org/regions/north-america/; Global Covenant of Mayors for Climate & Energy. (2024). *Who we are.* https://www.globalcovenantofmayors.org/who-we-are/; The United States Conference of Mayors. (2023). *About the Conference.* https://www.usmayors.org/the-conference/about/; National League of Cities. (2023). *About NLC.* https://www.nlc.org/about-nlc/; Federation of Canadian Municipalities. (2023). *About FCM.* https://fcm.ca/en/about-fcm

542 World Bank. (2024). *Land area (sq. km) – North America.* https://data.worldbank.org/indicator/AG.LND.TOTL.K2

543 Britannica. (2024). *North America | Description, Geography, & Facts.* https://www.britannica.com/place/North-America

544 World Bank. (n.d.). *Population estimates and projections.* https://databank.worldbank.org/source/population-estimates-and-projections#

545 Crimmins, E. M., Beltrán-Sánchez, H., Brown, L., & Yon, Y. (n.d.). *Ageing in North America: Canada and the United States.* In J.-P. Michel, B. L. Beattie, & F. Martin (Eds.), *Oxford textbook of geriatric medicine* (Chap. 3). Oxford University Press.

546 OECD. (2023). *Pensions at a Glance 2023.* https://www.oecd.org/pensions/pensions-at-a-glance/

547 World Bank. (n.d.). *Population estimates and projections.* https://databank.worldbank.org/source/population-estimates-and-projections#

548 Encyclopaedia Britannica. (2024). *North America.* https://www.britannica.com/place/North-America

flooding affecting inland and coastal communities.[549] These hazards are magnified where ageing infrastructure, legacy land uses, and socio-spatial inequalities intersect, leaving low-income, Indigenous, and racialised communities disproportionately exposed and with fewer resources to adapt.[550]

The region's economic structure is characterised by high-income, diversified economies with strong service sectors, advanced manufacturing, and significant technology- and knowledge-intensive industries.[551] Canada and the United States together constitute one of the largest economic blocs globally, underpinned by deep integration through trade agreements, cross-border supply chains, and shared infrastructure.[552] At the same time, there are marked disparities in income, productivity, and labour market performance, with prosperous metropolitan regions and innovation hubs co-existing alongside deindustrialised areas, resource-dependent communities, and rural regions facing demographic stagnation or decline.[553] These inequalities echo broader patterns observed across high-income regions, where gaps between dynamic urban centres and lagging areas pose ongoing challenges for social inclusion and sustainable development.[554]

North America is highly urbanised; more than four-fifths of residents in Canada and the United States live in urban areas, with much of urban growth concentrated in large metropolitan regions and suburban sprawl.[555] From a global perspective, North America stands alongside Latin America and the Caribbean as one of the world's most urbanised regions, with urbanisation levels at 80% or higher.[556] Major urban corridors such as the Northeast megalopolis, from Boston to Washington DC, in the United States and the Montréal–Toronto–Vancouver axis in Canada anchor national economies, while medium-sized cities and smaller regional centres play critical roles in service provision, logistics, and resource-based activities.[557] Despite the high level of urbanisation, there is considerable variation in settlement forms, from dense urban cores with growing multifamily housing to low-density suburbs and exurbs shaped by post-war car-oriented development.[558]

549 Intergovernmental Panel on Climate Change. (2023). *AR6 synthesis report: Climate change 2023*. https://www.ipcc.ch/report/ar6-synthesis-report/

550 U.S. Global Change Research Program. (2023). *Fifth National Climate Assessment (NCA5)*. https://toolkit.climate.gov/NCA5

551 World Bank. (2024). *World development indicators* (GDP, total and per capita). https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

552 International Monetary Fund. (2024). *IMF data – World economic outlook database*. https://www.imf.org/en/Data

553 OECD. (2024). *OECD regions and cities at a glance 2024*. https://doi.org/10.1787/f42db3bf-en

554 United Nations. (2025). *The Sustainable Development Goals report 2025*. https://unstats.un.org/sdgs/report/2025

555 United Nations, Department of Economic and Social Affairs. (2025). *World Urbanization Prospects 2025*. https://population.un.org/wup

556 World Bank. (2021). *Demographic trends and urbanization*. https://doi.org/10.1596/978-1-4648-1112-9

557 OECD. (2024). *OECD regions and cities at a glance 2024*. https://doi.org/10.1787/f42db3bf-en

558 World Bank. (2019). *Demographic trends and urbanization*. https://doi.org/10.1596/978-1-4648-1112-9

While overall population growth in the United States and Canada has transitioned to slower growth, even declining growth, global cities such as New York City, Seattle, Toronto, Vancouver, and San Francisco continue to attract people, capital, and high-value, tech-driven economic activities, exacerbating issues of housing affordability, infrastructure pressure, and spatial inequality amid exposure to climate risks.[559] Current efforts have shifted towards denser, smart growth development to combat the ecological impact of urban sprawl and rising infrastructure needs.[560] In Canada, this trend is reinforced by federal–municipal coordination and programmatic support that positions cities as delivery agents for national climate and housing objectives, while in the United States, it is shaped by a more decentralised and uneven urban policy landscape, where leading cities advance ambitious regulatory and financing innovations amid political and fiscal uncertainty.[561]

Urban governance and policy in Canada and the United States are shaped by federal systems in which provinces, states, and municipalities exercise significant responsibilities for land use planning, housing, transport, and local infrastructure.[562] There is no explicit, singular national urban policy. Instead, both countries utilise implicit, decentralised approaches towards sustainable, resilient urban development, albeit with differing governance structures.[563] Canada often works through federal infrastructure funding and provincial partnerships, while the United States influences cities through federal grants, housing policy, and highway investments.

City and municipal networks at national (e.g. US Conference of Mayors, National League of Cities, Federation of Canadian Municipalities) and transnational levels (e.g. C40 Cities Climate Leadership Group, Global Covenant of Mayors for Climate & Energy, Resilient Cities Network, ICLEI North America) complement these policy frameworks by promoting collaborative approaches to climate action, transport decarbonisation, housing affordability, and spatial inequality, aligning local initiatives with regional and global urban agendas.

559 Oxford Economics. (n.d.). *Oxford Economics Global Cities Index 2025*. Retrieved January 28, 2026, from https://www.oxfordeconomics.com/global-cities-index/; Government of Canada. (2024, May 8). *New housing supply: Urban sprawl and densification*. https://www150.statcan.gc.ca/n1/pub/46-28-0001/2024001/article/00003-eng.htm

560 OECD. (2019). *Integrated urban policy to achieve the SDGs*. https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/12/integrated-urban-policy-to-achieve-the-sdgs_e1bb165d/ada07311-en.pdf

561 Goverment of Canada. (2024, May 1). *Sustainable Development Goal 11: Sustainable cities and communities*. https://www.canada.ca/en/employment-social-development/programs/agenda-2030/cities-communities.html; UN-Habitat & OECD. (2024). *Global State of National Urban Policy 2024: Building Resilience and Promoting Adequate, Inclusive and Sustainable Housing*. UNON Publishing. https://unhabitat.org/global-state-of-national-urban-policy-2024

562 UN-Habitat & OECD. (2024). *Global state of national urban policy 2024*. https://unhabitat.org/global-state-of-national-urban-policy-2024

563 UN-Habitat. (2024). *World cities report 2024: Cities and Climate Action*. United Nations Human Settlements Programme. https://unhabitat.org/wcr/

6.2 Urban challenges

Urban challenges in the United States and Canada are increasingly shaped by the interaction of housing, infrastructure, and transportation systems with underlying social and spatial inequalities. Rising costs, ageing assets, and climate pressures are intensifying disparities in access to secure housing, safe neighbourhoods, and essential urban services.

6.2.1 Housing affordability and spatial inequality

Housing affordability in North America is at a historic low, with home-price-to-income ratios at their highest levels. In both countries, sustained increases in rents, home prices, interest rates, and non-mortgage housing costs have outpaced income growth, intensifying affordability pressures in large urban centres (e.g., Vancouver, Los Angeles, San Francisco) and contributing to widening spatial and social inequalities.[564] In 2022, half of all renter households (22.4 million) were cost-burdened, spending more than 30% of income on housing and utilities, the highest level on record, while severely cost-burdened renters (spending over 50%) reached an unprecedented high; about 23% of renters aged 35–44 are severely cost-burdened in the United States.[565] These pressures are unevenly distributed within and between cities, reinforcing long-standing racial and socio-economic divides in access to secure, well-located housing (Figure 6.1).

Figure 6.1 Derelict Heritage Housing in Toronto, Canada

There are widening gaps in homeownership rates and cost burdens between White households and Black, Hispanic, and lower-income households, alongside growing homelessness—there were 771,000 homeless people in the United States in 2024, representing the largest single year increase on record.[566] Statistics Canada found that 45% of Canadians reported being very concerned about their ability to afford housing in 2024, driven by rising rents, mortgage payments, and other shelter costs that have outpaced income growth, particularly in large urban centres such as Vancouver, Toronto, and Montréal.[567] These pressures are especially pronounced among renters, younger adults, low-income and vulnerable populations, where rising housing cost burden, limited housing supply, vacancy and suitability combine to contribute to elevated risks of housing instability and homelessness in many cities.[568]

Both countries are taking action to increase housing supply and reduce costs through innovative construction (e.g., modular and prefabricated construction, 3D printed houses), policy reform (e.g., zoning reforms, office to residential conversion) and funding models (e.g., Community Land Trusts, municipal bonds). The United States has worked on a combination of federal, state, and local measures to increase supply, provide rental assistance, and support first-time homebuyers to encourage new construction and develop affordable rental housing.[569] Another key strategy centres on energy-efficient and sustainable design. Major cities such as New York City, San Francisco, and Los Angeles have increasingly integrated housing affordability with climate and liveability agendas through transit-oriented development, adaptive reuse of commercial buildings, and energy-efficient affordable housing retrofits, recognising the co-benefits for household costs, emissions reduction, and access to jobs and services, though outcomes remain uneven.[570]

Canada implements a multi-pronged approach including expanding new housing supply (to build 4 million new homes by 2031) and protecting existing affordable units. Several federal initiatives are designed to accelerate homebuilding, e.g., the Build Canada, where government partners with industry to build at scale, utilising factory-built, modular, and mass timber technologies for faster, more sustainable construction. The C$82 billion National Housing Strategy and the 2024 Housing Plan, among others, support the construction and repair of social, community, and low-income housing for populations at greatest risk, including people experiencing or at risk of homelessness, older adults,

564 Harvard Joint Center for Housing Studies. (2024). *The State of the Nation's Housing 2024*. https://www.jchs.harvard.edu/state-nations-housing-2024; Statistics Canada. (2024). *Housing challenges related to affordability and adequacy*, https://www150.statcan.gc.ca

565 Harvard Joint Center for Housing Studies. (2024). *The State of the Nation's Housing 2024*. https://www.jchs.harvard.edu/state-nations-housing-2024

566 U.S. Department of Housing and Urban Development. (2024). JCHS State of the Nation's Housing Report. https://www.huduser.gov/archives/portal/pdredge/pdr-edge-featd-article-091724.html

567 Statistics Canada. (2024). *Housing challenges related to affordability and adequacy*. https://www150.statcan.gc.ca

568 Abacus Data. (2023). *The Housing Hardship: Low-income renters & Canada's crisis*, https://abacusdata.ca/the-housing-crisis-impact-on-low-income-renters; Statistics Canada. (2024). Op. cit.

569 U. S. Government Accountability Office. (2023, December 14). *Low-Income Housing Tax Credit: Opportunities to Improve Oversight*. https://www.gao.gov/products/gao-24-107064

570 Center for American Progress. (2024, September 19). *Incentivizing Housing That Is Affordable, Sustainable, and Transit-Accessible*. https://www.americanprogress.org/article/incentivizing-housing-that-is-affordable-sustainable-and-transit-accessible/

Indigenous people, and persons with disabilities.[571] Key instruments include the Affordable Housing Fund, Rapid Housing Initiative, and reforms to reduce construction barriers and scale up housing supply across urban, rural, and remote communities, e.g., streamlining zoning, bureaucratic processes, and reducing development charges by up to 50% in some cases.[572]

6.2.2 Climate vulnerability and ageing infrastructure

North America faces significant climate vulnerability from intensified heatwaves, wildfires, floods, and sea-level rise, severely impacting ecosystems, water resources, and urban infrastructure, much of which was not designed for current or future climate conditions.[573] Vulnerability is however, uneven, with risks compounded by socio-economic inequities.[574] Across the United States, the number and cost of extreme weather and climate events have risen sharply, with 2023 and 2024 setting records for frequency.[575] Between 1980 and 2024, the United States experienced 403 weather and climate disasters that exceeded US$1 billion in damages each, costing over US$2.9 trillion in total.[576] Official assessments point to rapidly rising disaster losses relative to the value of built assets if adaptation lags.[577]

Canada is facing increasingly frequent and severe extreme weather events driven by climate change. Climate models suggest that Canada will experience higher frequency and intensity of heavy precipitation and extreme hot days that threaten buildings, transport corridors, and critical services.[578] Federal technical assessments warn that Canada's buildings, roads, bridges, transit, and water systems were largely designed using historical climate norms that no longer reflect future conditions, increasing the likelihood of premature failures, service disruptions, and high repair costs.[579] Ageing and under-maintained infrastructure amplifies these risks, particularly in stormwater and wastewater systems, where more intense rainfall can overwhelm sewers, flood streets, and damage property in dense urban areas.[580] Climate impacts are distributed unevenly, with low-income neighbourhoods often experiencing higher flood and heat exposure and slower recovery from climate disasters.[581] Climate-proofing Canada's municipal infrastructure—including roads, buildings, and sewers—requires an estimated C$5.3 billion (0.2% of GDP) per year over the next 50 years.[582]

North America is advancing climate action through a mix of federal policies, state-level initiatives, and private sector innovation, aiming for net-zero emissions, though policy gaps remain (e.g., need for more coordinated, rapid, and comprehensive action to meet long-term climate goals). Key approaches include the dual track of reducing emissions and accelerating clean energy to build resilience. Local actions include investing in green infrastructure (e.g., green roofs, Figure 6.2) and renewable energy, upgrading transit systems to withstand extreme weather, adopting eco-asset accounting to value natural systems, updating zoning to limit development in high-risk areas, and utilising technologies for public infrastructure management, though approaches differ in their governance structures, funding support, and policy coherence.[583] Major cities such as New York City, Los Angeles, Vancouver, and Toronto have prioritised systems-based resilience planning, considering infrastructure upgrades as a central strategy for protecting vulnerable populations, safeguarding urban services, and sustaining long-term urban competitiveness and liveability.[584] But there are increasingly budgetary constraints to sustain these efforts, especially among American cities; in 2024, 124 cities reported a US$40.8 billion gap between needed climate project investment (US$62.7

571 Government of Canada. (2024). *Solving the Housing Crisis: Canada's Housing Plan*, https://housing-infrastructure.canada.ca/housing-logement/housing-plan-report-rapport-plan-logement-eng.html

572 Canada Mortgage and Housing Corporation. (n.d.). *Unlock opportunities with the Affordable Housing Fund*. https://www.cmhc-schl.gc.ca/professionals/project-funding-and-mortgage-financing/funding-programs/all-funding-programs/affordable-housing-fund; Canada Mortgage and Housing Corporation. (n.d.). *Rapid Housing Initiative*. https://www.cmhc-schl.gc.ca/professionals/project-funding-and-mortgage-financing/funding-programs/all-funding-programs/rapid-housing

573 NOAA National Centers for Environmental Information. (2025). *U.S. Billion-Dollar Weather and Climate Disasters*. https://www.ncei.noaa.gov/access/billions

574 OECD. (2025). *OECD economic surveys: Canada 2025*. OECD Publishing. https://www.oecd.org/en/publications/2025/05/oecd-economic-surveys-canada-2025_ee18a269.html; Chu, E., Natekal, A., Waaland, G., & Cannon, C. E. B. (2025). An evaluation of U.S. cities' efforts to further distributive justice in climate adaptation planning. *Npj Urban Sustainability*, *5*(1), 41. https://doi.org/10.1038/s42949-025-00237-5

575 NOAA National Centers for Environmental Information. (2025). *U.S. Billion-Dollar Weather and Climate Disasters*. https://www.ncei.noaa.gov/access/billions

576 NOAA National Centers for Environmental Information. (2025). *U.S. Billion-Dollar Weather and Climate Disasters*. https://www.ncei.noaa.gov/access/billions

577 NOAA National Centers for Environmental Information. (2025). *U.S. Billion-Dollar Weather and Climate Disasters*. https://www.ncei.noaa.gov/access/billions

578 Warren, F. J., & Lemmen, D. S. (Eds.). (2014). *Canada in a changing climate: Sector perspectives on impacts and adaptation*. Government of Canada. https://natural-resources.canada.ca/climate-change/canada-changing-climate/canada-changing-climate-sector-perspectives-impacts-and-adaptation/19831

579 Cannon, A. J., Jeong, D. I., Zhang, X., & Zwiers, F. W. (2020). Climate-Resilient Buildings and Core Public Infrastructure: An assessment of the impact of climate change on climatic design data in Canada. Government of Canada. https://climate-scenarios.canada.ca/?page=buildings-report

580 Warren, F. J., & Lemmen, D. S. (Eds.). (2014). *Canada in a changing climate: Sector perspectives on impacts and adaptation*. Government of Canada. https://natural-resources.canada.ca/climate-change/canada-changing-climate/canada-changing-climate-sector-perspectives-impacts-and-adaptation/19831

581 Warren, F. J., & Lemmen, D. S. (Eds.). (2014). *Canada in a changing climate: Sector perspectives on impacts and adaptation*. Government of Canada. https://natural-resources.canada.ca/climate-change/canada-changing-climate/canada-changing-climate-sector-perspectives-impacts-and-adaptation/19831; Avtar, R., Blickle, K., Chakrabarti, R., Janakiraman, J., & Pinkovskiy, M. (2023). Understanding the linkages between climate change and inequality in the United States. *Economic Policy Review*, *29*(1), 1-39.

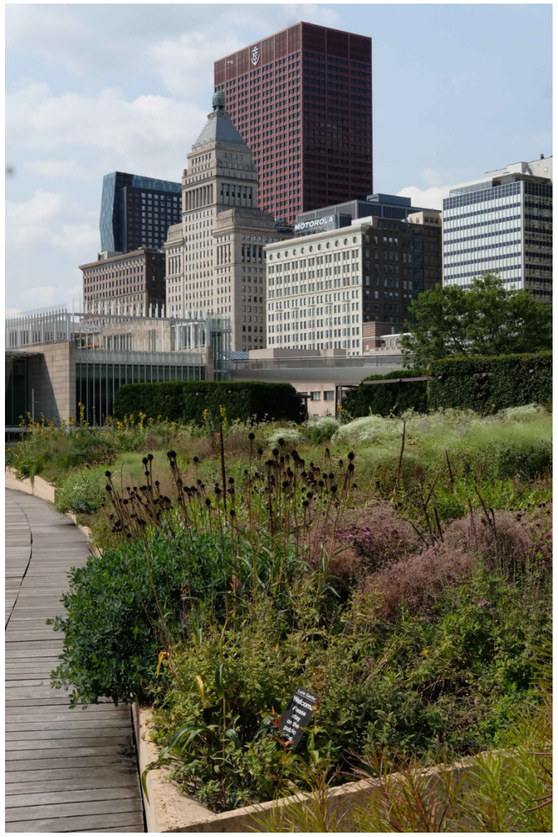
582 OECD. (2025). *OECD economic surveys: Canada 2025*. OECD Publishing. https://www.oecd.org/en/publications/2025/05/oecd-economic-surveys-canada-2025_ee18a269.html

583 Swanson, D., Murphy, D., Temmer, J., & Scaletta, T. (2021). Advancing the climate resilience of Canadian infrastructure. *International Institute for Sustainable Development*. https://www.iisd.org/system/files/2021-07/climate-resilience-canadian-infrastructure-en.pdf; Updike, B., Miller, J., Rao, R., & Metzger, D. (2024, April 1). Cooling American with Green and Resilient Infrastructure. *Federation of American Scientists*. https://fas.org/publication/shifting-to-resilient-infrastructure/

584 OECD. (2024). *Cities turning crisis into change: Post-pandemic pathways to resilience in complex times*. https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/10/cities-turning-crisis-into-change_c8a5565f/05c005d5-en.pdf?utm

billion) and available funds (US$22 billion).[585]

Figure 6.2 Green roof, eco-friendly garden over a parking garage in Millennium Park, Chicago



6.2.3 Car dependency, transport emissions, and access inequality

Car dependency is the defining feature of urban mobility and urban form in the United States and Canada, driven by infrastructure that favours automobiles. This has led to high car ownership rates (92% and 85% of households in the United States and Canada respectively), high vehicle kilometres travelled (4.8 trillion km annually, placing United States among the highest in the world), urban sprawl, and limited transit options, and reduced accessibility for those without vehicles.[586] In Canada, national reporting highlights declining connectivity and continued reliance on road travel, reinforcing equity, accessibility, physical and social exclusion concerns, especially among people with disabilities.[587] Car-centric infrastructure, particularly in cities like Calgary and Toronto, drives suburban sprawl and increases, rather than reduces, inequality; reliance on personal vehicles places a significant financial strain on lower-income households, limiting access to services. [588]

In the United States, transportation is the second-largest annual expense after housing, especially among low-income households; in 2023, American households spent an average of US$13,174 on transportation.[589] Federal equity guidance emphasises that areas of persistent poverty face compounded travel time and access barriers.[590] Heavy reliance on personal vehicles can have health implications—increases sedentary lifestyles. Transportation is the largest greenhouse gas source, with passenger cars and light-duty trucks contributing 57.5% of this sector's emission in the United States, producing air pollution and creates high-risk environments for pedestrians and cyclists.[591] Another critical challenge is funding gap due to decades of underinvestment; an estimated US$140 billion is needed to clear maintenance backlog and maintain a world-class transit fleet.[592]

Policy responses include multi-component, multi-pronged approaches, ranging from electrification and transit to mixed-use urban planning and investing in transit-

585 CDP. (2025, September 19). *From Climate Risk to Investment Opportunity: Filling the Funding Gap for Cities.* https://www.cdp.net/en/insights/from-climate-risk-to-investment-opportunity

586 U.S. Environmental Protection Agency. (2024*). Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2022.* https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks; Environment and Climate Change Canada. (2024). *National inventory report 1990–2023: greenhouse gas sources and sinks in Canada.* https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html

587 Transport Canada. (2023). *Transportation in Canada 2023: Greenhouse gas emissions.* https://tc.canada.ca/en/corporate-services/transparency/corporate-management-reporting/transportation-canada-annual-reports/transportation-canada-2023/greenhouse-gas-emissions

588 Environment and Climate Change Canada. (2024). *National inventory report 1990–2023: greenhouse gas sources and sinks in Canada.* https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html; Transport Canada. (2023). *Transportation in Canada 2023: Greenhouse gas emissions.* https://tc.canada.ca/en/corporate-services/transparency/corporate-management-reporting/transportation-canada-annual-reports/transportation-canada-2023/greenhouse-gas-emissions

589 U.S. Department of Transportation. (2021). *National Transportation Statistics.* https://www.bts.gov/topics/national-transportation-statistics

590 US Department of Transportation. (n.d.). *MPDG - Areas of Persistent Poverty and Historically Disadvantaged Communities.* https://www.transportation.gov/grants/mpdg-areas-persistent-poverty-and-historically-disadvantaged-communities-1

591 U.S. Environmental Protection Agency. (2024*). Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2022.* https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

592 Transportation For America. (2026, January 14). *Fixing the fleet and backlog: World-Class American Transit.* https://t4america.org/resource/maintenance-needs/

oriented development, but impacts are uneven.[593] Shifting car trips to public transport, walking and cycling depends on frequent services, safe street design, and first- and last-mile connectivity, alongside fare policies that protect affordability for low-income riders (Figure 6.3).[594] National statistics support the development of dense, mixed-use neighbourhoods within a half-mile of transit stations, designed to reduce car dependency and foster walkable communities—these neighbourhoods achieve better accessibility while auto oriented expansion locks in higher travel distances and energy use.[595]

Figure 6.3 Metropolitan Area Express in Portland, United States

593 Environment and Climate Change Canada. (2024). *National inventory report 1990–2023: greenhouse gas sources and sinks in Canada*. https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html; U.S. Environmental Protection Agency. (2024*). Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2022*. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

594 US Department of Transportation. (n.d.). *MPDG - Areas of Persistent Poverty and Historically Disadvantaged Communities*. https://www.transportation.gov/grants/mpdg-areas-persistent-poverty-and-historically-disadvantaged-communities-1

595 U.S. Department of Transportation. (2021). *National Transportation Statistics*. https://www.bts.gov/topics/national-transportation-statistics

6.3 Smart city development

Smart city development in North America is accelerating through the adoption of IoT, data analytics, and AI to optimise urban infrastructure and improve urban sustainability and quality of life. Key initiatives focus on smart grids, connected infrastructure, and digital citizen services in cities like New York, San Francisco, Seattle, and Toronto. The trend is towards a diversified, city-led agenda, with major metropolitan areas using digital technologies to enhance how infrastructure and public services are planned and managed.[596] In the United States, federal initiatives such as the *Smart Cities and Communities Act 2024*, alongside infrastructure and grid-modernisation programmes, support the integration, piloting and scaling of digital and data-driven solutions into city infrastructure, developing cleaner, safer, and more efficient living environment in cities.[597]

New York City is consistently ranked as a top-tier global smart city, frequently alongside London and Paris for its integration of technology, sustainability, and urban innovation. The approach centres on linking longstanding open-data and performance-management reforms with a deliberate effort to attract and coordinate technology firms, researchers, and startups around urban challenges such as mobility, energy, climate resilience, and service delivery.[598] The city's smart cities agenda emphasises data platforms, integrated service delivery, and strong institutional capacity, with implementation through pilots and testbeds but aiming to move beyond isolated technology projects towards a more systematic deployment of digital infrastructure[599] (Box 6.1).

A similar pattern is seen in Canada where data, AI, and connectivity are leveraged to improve urban life, mobility, and sustainability. Sustainable development strategies, guided by the Federal Sustainable Development Act, frame digital and smart technologies as key tools for decarbonisation, climate resilience, and more efficient management of federal assets. The *Natural Resources Canada's 2023–2024 Strategy*, for example, links data and innovation to reducing emissions from buildings and fleets, improving climate-risk assessment, and protecting critical energy and resource infrastructure.[600] Funding is provided. In 2017, the first federal prize-based funding was introduced to encourage local governments and Indigenous communities to develop locally defined smart projects that improve quality of life and to share lessons across communities

596 Gerli, P., Mora, L., Rocha, F. N. D., & Nguyen, H. (2024). *World Smart Cities Outlook 2024* (No. HS/042/21E). https://unhabitat.org/world-smart-cities-outlook-2024

597 U.S. Congress. (2024). *Smart Cities and Communities Act of 2024, H.R. 9892*. https://www.congress.gov/bill/118th-congress/house-bill/9892/text

598 Eden Strategy Institute & OXD. (2018). *Smart City Governments: A global ranking of 50 smart city governments*. https://www.edenstrategyinstitute.com/wp-content/uploads/2018/07/Eden-OXD_Top50SmartCityGovernments.pdf

599 New York City Economic Development Corporation. (n.d.). *Smart Cities*. https://edc.nyc/industry/smart-cities

600 Natural Resources Canada (2024). *2023–2024 Departmental Sustainable Development Strategy*. https://prod-natural-resources.azure.cloud.nrcan-rncan.gc.ca/corporate/transparency/2023-2024-departmental-sustainable-development-strategy-report

through a common national Smart Cities Challenge framework.[601] Target areas include improving city services, environmental quality, health, safety, and digital inclusion. The Smart Cities Challenge offers tiered prizes, including one C$50 million prize for any community, two C$10 million prizes for communities with populations under 500,000, and one C$5 million prize for communities under 30,000 residents. In addition, finalists, selected by a jury, receive a C$250,000 grant to develop their proposals, allowing them to focus on project management, feasibility studies, and community engagement.

Toronto's "city of surveillance" smart city project prompted intense scrutiny over how intimate resident data would be collected, stored, and utilised. Concerns were raised over surveillance, data privacy, and the role of private tech corporations in managing public infrastructure in the proposed but ultimately, cancelled Sidewalk Labs waterfront development (Box 6.2).[602] National security assessments now highlight smart city platforms as potential vectors for espionage and cyber-risk, reinforcing stringent governance of vendors, data flows, and critical infrastructure in Canadian municipalities and that community-led development is essential to prevent privatised, unaccountable "smart" neighbourhoods.[603]

The practice of piloting, scaling, and replication is a key feature of smart city development in North America, particularly through national and international learning networks, professional alliances, and thematic coalitions.[604] The effort is not limited to major cities like New York and Toronto. In Michigan, the MiNextCities (2022–2025) aims to create a sustainable, scalable roadmap for small to midsized Michigan cities to improve infrastructure and reduce emissions through tailored, sustainable "smart city" technologies. The focus is on technologies that can be replicated across communities with similar economic, social, and infrastructural challenges.[605] Another is the Smart Columbus in Ohio (Box 6.3), where federal funding can catalyse public-private investment and data-driven mobility transformation can shift from temporary pilot projects to sustainable, long-term impact.[606]

601 Goodman, N., Zwick, A., Spicer, Z., & Carlsen, N. (2020). Public engagement in smart city development: Lessons from communities in Canada's Smart City Challenge. *Canadian Geographer / Le Géographe Canadien, 64*(3), 416–432. https://doi.org/10.1111/cag.12607

602 Carter, A., & Rieti, J. (2020, May 7). Sidewalk Labs cancels plan to build high-tech neighbourhood in Toronto amid COVID-19. *CBC News*. https://www.cbc.ca/news/canada/toronto/sidewalk-labs-cancels-project-1.5559370

603 Canadian Security Intelligence Service. (2022). *Smart cities and national security*. Government of Canada. https://www.canada.ca/en/security-intelligence-service/corporate/publications/smart-cities-national-security/smart-cities-national-security.html

604 Resilient Cities Network. (2023). *Impact Report 2022–23*. https://resilientcitiesnetwork.org/wp-content/uploads/2024/09/R-Cities-2022-23-Impact-Report.pdf

605 MiNextCities. (2022). *Current State of Smart Cities Programs*. https://minextcities.org/wp-content/uploads/2023/01/MNC-Current-State-of-Smart-Cities-Programs-Report-November-2022.pdf

606 US Department of Transportation. (2016, June 23). *U.S. Department of Transportation Announces Columbus as Winner of Unprecedented $40 Million Smart City Challenge*. https://www.transportation.gov/briefing-room/us-department-transportation-announces-columbus-winner-unprecedented-40-million-smart

Box 6.1. New York City, United States: Smart City Testbed Program

New York City's Smart City Testbed Program streamlines and accelerates the citywide process for piloting new and emerging technologies. City agencies partner with applicant companies and academic groups to use public assets, from streets and sidewalks to building facades, as real-world test sites for new digital solutions. Run by the Office of Technology and Innovation, the programme serves as a central gateway through which agencies, companies and academic groups co-design six-to-nine-month pilots, focusing on challenges such as street safety, energy efficiency, and environmental monitoring, and evaluating their scaling potential across the city.

Early pilots include the deployment of computer-vision street-activity sensors by the Department of Transportation at multiple sites in Manhattan and Brooklyn to anonymously track pedestrian, cyclist, and vehicle movements, generating granular data for street redesign, curb-space management, and targeted safety interventions. The pilot received US$100,000 in city funding to support design, installation, and evaluation activities. Other pilots use drones and robotics to scan building envelopes for energy leakage and greenhouse-gas hotspots, illustrating how the city can become a living lab where sensors, connectivity, and analytics can be trialled and assessed before integrating them into long-term city infrastructure.

Image source: Civic Tech Field Guide

Source: Rueter, T. (2025, November 25). *NYC Launches Fresh Smart City Technology Pilot Program*. GovTech. https://www.govtech.com/biz/nyc-launches-fresh-smart-city-technology-pilot-program; Civic Tech Field Guide. (n.d.). *Street Activity Sensors*. https://directory.civictech.guide/listing/street-activity-sensors

Box 6.2. Toronto, Canada: Sidewalk Labs and politics of smart city data

Sidewalk Toronto was an ambitious, cancelled smart city project by Alphabet's Sidewalk Labs (urban planning company) and Waterfront Toronto. Initiated in 2017 to transform the Quayside waterfront area into an innovative, high-tech district and a prototype for future cities, the project was terminated in 2020 due to economic uncertainty and disagreements over the project's scope, financial viability, and the extent of private influence over public infrastructure and urban data. The project faced sustained opposition from the public and experts who warned that the proposed extensive sensor networks and data collection plans risked creating a high-surveillance environment and entrenching private control over urban data. The project became a stress test for existing privacy and data-protection frameworks, exposing gaps in how public authorities oversee corporate actors involved in digital urban infrastructure and in how benefits, risks, and governance rights are distributed between residents, governments, and firms. The failed project testifies to the importance of people-first in smart city development—that public trust, data privacy, and transparent governance are more crucial to smart city development than technology itself.

Image source: Lachman, R.

Source: Lachman, R. (2020, May 28). *Sidewalk Labs' city-of-the-future in Toronto was a stress test we needed*. Policy Options. https://policyoptions.irpp.org/magazines/may-2020/sidewalk-labs-city-of-the-future-in-toronto-was-a-stress-test-we-needed/; Jacobs, K. (2022, June 29). Toronto wants to kill the smart city forever. *MIT Technology Review*. https://www.technologyreview.com/2022/06/29/1054005/toronto-kill-the-smart-city/

Box 6.3. Columbus, United States: Smart City Challenge and district mobility transformation

Smart Columbus in Ohio was initiated with its selection in 2016 as the winner of the U.S. Department of Transportation's Smart City Challenge, receiving US$40 million in federal grant and later generating over US$500 million in public-private investment to implement a holistic, data-driven mobility vision across the city. It acts as an innovation lab for deploying intelligent transportation, digital infrastructure, and electric mobility to improve access to jobs, reduce congestion and emissions, and enhance community equity in mobility and health.

Between 2016 and 2021, *Smart Columbus* implemented nine major projects, covering multimodal trip-planning and payment apps, electric vehicle charging and fleet electrification, truck platooning pilots that were later discontinued, connected intersections, and mobility-as-a-service experiments, while building a collaborative governance model involving city government, state agencies, universities, and over 100 private and civic partners. Since May 2021, the initiative has transitioned from a time-bound, grant-funded project into a permanent, collaborative innovation lab under a permanent Smart Columbus organisation, with a legacy of digital infrastructure, institutional capacity, and community engagement platforms that continue. The initiative is designed to create lasting infrastructure and data-driven improvements, rather than short-term experiments.

Image source: SmartCitiesDive

Source: Smart Columbus & U.S. Department of Transportation. (2021). *Smart City Challenge: Lessons learned* (Report). U.S. Department of Transportation. https://www.transportation.gov/sites/dot.gov/files/docs/Smart%20City%20Challenge%20Lessons%20Learned.pdf; SmartCitiesDive. (2021, October 10). *6 questions with Smart Columbus on lessons since program's inception*. https://www.smartcitiesdive.com/news/smart-columbus-ohio-smart-city-challenge-winner-lessons-learned/607999/

Increasingly, smart city development in North America is evolving from technology-focused pilot projects towards not just municipal-led but people-centred, sustainability-oriented, inclusive and integrated urban ecosystems. The development trajectory

emphasises using IoT and data analytics for climate resilience, equity, and operational efficiency rather than just technological adoption. In the current effort, national smart city frameworks are being complemented by municipal innovation offices, open data and digital government programmes, and by the gradual adoption of more systematic measurement approaches to help city leaders evaluate the effectiveness and community impact of smart city technologies. In 2022, the National Institute of Standards and Technology (part of the U.S. Department of Commerce) introduced the Holistic KPI (H-KPI) for smart cities and communities, advocating a three-level analysis (evaluate, integrate, and adapt) for tracking, managing, and improving infrastructure and services by connecting technological performance with community benefits. The H-KPI defines smartness as the efficient and effective use of digital technologies to deliver high-quality infrastructure services and community benefits, with five core metrics: alignment of KPI with community priorities, investment alignment with community priorities, investment efficiency, information-flow density, and service/benefit quality.[607]

Despite these aspirations, translating frameworks into practice can be challenging across North American cities. Securing sustained funding beyond pilot phases remains a consistent obstacle, as smart city initiatives have often depended on short-term federal grants or corporate partnerships that do not outlast their demonstration period.[608] Digital equity concerns persist, as communities with limited digital access or lower digital literacy risk being excluded from — or further disadvantaged by — smart city benefits.[609]

6.4 Low carbon development

Low carbon development in North America is rapidly advancing through renewable energy integration, energy-efficient building standards, and large-scale sustainable urban planning. A low carbon city is defined as an urban area that systematically measures community-wide greenhouse gas emissions and acts to reduce emissions across sectors of buildings, transport, energy supply, waste, materials, and increasingly embodied carbon through highlighting the principles of reduction, reutilisation, and recycling to achieve deep decarbonisation and net-zero emissions.[610] The concept is increasingly embedded in broader policy frameworks that address sustainable urban transitions and the co-benefits of low carbon actions for public health, social equity, and economic resilience.[611]

The United States aims to achieve a 50–52% reduction in greenhouse gas emissions by 2030 and net-zero emissions by 2050, largely driven by the Inflation Reduction Act (IRA). This strategy relies on sector-specific electrification, clean energy tax credits, and infrastructure investment to accelerate industrial and transport decarbonization, embedding climate mitigation across fiscal, industrial, and social policy, including the largest federal climate and energy investment in American history.[612] The IRA, enacted in 2022, adopted an incentive-driven, market-mobilisation approach through long-term tax credits, grants, and rebates to accelerate decarbonisation across electricity generation, buildings, transport, and manufacturing, with subnational institutions—including cities, utilities, housing authorities, businesses, and community organisations—as key actors in implementation.[613] However, since the change in federal administration in 2025, while the IRA remains statutory law and has not been fully repealed, its climate ambition has been partially diluted through executive actions, programme pauses, and subsequent legislative amendments that have narrowed or restructured several clean-energy tax credits and grant programmes.[614] The current development reflects a tension between strategies like IRA with its original design as a stable, long-term decarbonisation framework and a more uncertain implementation landscape shaped by political realignment, regulatory reinterpretation, and contested federal priorities—creating fragility in the national low carbon policy environment.[615]

Equally, Canada is pursuing a low carbon economy, to reach net-zero emissions by 2050**.** Canada's approach relies on accelerating renewable energy, improving energy efficiency, and phasing out fossil fuel expansion under a legislated net-zero accountability and multilevel governance framework, anchored by the Net-Zero Emissions Accountability Act (NZEA). The NEZA legally commits the federal government to achieving net-zero greenhouse gas emissions by 2050 and mandates the preparation of successive five-year emissions reduction plans, progress reports, and independent assessments.[616] The NZEA is complemented by the Pan-Canadian Framework on Clean Growth and Climate

607 NIST. (2022). *Smart Cities and Communities: A Key Performance Indicators Framework*, https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1900-206.pdf

608 Goldsmith, S., & Crawford, S. (2014). *The Responsive City: Engaging Communities Through Data-Smart Governance*. Jossey-Bass; Deloitte. (n.d.). *Smart Cities Funding and Financing Strategies*. https://www.deloitte.com/mu/en/Industries/government-public/perspectives/smart-cities-funding-and-financing-strategies.html

609 Powell, A. B. (2021). *Undoing Optimization: Civic Action in Smart Cities*. Yale University Press.

610 Pashaei, S., & An, C. (2024). Assessment of urban greenhouse gas emissions towards reduction planning and low-carbon city: A case study of Montreal, Canada. *Environmental Systems Research*, *13*(1), 12. https://doi.org/10.1186/s40068-024-00341-y; Chen, L., Huang, L., Hua, J., Chen, Z., Wei, L., Osman, A. I., Fawzy, S., Rooney, D. W., Dong, L., & Yap, P.-S. (2023). Green construction for low-carbon cities: A review. *Environmental Chemistry Letters*, *21*(3), 1627–1657. https://doi.org/10.1007/s10311-022-01544-4

611 Low Carbon Cities Canada. (n.d.). *About*. Retrieved January 20, 2026, from https://lc3.ca/about/

612 U.S. Department of Energy. (n.d.). *INFLATION REDUCTION ACT OF 2022*. Retrieved January 20, 2026, from https://www.energy.gov/edf/inflation-reduction-act-2022

613 Internal Revenue Service. (n.d.). *Inflation Reduction Act of 2022*. https://www.irs.gov/inflation-reduction-act-of-2022

614 Guarna, O., Webb, R., & Webb, O. G. and R. (2025, May 13). IRA Programs at Risk under the Budget Reconciliation Bill. *Climate Law Blog*. https://blogs.law.columbia.edu/climatechange/2025/05/13/ira-programs-at-risk-under-the-budget-reconciliation-bill/

615 Fujii-Rajani, R., & Patnaik, S. (2025, January 6.). What will happen to the Inflation Reduction Act under a Republican trifecta?. *Brookings*. https://www.brookings.edu/articles/what-will-happen-to-the-inflation-reduction-act-under-a-republican-trifecta/; Guarna, O., Turner, A., & Turner, O. G. and A. (2025, April 29). 100 Days of Trump 2.0: The Inflation Reduction Act. *Climate Law Blog*. https://blogs.law.columbia.edu/climatechange/2025/04/29/100-days-of-trump-2-0-the-inflation-reduction-act/

616 Government of Canada. (2023, March 31). *Consolidated federal laws of Canada, Canadian Net-Zero Emissions Accountability Act*. https://laws-lois.justice.gc.ca/eng/acts/C-19.3/

Change (PCF),[617] Canada's first comprehensive intergovernmental climate strategy. The PCF includes an economy-wide carbon pricing system, which establishes a consistent national price signal on carbon while allowing provinces and territories flexibility in design and implementation.[618] Within this national architecture, cities are recognised as critical delivery agents for achieving climate targets, particularly in high-emitting urban sectors such as buildings, transport, and waste, where municipal governments exercise direct authority over planning, infrastructure, and service provision.[619] Peer learning is a key feature, using networks like C40 Cities and ICLEI to share climate strategies, benchmark progress, and access funding, which significantly influence local policy and foster collaboration to innovate and implement effective, localised solutions.

In Canada, the multilevel governance model is operationalised through federal–municipal intermediary institutions, notably the Federation of Canadian Municipalities, which represents over 2,000 Canadian municipalities (more than 92% of Canadians), in negotiations with federal departments and agencies to ensure that their citizens' needs are reflected in federal policies and programmes.[620] For instance, the Low Carbon Cities Canada (a partnership between the Federation of Canadian Municipalities and seven of Canada's largest cities and supported by C$183 million endowment from the Government of Canada) channels federal funding, technical assistance, and capacity-building to local governments to accelerate urban decarbonisation and share best local solutions.[621] Cities in both countries are increasingly relying on standardised measurement, reporting (e.g., CDP-ICLEI Track), and verification frameworks to monitor progress, though practices vary. In the United States, benchmarking tools such as the American Council for an Energy-Efficient Economy (ACEEE) City Clean Energy Scorecard and mandatory building energy disclosure laws support comparative assessment and compliance monitoring.[622] In Canada, national programmes and reporting mechanisms, aligned with the Net-Zero Emissions Accountability Act (e.g., a mandatory five-year planning and reporting cycle), reinforce longer-term accountability.[623]

617 Government of Canada. (2022, June 23). *Pan-Canadian Framework on Clean Growth and Climate Change*. https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework.html

618 Government of Canada. (2025, December 17). *Carbon pricing systems across Canada*. https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work.html

619 Government of Canada. (2025, December 31). *2030 Emissions Reduction Plan: Clean Air, Strong Economy*. https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030.html

620 *Federation of Canadian Municipalities*. (n.d.). *About FCM*. Retrieved January 20, 2026, from https://fcm.ca/en/about-fcm

621 Green Municipal Fund. (n.d.). *Low Carbon Cities Canada (LC3)*. Retrieved January 20, 2026, from https://greenmunicipalfund.ca/low-carbon-cities-canada-lc3

622 Samarripas, S., Jarrah, A., Runge, E., ... & Sachson, W. (2024). *The 2024 City Clean Energy Scorecard*. https://www.aceee.org/sites/default/files/pdfs/2024_city_clean_energy_scorecard.pdf

623 Government of Canada. (2022, March 29). *Canadian Net-Zero Emissions Accountability Act*. https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050/canadian-net-zero-emissions-accountability-act.html

Low carbon city development in North America is, however, uneven, reflecting differences in institutional capacity, financing mechanisms, and political alignment across jurisdictions. In the United States, progress has been driven more by regulatory and policy innovation at the city level. An example is New York City's building emissions caps under Local Law 97 (Box 6.4), which have catalysed detailed emissions inventories, compliance regimes, and retrofit planning among large building owners.[624] While such policies have positioned leading American cities at the forefront of low carbon urban governance, implementation has been uneven and politically contested, noticeably affected by economic pressures, legal challenges, energy price volatility, and concerns over affordability and distributional impacts.[625] In Canada, major cities such as Toronto and Vancouver (Box 6.5) have benefited from well-resourced low carbon development plans and collaborative federal–municipal support structures, which have accelerated mitigation efforts, particularly in building retrofits, energy efficiency, and electrification.[626] However, progress varies, depending on local delivery capacity and market constraints, with increasing concerns of affordability.[627]

624 Columbia University. (n.d.). *Progress and Obstacles in Implementing NYC's Local Law 97 and a Sustainable NYC*. Retrieved January 20, 2026, from https://sps.columbia.edu/news/progress-and-obstacles-implementing-nycs-local-law-97-and-sustainable-nyc; Urban Green Council. (n.d.). *Local Law 97*. Retrieved January 20, 2026, from https://www.urbangreencouncil.org/what-we-do/driving-innovative-policy/ll97/

625 Chen, L., Huang, L., Hua, J., Chen, Z., Wei, L., Osman, A. I., Fawzy, S., Rooney, D. W., Dong, L., & Yap, P.-S. (2023). Green construction for low-carbon cities: A review. *Environmental Chemistry Letters*, *21*(3), 1627–1657. https://doi.org/10.1007/s10311-022-01544-4; Diezmartínez, C. V., & Short Gianotti, A. G. (2022). US cities increasingly integrate justice into climate planning and create policy tools for climate justice. *Nature Communications*, *13*(1), 5763. https://doi.org/10.1038/s41467-022-33392-9

626 Burns, P. (2025, July 29). Canadian Cities at the Forefront of Climate Action: A Deep Dive into Ambitious Net-Zero Plans. *The New Climate*. https://thenewclimate.ca/canadian-cities-at-the-forefront-of-climate-action-a-deep-dive-into-ambitious-net-zero-plans/

627 Lockhart, K. (2025, September 14). *Build Canada Homes signals urgency—Affordable and low carbon construction must follow*. Pembina Institute. https://www.pembina.org/media-release/build-canada-homes-signals-urgency-affordable-low-carbon-construction-must-follow

Box 6.4. New York City, United States: Local Law 97

New York City represents one of the most advanced examples of regulatory-led low carbon urban development in North America through the adoption of Local Law 97, a cornerstone of the city's Climate Mobilization Act. Local Law 97 is a landmark climate law passed in 2019 that targets the city's largest emissions source, setting strict greenhouse gas emission limits for most buildings over 25,000 square feet, starting in 2024. The law aims to reduce building emissions by 40% by 2030 and achieve net zero by 2050. Certain buildings, e.g., places of worship, non-profit hospitals, and specific rent-regulated housing, may have exemptions.

Rather than relying on voluntary efficiency programmes, the law mandates performance-based emissions reductions, with enforceable compliance timelines and fines for exceeding emission limits. Building owners are required to measure and report emissions intensity. Investments in energy efficiency upgrades, electrification of heating systems, and low carbon retrofits are incentivised. The introduction of Local Law 97 has catalysed systematic emissions accounting, benchmarking, and retrofit planning across New York City's commercial and residential building stock, while stimulating demand for clean energy services, engineering expertise, and new financial products tailored to compliance needs.

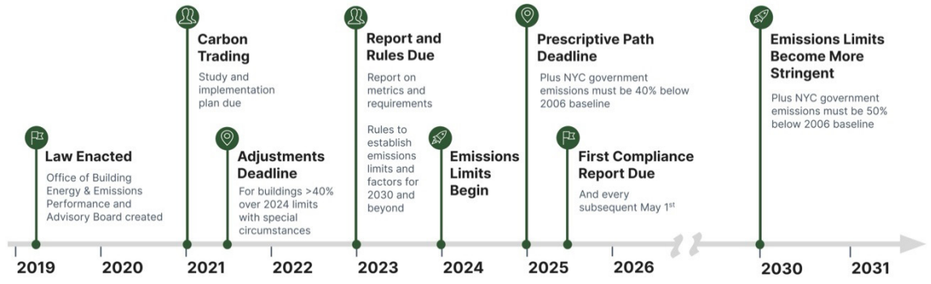


Image source: Urban Green Council.

Source: NYC Accelerator. (n.d.). *Local Law 97*. Retrieved January 20, 2026, from https://accelerator.nyc/ll97; City of New York. (n.d.). *LL97 Greenhouse Gas Emissions Reduction—Buildings*. Retrieved January 20, 2026, from https://www.nyc.gov/site/buildings/codes/ll97-greenhouse-gas-emissions-reductions.page; Urban Green Council. (n.d.). *Local Law 97*. Retrieved January 20, 2026, from https://www.urbangreencouncil.org/what-we-do/driving-innovative-policy/ll97/

Box 6.5. Vancouver, Canada: Circular Food Innovation Lab

A 2019 Canadian report estimated that 8.79 million tonnes of avoidable, unplanned food waste resulted in a loss of C$39 billion to the food industry. In Vancouver, 25,000 tonnes of edible food was discarded by businesses in 2019 (a loss of 37,000 meals). The Circular Food Innovation Lab engaged 18 Vancouver-based food supply chain businesses in a 10-month project from April 2022 to February 2023 to co-create a roadmap and education materials to advance an equitable circular economy of food.

The lab is embedded within a broader municipal commitment to circular economy and climate mitigation, articulated through the city's vision of becoming "a zero-waste community by 2040". This vision frames waste not merely as a disposal challenge but as a systemic source of avoidable greenhouse gas emissions, particularly through food loss, organic waste, and upstream production inefficiencies. By supporting food waste prevention, surplus food redistribution, circular procurement, and innovation among food businesses, the lab operationalises the zero-waste ambition along business supply chains and prototype solutions as a form of low carbon development, reducing both methane emissions from landfills and embodied emissions associated with food production and transport.

Image source: City of Vancouver

Source: City of Vancouver. (n.d.). *Zero Waste 2040.* Retrieved January 20, 2026, from https://vancouver.ca/green-vancouver/zero-waste-vancouver.aspx; City of Vancouver. (n.d.). *Circular Food Innovation Lab*. Retrieved January 20, 2026, from https://vancouver.ca/green-vancouver/circular-food-innovation-lab.aspx

Across North America, low carbon cities are facing a growing gap between strategic ambition and on-the-ground delivery. While many cities have set net-zero goals, high energy use in buildings and transportation, along with ageing infrastructure and urban sprawl, complicates progress, making voluntary targets difficult to achieve without stringent policies, underscoring the importance of governance capacity and financial

durability in shaping the pace and equity outcomes of urban decarbonisation.[628] In the United States, these challenges are compounded by a highly decentralised policy environment, fragmented authority across federal, state, and local levels, and political volatility that affects funding continuity.[629] Although federal–municipal coordination is stronger in Canada, cities still face capacity constraints, rising construction and retrofit costs, labour shortages, and tensions between decarbonisation goals and housing affordability.[630]

628 ICLEI USA. (2023, January 12). *The Ambition Gap: From Intent to Implementation in Local Climate Action - Policy Brief*. https://icleiusa.org/resources/the-ambition-gap-from-intent-to-implementation-in-local-climate-action-policy-brief/

629 Bullard, N. (2023). *Challenges to Scaling U.S. Low-Carbon Technology*. https://www.csis.org/analysis/challenges-scaling-us-low-carbon-technology; Basseches, J. A., Bromley-Trujillo, R., Boykoff, M. T., Culhane, T., Hall, G., Healy, N., Hess, D. J., Hsu, D., Krause, R. M., Prechel, H., Roberts, J. T., & Stephens, J. C. (2022). Climate policy conflict in the U.S. states: A critical review and way forward. *Climatic Change*, *170*(3–4), 32. https://doi.org/10.1007/s10584-022-03319-w

630 Swanson, D., Murphy, D., Temmer, J., & Scaletta, T. (2021). Advancing the climate resilience of Canadian infrastructure. *International Institute for Sustainable Development*. https://www.iisd.org/system/files/2021-07/climate-resilience-canadian-infrastructure-en.pdf

Chapter 7

Oceania

Chapter 7: Oceania

7.1 Region context

Location	Oceania
Countries	14 countries
Land Size	~ 8,500,000 square kilometres
Population	~ 46 million (2025)
Population Ageing Trend	People over age 65: 13.9% in 2025, 18.6% in 2050
Urbanisation Level	~67.8% of population live in urban areas (2025) Australia: 87-90% New Zealand: 83% Pacific Island Nations: 25% (from Papua New Guinea 15.8% to 100% in Nauru (2025).
Geographic Overview	Oceania consists of thousands of islands across the Central and South Pacific. The region features a diverse range of climates, including tropical zones in the Pacific islands, Mediterranean in southern Australia, dry deserts inland, and Oceanic in New Zealand. Its ecosystems are varied, spanning coral reefs, kelp forests, mangroves, montane forests, wetlands, and deserts
Climate Risks	More frequent and intense extreme weather events and hydro-meteorological disasters (e.g., heatwaves, droughts, flooding, tropical cyclones), and ocean acidification
Key Urban Networks	Pacific Island Forum; Pacific Urban Forum; Pacific Resilience Partnership; Asia-Pacific Urban Forum; Resilient Cities Network (Asia-Pacific).

Source: Various Sources[631]

631 International Union for Conservation of Nature. (n.d.). ***Oceania***. Retrieved January 23, 2026, from https://iucn.org/our-work/region/oceania#:~:text=Description%201,forests%2C%20and%20wetlands%20to%20deserts; UNSD. (2021). ***Population by sex, annual rate of population change, surface area and density***. Retrieved January 23, 2026, from https://unstats.un.org/UNSDWebsite/; World Bank. (n.d.). ***Population estimates and projections***. Retrieved January 23, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections#; British Broadcasting Corporation (BBC). (n.d.). ***The geography of Oceania***. Retrieved January 23, 2026, from https://www.bbc.co.uk/bitesize/articles/zb63r2p#zx9mtrd; National Geographic. (n.d.). ***Australia and Oceania: Physical Geography***. Retrieved January 23, 2026, from https://education.nationalgeographic.org/resource/oceania-physical-geography/; Pacific Community. (2016). ***Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030***. https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf;

Oceania is a vast and diverse region, comprising over 10,000 islands scattered across Central and South Pacific Ocean.[632] The region includes 14 countries including Australia, New Zealand, New Guinea, the Melanesia, Micronesia, and Polynesia islands.[633] Oceania's total land area is approximately 8,500,000 square kilometres[634], with Australia being the largest country at 7,692,020 square kilometres[635]. Geographically, the continent can be classified into three distinct groups: continental islands that were once attached to continents (Australia, Zealandia, and New Guinea), high islands that are volcanic in origin (e.g., Fiji, Solomon Islands, Vanuatu, and Papua New Guinea), and low islands that are typically low-lying coral atolls (e.g., Kiribati, Marshall Islands, and Micronesia).[636] Oceania's climate is diverse, ranging from tropical climate in most of the Pacific islands, Mediterranean climate in the southern region of Australia, dry climate in Australia's interior desert region, to Oceanic climate in New Zealand.[637] The diversity in climates and geography creates a wide range of ecosystems such as coral reefs, kelp forests, mangroves, montane forests, wetlands, and deserts.[638]

The estimated population of Oceania is about 46 million in 2025.[639] The most populated countries include Australia, Papua New Guinea, and New Zealand (Table 7.1). Oceania is undergoing significant demographic shifts. Population ageing is notable in countries throughout this region. The proportion of people aged 65 and over has increased from 9.9% in 2000 to 13.9% in 2025, with projected increase to 18.6% by 2050. Population ageing trend is particularly evident in Paula (6.7%), New Zealand (5.9%), and Australia (5.8%), against increases of 0.2% to 3.2% in other countries in the region.[640] Age dependency ratio increased notably in Australia (6.2%) and New Zealand (2.3%) from 2000 to 2025, indicating a growing burden on the working-age population to support non-working populations (children and older adults).[641]

632 British Broadcasting Corporation (BBC). (n.d.). ***The geography of Oceania***. Retrieved January 23, 2026, from https://www.bbc.co.uk/bitesize/articles/zb63r2p#zx9mtrd

633 National Geographic. (n.d.). ***Australia and Oceania: Physical Geography***. Retrieved January 23, 2026, from https://education.nationalgeographic.org/resource/oceania-physical-geography/

634 International Union for Conservation of Nature. (n.d.). ***Oceania***. Retrieved January 23, 2026, from https://iucn.org/our-work/region/oceania#:~:text=Description%201,forests%2C%20and%20wetlands%20to%20deserts

635 World Bank. (2023). ***Land area (sq. km)***. Retrieved January 23, 2026, from https://data.worldbank.org/indicator/AG.LND.TOTL.K2

636 National Geographic. (n.d.). ***Australia and Oceania: Physical Geography***. Retrieved January 23, 2026, from https://education.nationalgeographic.org/resource/oceania-physical-geography/

637 British Broadcasting Corporation (BBC). (n.d.). ***The geography of Oceania***. Retrieved January 23, 2026, from https://www.bbc.co.uk/bitesize/articles/zb63r2p#zx9mtrd; National Geographic. (n.d.). ***Australia and Oceania: Physical Geography***. Retrieved January 23, 2026, from https://education.nationalgeographic.org/resource/oceania-physical-geography/.

638 International Union for Conservation of Nature. (n.d.). ***Oceania***. Retrieved January 23, 2026, from https://iucn.org/our-work/region/oceania#:~:text=Description%201,forests%2C%20and%20wetlands%20to%20deserts.

639 UNSD. (2021). ***Population by sex, annual rate of population change, surface area and density***. Retrieved January 23, 2026, from https://unstats.un.org/UNSDWebsite/

640 World Bank. (n.d.). ***Population estimates and projections***. Retrieved January 23, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections#

641 World Bank. (n.d.). ***Population estimates and projections***. Retrieved January 23, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections#

Table 7.1. Population of Oceania (2000, 2025, and 2050)

Country	Population Estimates and Projections (Millions of People)		
	2000	**2025**	**2050**
Oceania (Region)	**30.5**	**46.3**	**57.1**
Australia	19.0	27.4	32.8
Fiji	0.8	0.9	1.0
Kiribati	0.1	0.1	0.2
Marshall Islands	0.1	0.0	0.0
Micronesia	0.1	0.1	0.1
Nauru	0.0	0.0	0.0
New Zealand	3.9	5.3	5.8
Palau	0.0	0.0	0.0
Papua New Guinea	5.5	10.8	14.9
Samoa	0.2	0.2	0.3
Solomon Islands	0.4	0.8	1.3
Tonga	0.1	0.1	0.1
Tuvalu	0.0	0.0	0.0
Vanuatu	0.2	0.3	0.5

Source: World Bank [642]

In 2025, while 67.8% of the region's population resides in urban areas, urbanisation levels vary significantly across Oceania countries. Urban population rates exceed 80% in Australia, New Zealand, and Nauru, but fall below 20% in Papua New Guinea and Samoa.[643] By 2050, Oceania's urban population is projected to reach 72.7%, with more countries having urban population over 80%, e.g., the Marshall Islands, Palau, and Tuvalu.[644] Pacific Island counties are experiencing rapid urbanisation, driven by modernisation, economic and social development opportunities.[645] The provision of urban infrastructure in Oceania demonstrates a clear divide: Australia and New Zealand have developed highly advanced well-equipped urban networks (transport, digital, social), while Pacific nations face rapidly growing deficit-stricken urban centres with basic infrastructure gap in water, energy, and sanitation amid accelerating urbanisation.[646]

Australia and New Zealand are the dominant economic hubs of Oceania and major trading partners for many Pacific Island countries. Australia, New Zealand, Palau and Nauru are classified as the high-income group, while the remaining countries have notably lower income.[647] Human development levels vary. Australia and New Zealand have very high human development on the United Nations Development Index,[648] reflecting advanced education systems, robust healthcare, and high standards of living and high GDP per capita. Fiji, the Marshall Islands, Nauru, Palau, Samoa, and Tonga are within the high human development category, while the remaining countries are in the medium human development group, with moderate advancement across essential aspects of human development.

Oceania's leading global cities are primarily in Australia and New Zealand. Sydney is an Alpha+ world city and Melbourne an Alpha city within the global network and economy.[649] Auckland is a Beta+ world city, playing an instrumental role in linking New Zealand and the region into the world economy.[650] On urban liveability, Melbourne, Sydney, Auckland, and Adelaide are among the top ten most liveable cities in the world according to the Economist Intelligence Unit Global Liveability Index 2025.[651] Urban development in Australia and New Zealand is characterised by low-density development outside the urban core and car-dependent urban sprawl (Figure 7.1). Over the past two decades, urban planning initiatives in Australia and New Zealand cities have increasingly focused on densification within inner cities and established urban areas through strategies such as transit-oriented development[652], compact development[653], and 20-minute neighbourhoods[654]. Pacific Island countries are experiencing rapid urbanisation, with

642 World Bank. (n.d.). *Population estimates and projections*. Retrieved January 23, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections#

643 World Bank. (n.d.). *Population estimates and projections*. Retrieved January 23, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections#

644 World Bank. (n.d.). *Population estimates and projections*. Retrieved January 23, 2026, from https://databank.worldbank.org/source/population-estimates-and-projections#

645 UN-Habitat. (2020). *National Urban Policy: Pacific Region Report*. https://unhabitat.org/national-urban-policy-pacific-region-report

646 The World Bank. (2018). *The Status of Infrastructure Services in East Asia and Pacific*. https://openknowledge.worldbank.org/entities/publication/9778a758-33ca-5d93-865a-538ce1cee654.

647 The World Bank. (n.d.). *Economies*. Retrieved January 23, 2026, from https://data360.worldbank.org/en/economies#by-region

648 United Nations. (n.d.). Human Development Index. In *Human Development Reports*. United Nations. Retrieved January 23, 2026, from https://hdr.undp.org/data-center/human-development-index

649 Globalization & World Cities (GaWC). (2026). *World Cities 2024*. Retrieved January 23, 2026, from https://gawc.lboro.ac.uk

650 Globalization & World Cities (GaWC). (2026). *World Cities 2024*. Retrieved January 23, 2026, from https://gawc.lboro.ac.uk

651 The Economist Group. (2025). *EIU Global Liveability Index 2025 Copenhagen replaces Vienna as world's most liveable city*. Retrieved January 23, 2026, from https://www.economistgroup.com/press-centre/economist-intelligence/eiu-global-liveability-index-2025-copenhagen-replaces-vienna-as-worlds-most

652 NSW Government Department of Planning, Housing and Infrastructure. (2023). *Transport Oriented Development Program*. https://www.planning.nsw.gov.au/sites/default/files/2023-12/transport-oriented-development-program.pdf

653 Auckland Council. (2023). *Auckland Future Development Strategy 2023-2050*. https://www.aucklandcouncil.govt.nz/content/dam/ac/docs/plans-projects-policies-reports-bylaws/misc/future-development-strategy.pdf

654 Victoria State Government Department of Transport and Planning. (n.d.). *20-minute neighbourhoods*. Retrieved January 26, 2026, from https://www.planning.vic.gov.au/guides-and-resources/strategies-and-initiatives/20-minute-neighbourhoods

urban expansion occurring increasingly through informal settlements in peri-urban or hazard-prone areas.[655] These informal settlements often lack basic infrastructure and are highly vulnerable to natural hazards.[656]

Figure 7.1. Low-density urban development in Melbourne, Australia

Launched in 2022, the *2050 Strategy for the Blue Pacific Continent* is a comprehensive long-term plan endorsed by Pacific Island Forum leaders. It sets out the vision for "a resilient Pacific Region of peace, harmony, security, social inclusion and prosperity, that ensures all Pacific peoples can lead free, healthy and productive lives".[657] Seven key thematic areas are highlighted: political leadership and regionalism, people-centred development, peace and security, resource and economic development, climate change and disasters, ocean and environment, and technology and connectivity. This long-term development strategy calls for a whole-of-region approach, involving all stakeholders, and engagement in strategic partnerships at various levels to achieve shared priorities. Aligned with the 2050 Strategy, many countries, e.g., Australia[658], New Zealand[659], and Fiji[660], have established regional/national development plans to put into action the regional development priorities in the Pacific.

7.2 Urban challenges

Oceania countries face a diverse range of urban challenges due to differences in economic development, urbanisation rates, demographic profiles, environmental risks, and technological changes. Key urban challenges include housing affordability in Australia and New Zealand, housing informality in the Pacific Island countries, and climate vulnerability in most countries across Oceania.

7.2.1 Housing affordability

Australia and New Zealand are facing rapidly growing challenges in housing affordability for both owners and renters in the past 25 years. According to the *2025 Demographia International Housing Affordability* annual report, which compares housing affordability in 94 major cities across eight nations (Australia, Canada, China, Ireland, New Zealand, Singapore, United Kingdom, and the United States), major cities in Australia are among the least affordable housing markets in the world. Sydney is the least affordable market in Australia, and the second least affordable market internationally after Hong Kong.[661] Since the early 2000s, the price of an average Australian home has increased at a much faster rate than incomes—rising from around four times the median income to over eight times in 2025. Housing price increasing rate is most significant in Sydney, the most populated city in Australia.[662] Nationwide, home ownership is falling significantly among younger adults. For the 30-34 years old, just half owned their home in 2021, dropping from 57% in 2001. For the 25-29 years old, home ownership declined from 43% in 2001 to 36% in 2021. Home ownership rates are dropping most rapidly for the lowest 40% income group within each age bracket. It now takes over 12 years to save a 20% deposit for a typical dwelling for an average Australian household, rising notably from about 6 years in the early 1990s.[663]

At the same time, rental price is growing fast, especially after the COVID-19 pandemic. Rental vacancies are at historic low, while asking rents for new listings have surged—

655 World Bank. (2025, December 18). *Seizing the Urban Opportunity in the Pacific*. Retrieved January 26, 2026, from https://www.worldbank.org/en/country/pacificislands/publication/seizing-the-urban-opportunity-in-the-pacific

656 UN-Habitat. (2020). *National Urban Policy: Pacific Region Report*. https://unhabitat.org/national-urban-policy-pacific-region-report

657 Pacific Islands Forum. (2022). *2050 Strategy for the Blue Pacific Continent*. https://forumsec.org/2050

658 Australian Government Department of Foreign Affairs and Trade. (2025). *Australia – Pacific Regional Development Partnership Plan 2025–2029*. https://www.dfat.gov.au/sites/default/files/australia-pacific-regional-development-partnership-plan-2025-2029.pdf

659 New Zealand Foreign Affairs and Trade. (2025). *Pacific Regional Plan*. https://www.mfat.govt.nz/assets/Aid-Prog-docs/4-year-plans/Pacific-Regional-Plan-2024-27.pdf

660 Government of the Republic of Fiji. (2024). *Fiji National Development Plan 2025-2029 and Vision 2050*. https://www.finance.gov.fj/wp-content/uploads/2024/09/NPDF_final-9.pdf

661 Cox, W. (2025). *Demographia International Housing Affordability: 2025 Edition*. https://www.chapman.edu/communication/_files/Demographia-International-Housing-Affordability-2025-Edition.pdf

662 Coastes, B., Moloney, J., & Bowes, M. (2025, March 28). 25 years into a new century and housing is less affordable than ever. *The Conversation*. Retrieved February 2, 2026, from https://theconversation.com/25-years-into-a-new-century-and-housing-is-less-affordable-than-ever-250067

663 Coastes, B., Moloney, J., & Bowes, M. (2025, March 28). 25 years into a new century and housing is less affordable than ever. *The Conversation*. Retrieved February 2, 2026, from https://theconversation.com/25-years-into-a-new-century-and-housing-is-less-affordable-than-ever-250067

an increase of around 20% in Sydney and Melbourne over the past four years, and even higher increases in other major cities, including Brisbane, Adelaide, and Perth. The rising housing prices have led to growing wealth inequality in Australia over the past 20 years.[664]

Like Australia, New Zealand's housing prices are growing much faster than incomes and rental costs are consistently increasing in most areas.[665] The average annual housing costs for a New Zealand household has risen by 31% from 2020 to 2024, while the average disposable income increased by 24% during the same period. In 2024, Auckland remains one of the least affordable cites in the country, with median house sale prices 17.2 times higher than the median household disposable income.[666] It takes an average New Zealand household 20 years to save for a 20% deposit, based on the median house sale price and median household income in 2024. Although home ownership rate increased from 64.5% in 2018 to 66% in 2023, home ownership rates vary notably across different regions. The Canterbury and greater Wellington areas had the highest household home ownership rates, while Auckland and Gisborne regions had the lowest.[667] Despite the recent increase in residential housing building, housing supply shortage remains and has affected housing affordability throughout New Zealand, especially for economically dynamic regions like Auckland.[668] Globally, Auckland is rated as severely unaffordable in the *2025 Demographia International Housing Affordability* report.[669]

Both countries are implementing policies to increase housing supply and address the ongoing challenge of housing affordability. State governments in Australia, particularly Victoria and New South Wales, are advancing plans to increase housing in activity centres and near transport links.[670] The Victorian government has identified 25 more train and tram zones where planning regulations would be changed to allow more high-rise housing development (Figure 7.2). The New South Wales government is addressing the ongoing housing shortage by prioritising the development of a broader range of residential options in well-located areas, with proximity to public transport, green spaces, schools, hospitals, and community facilities. This will be achieved by implementing major planning initiatives like the Transport Oriented Development Programme, and other housing reforms for diverse low- and mid-rise housing development.[671] The New Zealand government is implementing the Going for Housing Growth programme as part of the nation's broader plan to address housing shortage. The programme seeks to improve housing affordability by significantly increasing the supply of developable land for housing both within and at the edge of established urban areas.[672]

Figure 7.2. Area for higher-density development around new Arden Station in Melbourne, Australia

664 Coastes, B., Moloney, J., & Bowes, M. (2025, March 28). 25 years into a new century and housing is less affordable than ever. *The Conversation*. Retrieved February 2, 2026, from https://theconversation.com/25-years-into-a-new-century-and-housing-is-less-affordable-than-ever-250067

665 New Zealand Government. (2025). *Housing in Aotearoa New Zealand: 2025*. https://www.stats.govt.nz/reports/housing-in-aotearoa-new-zealand-2025/#:~:text=Housing%20affordability%20–%20the%20affordability%20of,equivalised%20disposable%20income%20in%202024.

666 New Zealand Government. (2025). *Housing in Aotearoa New Zealand: 2025*. https://www.stats.govt.nz/reports/housing-in-aotearoa-new-zealand-2025/#:~:text=Housing%20affordability%20–%20the%20affordability%20of,equivalised%20disposable%20income%20in%202024.

667 New Zealand Government. (2025). *Housing in Aotearoa New Zealand: 2025*. https://www.stats.govt.nz/reports/housing-in-aotearoa-new-zealand-2025/#:~:text=Housing%20affordability%20–%20the%20affordability%20of,equivalised%20disposable%20income%20in%202024.

668 New Zealand Government. (2025). *Housing in Aotearoa New Zealand: 2025*. https://www.stats.govt.nz/reports/housing-in-aotearoa-new-zealand-2025/#:~:text=Housing%20affordability%20–%20the%20affordability%20of,equivalised%20disposable%20income%20in%202024.

669 Cox, W. (2025). *Demographia International Housing Affordability: 2025 Edition*. https://www.chapman.edu/communication/_files/Demographia-International-Housing-Affordability-2025-Edition.pdf

670 Coastes, B., Moloney, J., & Bowes, M. (2025, March 28). 25 years into a new century and housing is less affordable than ever. *The Conversation*. Retrieved February 2, 2026, from https://theconversation.com/25-years-into-a-new-century-and-housing-is-less-affordable-than-ever-250067

671 NSW Government. (n.d.). *Housing | Creating capacity to deliver more high-quality and diverse housing.* Retrieved February 2, 2026, from https://www.planning.nsw.gov.au/policy-and-legislation/housing

672 Ministry of Housing and Urban Development. (2025, December 23). *Going for Housing Growth programme*. Retrieved February 2, 2026, from https://www.hud.govt.nz/our-work/going-for-housing-growth-programme

7.2.2 Housing informality

Many Pacific Island countries are experiencing the proliferation of low-income and under-serviced informal settlements. These settlements are becoming a permeant feature of urban areas, often formed in peri-urban areas, on customary land and marginal, hazard-prone land with poor tenure security and inadequate infrastructure, making them highly vulnerable to climate change, flooding, and tropical cyclones.[673] These settlements are often built from temporary or salvaged materials, though some have become more permanent (semi-permanent) over time as residents establish their homes, creating a mix of traditional and modern materials (e.g., corrugated metal roofing). Key drivers and challenges include high rural-to-urban migration, lack of access to affordable formal housing, and limited land available for urban expansion, resulting from a combination of economic development and land issues such as landowner disputes, challenging terrain, and limited land tenure options.[674] About 20–50% of the population in Melanesian capitals are estimated to live in such areas.[675] Residents, particularly women, face high risks of violence. In some places like Vanuatu and Papua New Guines, forced evictions from private or state land leave families in limbo and disrupt incomes and children's education.

Action measures for informal settlements in the Pacific Islands are increasingly focused on climate-resilient upgrading**,** participatory planning**,** and securing land tenure rather than relocation. Key initiatives involve blending traditional knowledge with modern engineering such as nature-based solutions (e.g., using community gardens, constructing wetlands, restoring mangrove habitats, creating green open spaces to manage water and improve food security) and upgrading infrastructure to withstand extreme weather. Informal settlements upgrading programmes often adopt a multi-level governance approach. For instance, in Fuji, the Ministry of Local Government leads the informal settlements upgrading programme, collaborating with the Ministry for Housing on scheme and subdivision plan approvals. Municipal Councils assist with upgrades and sanitation services. Provincial Councils receive central funding and coordinate activities at that level, while district Municipal Councils serve as the Local Authority for urban and rural areas.[676] Strategies include incremental upgrades and customary land partnership to provide residents with legal security and access to services. In Papua New Guinea, the National Capital District is partnering with the National Housing Corporation to transition informal areas into formal suburbs with proper infrastructure.

673 Habitat III. (2016). *Habitat III Regional Report for Asia and the Pacific.* https://habitat3.org/wp-content/uploads/Habitat-III-Regional-Report-Asia-Pacific.pdf

674 Habitat III. (2016). *Habitat III Regional Report for Asia and the Pacific.* https://habitat3.org/wp-content/uploads/Habitat-III-Regional-Report-Asia-Pacific.pdf; UN-Habitat. (2020). *National Urban Policy: Pacific Region Report.* https://unhabitat.org/sites/default/files/2020/06/pacific_nup_report_web.pdf

675 Habitat III. (2016). *Habitat III Regional Report for Asia and the Pacific.* https://habitat3.org/wp-content/uploads/Habitat-III-Regional-Report-Asia-Pacific.pdf

676 UN-Habitat. (2020). *National Urban Policy: Pacific Region Report.* https://unhabitat.org/sites/default/files/2020/06/pacific_nup_report_web.pdf

7.2.3 Climate vulnerability

Although the Oceania region accounts for slightly more than 1% of total global greenhouse gas emissions,[677] it is among the most vulnerable areas to climate change in the world.[678] About 90% of the Pacific population live within 5 kilometres of the coast. Climate change is causing severe impacts in Oceania, from ocean surface warming (three times faster than the global average) to rapid sea-level rise causing coastal inundation and salt water intrusion, intensified tropical cyclones, and severe droughts.[679] The region is projected to have more extremely hot days and warm nights by 2030.[680] By 2090, extreme rainfall that once happened every 20 years during 1986-2005 could occur every 7–10 years with a very low emissions scenario, or every 4–6 years with a very high emissions scenario. In the South Pacific sub-region, tropical cyclone rainfall intensity is likely to rise, while the North Pacific may experience fewer tropical cyclones but greater intensity and associated rainfall.[681]

Australia faces intense heatwaves, drought, and fire risks, while Pacific islands experience increased cyclone intensity and habitat loss. Low-lying nations like Tuvalu, Kiribati, and the Marshall Islands face existential threats to land and livelihood, e.g., displacement of communities and declined access to water, food, health, and education.[682] Key drivers include a combination of global greenhouse gas emissions and localised, high-intensity human activity, particularly the burning of fossil fuels (coal, oil and gas for electricity and transport), deforestation, agriculture and industrial processes (e.g., mining). Climate vulnerability levels, however, differ—distinct environmental, social, and economic factors shape each nation's capacity to mitigate climate risks. Factors like population growth, urbanisation, migration, lack of planning controls, inadequate infrastructure, and ecosystem degradation contribute to climate change and disaster risk, often leading to fragmented settlements with heightened exposure to hazards and increased vulnerability.[683]

677 Pacific Islands Forum. (2022). *2050 Strategy for the Blue Pacific Continent.* https://forumsec.org/2050

678 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030.* https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

679 Pacific Islands Forum. (2022). *2050 Strategy for the Blue Pacific Continent.* https://forumsec.org/2050

680 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030.* https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

681 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030.* https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

682 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030.* https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

683 The World Bank. (2025). *Livable Pacific Cities and Towns: Urbanization Strategies for Resilience, Sustainability, and Inclusion.* https://openknowledge.worldbank.org/entities/publication/60e27039-fd9a-4b1e-a0d2-74e043066f85

In response, there is increased focus on disaster risk reduction, climate adaptation, and resilience strategies such as using nature-based solutions (Figure 7.3), building coastal defences, improving water management, and implementing early warning systems for natural disasters. Key regional policies include the *Framework for Resilience Development in the Pacific,*[684] established in 2016, and the *2050 Strategy for the Blue Pacific Continent*[685] launched in 2022. These policies outline strategic goals, focus areas, and collective actions for all countries in the region to address climate change and disaster impacts. At the national level, climate actions in many countries have incorporated the regional integrated approach to climate resilience. For instance, a key objective of the *Solomon Islands National Climate Change Policy 2023-2032* is to achieve its national obligations to meet regional and international commitments through conducting climate change assessments and supporting national and international reporting obligations.[686] Australia is implementing a wide range of policies and programmes to mitigate and adapt to climate impacts.[687] Australia is a key international partner for climate action in Oceania, with focus on accelerating the transition to renewable energy, implementing nature-based solutions, and enhancing disaster resilience. Australia also plays a central role in financing and supporting Pacific Island nations.[688]

684 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030.* https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

685 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030.* https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

686 Solomon Islands Government Ministry of Environment Climate Change and Disaster Management. (2023). *Solomon Islands National Climate Change Policy 2023-2032.* https://www.usp.ac.fj/pace-sd/wp-content/uploads/sites/80/2024/11/Solomon-Islands-National-Climate-Change-Policy-2023-2032.pdf

687 Australian Government Department of Climate Change, Energy, the environment and Water. (2025, November 27). *Australia's climate change action*. Retrieved January 23, 2026, from https://www.dcceew.gov.au/climate-change/action

688 Australian Government Department of Climate Change, Energy, the environment and Water. (2025, January 28). *Australia's international climate and clean energy partnerships*. Retrieved January 29, 2026, from https://www.dcceew.gov.au/climate-change/international-climate-action/international-partnerships

Figure 7.3. Public spaces along the Green Link in Auckland, New Zealand

7.3 Smart city development

Smart city development in Oceania is characterised by uneven adoption of technology, with a divide between advanced, tech-driven urban centres and smaller or less-resourced municipalities. Australia leads the region, with 21% of Australian local councils piloting smart city projects, and 42% in strategy and development stages through initiatives focused on data-driven planning, Internet of Things (IoT) sensors, and sustainable infrastructure. While Australia and New Zealand's major cities (e.g., Auckland, Canberra, Sydney, Melbourne) are leveraging technology to advance urban liveability and digital twins, the broader region faces challenges, including economic, technical, and institutional barriers, e.g., high development costs, lack of standardisation, and a significant digital divide, particularly in Pacific Island nations.

A key characteristic of this smart sustainability transformation is a people-centric approach, which ensures that technological innovations are implemented to deliver positive outcomes within communities, rather than serving merely as experimental platforms for emerging technologies. In 2016, Australia launched the *Smart Cities Plan*, aiming to harness technological innovation to enhance urban liveability, prosperity, and sustainability. The plan identifies three pillars: Smart Investment, Smart Policy, and Smart Technology.[689] Aligning with this national plan, local governments have developed smart city strategies and initiatives to address their specific urban challenges. For instance, the City of Sydney (Box 7.1) defines smart city development as a smart transformation process that "puts technology and data to work to make better decisions, navigate uncertainty and deliver better outcomes for the city's diverse community of residents,

689 Australian government Department of the Prime Minister and Cabinet. (2016). *Smart Cities Plan*. https://ssroc.nsw.gov.au/wp-content/uploads/2016/06/Smart_Cities_Plan.pdf

workers, visitors and businesses".[690] In Melbourne, the Data in the Park programme (Figure 7.4) uses sensors and advanced data analytics to monitor park usage patterns and environmental conditions. The rich data insights help inform public open space planning, management, and operation.[691]

Figure 7.4. Sensors installed in Royal Park in Melbourne, Australia

In New Zealand, at the national level, a key policy driver for digital transformation is the *Digital Strategy for Aotearoa* launched in 2022. Its vision is to enable New Zealand's people, communities, economy, and environment to flourish and prosper in the digital era.[692] Smart city strategies have been developed at local government level. For instance, the *Smart Christchurch Strategy* (Box 7.2) explores new technology and innovative trials to deliver rapid proof of concepts to help support the city's vision for "a vibrant, prosperous and sustainable 21st century city, and that it supports a better quality of life for citizens".[693]

Smart city development in Pacific Island countries focus on enhancing ICT infrastructure and digital connectivity. Many countries in this sub-region, e.g., the Solomon Islands, Papua New Guinea, and Micronesia, pay the highest prices globally of broadband internet, but internet speed is often slow and capped at low monthly averages. This can lead to significant developmental challenges, especially during disasters or sudden shocks like the COVID-19 pandemic.[694] To address this issue and advance sustainable development in Pacific Island countries, the Smart Islands initiative has been developed to bridge the digital divide (Box 7.3). More recently, the sub-region is building the foundation for digital economy by promoting digital entrepreneurship and trade.[695]

690 City of Sydney. (2020). *Smart City Strategic Framework*. https://www.cityofsydney.nsw.gov.au/strategies-action-plans/smart-city-strategic-framework

691 Yuen, B., Chan, F., Yang, X., & Lim, K. (2024). *Smart Sustainability Transformation Playbook*. World Scientific.

692 New Zealand Government. (2022). *The Digital Strategy for Aotearoa*. https://www.digital.govt.nz/assets/Digital-government/Strategy/Digital-Strategy-for-Aotearoa-English-PDF.pdf

693 Christchurch City Council. (2022). *Smart Christchurch Strategy 2022-2025*. https://ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Strategies/Smart-Christchurch-Strategy-2022-25.pdf

694 United Nations. (2021). December 13). *Smart Islands Initiative: An affordable, accessible digital future for Pacific communities*. Retrieved February 5, 2026, from https://pacific.un.org/en/164892-smart-islands-initiative-affordable-accessible-digital-future-pacific-communities

Box 7.1. Sydney, Australia: Smart City Strategic Framework

In 2020, Sydney introduced the Smart City Strategic Framework that adopts a people-centric, outcomes-focused approach to smart city transformation. The framework is a playbook that defines Sydney's smart city development vision and guides the design and development of a city where technology is deeply integrated into daily life to address real needs and adapt flexibly as contexts and needs evolve. The vision is to develop Sydney as "a dynamic, responsive city, harnessing technology and data to enable collaborative innovation and create a thriving, inclusive and resilient future for all". Five interconnected strategic outcomes are envisaged. Under each strategic outcome, the framework outlines the objective, priorities, and promising areas for actions. There are five layers of smart infrastructure, including sensors, data integration and analytics platforms, user interfaces, communication and connectivity networks, and physical landscape and infrastructure. Key enabling factors range from leadership and governance, funding and financing, partnership, standards, ethical innovation, culture, to monitoring and measurement. The strategic framework was developed based on a comparative study of global good practices and co-design workshops with key stakeholders (local government, state government, industry, startups, academia, not-for-profits and community).

Image source: City of Sydney

Source: City of Sydney. (2020). *Smart City Strategic Framework*. https://www.cityofsydney.nsw.gov.au/strategies-action-plans/smart-city-strategic-framework

695 United Nations. (2025). *Digital Economy Report Pacific Edition 2024: Promoting Digital Entrepreneurship and Trade*. https://unctad.org/publication/digital-economy-report-pacific-edition-2024

Box 7.2. Christchurch, New Zealand: Smart Christchurch Strategy

Christchurch initiated the Smart Christchurch Programme in 2016. In 2022, the Smart Christchurch Strategy 2022-2025 was developed to signify a more mature stage of the programme and establish strategic direction for the next three years. This strategy aligns with the global trend of smart city development that prioritises people-centric approaches to achieving community outcomes.

The vision of Smart Christchurch is "to promote Ōtautahi-Christchurch as an exemplar open and connected city, showcasing solutions that make life better and that are replicated by others." The programme is designed to rapidly deliver proof-of-concept projects by testing innovative solutions, to fail fast when needed, in a de-risked environment, allowing for quick learning, adaptation, and measurement. The programme uses smart technologies and sensors to gather real-time city data to enable informed responses. In addition to prototypes and trials, the programme also develops larger citywide and regional strategies to support the wider innovation ecosystem. The programme identifies two overarching focus areas for smart transformation—sustainability and climate change, encompassing air, water, waste, mobility, energy, and economic development. In collaboration with private sector partners, over 20 smart initiatives have been developed across various phases, including exploration, ideation, trial, and implementation (e.g., SmartView, Smart Bins, Bin Good Game). Implementation progress and success will be measured by four broad categories of indicators:

- Positive change in citizen's lives.
- Operational efficiency gains for the city council.
- Accelerated momentum in key council strategies.
- Integration of innovation and smart technology into solutions and council's operating models.

Image source: Christchurch City Council

Source: Christchurch City Council. (2022). *Smart Christchurch Strategy 2022-2025*. https://ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Strategies/Smart-Christchurch-Strategy-2022-25.pdf; Christchurch City Council. (n.d.). *Smart Christchurch*. Retrieved February 3, 2026, from https://ccc.govt.nz/the-council/future-projects/smart-christchurch

Box 7.3. Pacific Island Countries: Smart Islands Initiative

The Smart Islands Initiative is a joint UN programme led by the International Telecommunication Union and is part of the broader Smart Villages and Smart Islands programme first piloted in Niger. Launched in 2022, the Smart Islands initiative in the Pacific aims to enhance the well-being and livelihoods of disadvantaged island communities by delivering internet connectivity and an integrated suite of scalable and sustainable services through partnerships and technology.

The initiative has been implemented in nine Pacific Islands countries, including Fiji, Kiribati, Micronesia, Nauru, Papua New Guinea, Samoa, Tonga, Tuvalu and Vanuatu with over 90 satellite ground terminals provided. A whole-of-government approach is adopted to facilitate cross-sector collaboration and to address user needs, flexibility, sustainability, and scalability. The initiative focuses on four pillars: enhancing broadband connectivity, making internet access affordable, improving digital skills, and providing vital digital services to meet local priorities. The initiative targets key sectors, including health, education, agriculture, early warning and disaster response, digital financial services, tourism, and fishing. The aim is to transform small islands into smart islands where quality of life is improved by enhanced connectivity to essential ICT-enabled services. The project also promotes interoperability, cooperation, and a comprehensive, demand-driven response to meet the Sustainable Development Goals, ensuring that no one is left behind in the digital age.

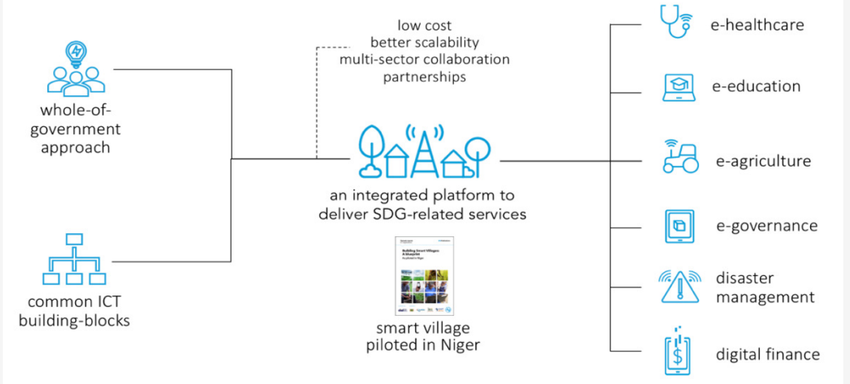


Image source: International Telecommunication Union

Source: International Telecommunication Union. (n.d.). *Smart Islands*. Retrieved February 5, 2026, from https://www.itu.int/en/ITU-D/ICT-Applications/Pages/smart-islands.aspx; United Nations. (2021). December 13). *Smart Islands Initiative: An affordable, accessible digital future for Pacific communities*. Retrieved February 5, 2026, from https://pacific.un.org/en/164892-smart-islands-initiative-affordable-accessible-digital-future-pacific-communities

Despite progress in smart city development in the Oceania region, individual countries are facing specific challenges in their smart transformation pathways. In Australia, smart city development faces ongoing challenges in funding and financing, data privacy and security, governance, wider application and scaling up, and spatial issues related to urban sprawl.[696] New Zealand's smart city development progress is hindered by issues such as fragmented data, funding, limited use of new proven technologies, and the need to shift from trials to meaningful actions.[697] Internet connectivity, affordability and access to essential digital devices remain critical challenges for Pacific Island counties.[698]

Plans for scaling smart city development in Oceania are developed by two different approaches. First, Australia and New Zealand do not have a standalone, national plan for scaling up smart city development, largely reflecting the fragmented governance structure in these countries. Plans for advancing smart city development are primarily developed at the local government level. For example, the City of Sydney integrates smart transformation actions into ten strategic directions of the city's long-term strategic plan. Measurement indicators include internet access at home, jobs and worker productivity of the innovation economy, Sydney's position on the global Destination Sustainability Index, among others.[699]

Second, in Pacific Island countries, a regional approach is adopted to scaling the development of smart islands. Under the *2050 Strategy for the Blue Pacific Continent*, the thematic area of Technology and Connectivity focuses on addressing the need for a well-connected region where "all Pacific people have access to affordable, reliable, resilient, safe, secure, inclusive, and interoperable ICT services, including e-services and digital economy".[700] Implementation progress is measured by four broad categories of indicators, ranging from access to ICT services (e.g., mobile phone ownership, fixed internet broadband subscriptions), digital literacy (e.g., proportion of individuals sending email with a file, software installation), e-services (e.g., e-government, online service), to cyber security (e.g., National Cybersecurity Index, cybersecurity policy).[701]

696 City of Sydney. (2020). *Smart City Strategic Framework*. https://www.cityofsydney.nsw.gov.au/strategies-action-plans/smart-city-strategic-framework; Yigitcanlar, T., Kankanamge, N., Butler, L., Vella, K., & Desouza, K. C. (2020). *Smart Cities Down Under: Performance of Australian Local Government Areas*. Queensland University of Technology. https://eprints.qut.edu.au/136873/1/Smart_Cities_Down_Under_2020_Report.pdf

697 Smart City New Zealand. (2025, May 16). *Why New Zealand's cities are falling behind in the Smart City race*. Retrieved February 5, 2026, from https://www.smartcity.co.nz/blog/why-new-zealands-cities-are-falling-behind-in-the-smart-city-race/; Francis, R. (2025, March 5). Closing New Zealand's Infrastructure Gap: Smart Infrastructure as the Key to Unlocking Future Opportunities. *Smart Cities Council*. Retrieved February 5, 2026, from https://www.smartcitiescouncil.com/news/post/unlocking-opportunities-in-new-zealand-the-role-of-smart-infrastructure

698 United Nations. (2025). *Digital Economy Report Pacific Edition 2024: Promoting Digital Entrepreneurship and Trade*. https://unctad.org/publication/digital-economy-report-pacific-edition-2024

699 City of Sydney. (2025). *Community Strategic Plan: Delivering Sustainable Sydney 2030-2050*. https://www.cityofsydney.nsw.gov.au/strategies-action-plans/community-strategic-plan

700 Pacific Islands Forum. (2022). *2050 Strategy for the Blue Pacific Continent*. https://forumsec.org/2050

701 Pacific Islands Forum. (n.d.). *Blue Pacific 2050 Dashboard*. Retrieved January 29, 2026, from https://blue-pacific-2050.pacificdata.org/people-centred-development

7.4 Low carbon development

Low carbon city development in Oceania is characterised by a strong, policy-driven transition in Australia and New Zealand, contrasted with adaptation-focused, community-level resilience projects in the Pacific Island nations. The focus is on building climate resilience, maintaining economic growth, and improving quality of life through climate change mitigation measures, climate resilient infrastructure development, and technology.[702] Oceania has the lowest regional transport CO_2 emissions, but passenger vehicle reliance and high-carbon freight in Australia and New Zealand contribute significantly to regional totals. Central to the regional approach is the implementation of the *Framework for Resilience Development in the Pacific* (FRDP).

Established in 2016, the FRDP provides a high-level regional policy framework to guide different stakeholder groups to enhance resilience to climate change and disasters towards three strategic goals: strengthened integration adaptation and risk reduction, low carbon development, and strengthened disaster preparedness, response and recovery.[703] The FRDP establishes objectives to enhance end-use energy consumption efficiency, reduce carbon intensity of development activities, promote conservation of terrestrial and marine ecosystems, and increase energy infrastructure resilience across Pacific Island countries and territories.[704] Several priority actions are outlined such as fostering a supportive policy and institutional environment for the formation of public–private partnerships to facilitate the growth of independent power producers and community-based projects; ensuring that all low carbon initiatives address country and community priorities equitably and are gender responsive; securing technical and financial resources to develop and implement Nationally Determined Contributions targets and long-term low carbon strategies; and creating programmes to encourage private sector investment in low carbon development.[705]

Future planning for low carbon development is guided by the *2050 Strategy for the Blue Pacific Continent*. Endorsed in 2022, the strategy provides a collective, long-term framework for integrated actions towards the vision of a sustainable and resilient Pacific Region.[706] A core thematic area of the 2050 strategy is Climate Change and Disasters,

702 Pacific Islands Forum. (2022). *2050 Strategy Implementation Plan 2023-2030*. https://forumsec.org/sites/default/files/2024-03/2050-Strategy-Implementation-Plan_2023-2030.pdf

703 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030*. https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

704 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030*. https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

705 Pacific Community. (2016). *Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management (FRDP) 2017 – 2030*. https://gsd.spc.int/frdp/assets/FRDP_2016_Resilient_Dev_pacific.pdf

706 Pacific Islands Forum. (2022). *2050 Strategy for the Blue Pacific Continent*. https://forumsec.org/2050

which seeks to enhance the region's climate resilience through implementing agreed, culturally appropriate actions that address climate change and current and future disasters like extreme weather events, cyclones, droughts, floods, sea level rise, and ocean acidification.[707] This thematic area also addresses issues such as climate finance, disaster risk reduction, loss and damage, and disaster-related mobility, like relocation, migration, and displacement. For climate and disaster resilience, the implementation plan sets out the goal for all Pacific people to live safe, secure, and prosperous lives, resilient to the impacts of climate change and disasters. The desired trajectory is towards a just transition to low carbon, low emissions and climate resilient infrastructure, development and technology, developing climate actions, from policy and frameworks, system and institutional strengthening, capacities and capabilities, financing, to partnerships, engagement and advocacy.[708] Low carbon development is emerging in Pacific Island countries. For instance, Solomon Islands has developed the low carbon development pathway to support the vision to maintain net zero emissions across all sectors by 2050 with equitable economic growth and resilience (Box 7.4).[709] Progress is monitored at the regional level using the Blue Pacific 2050 Dashboard (Box 7.7).[710]

Major Australian capital cities—Melbourne, Sydney, Brisbane, and Adelaide—have been carbon neutral for years. Australia has established legislated targets to reduce greenhouse gas emissions by 43% below 2005 levels by 2030 and reach net zero by 2050. Sydney has set a zero-CO_2 emissions target by 2050 and is implementing green infrastructure that sequestrates 18,000 metric tons of CO_2 annually. Net zero programmes and policies have been developed across all levels of government in Australia, including federal, state, and municipal (Box 7.5). Australia's plans for scaling up low carbon development centre on transitioning the energy sector, building a strong net zero economy, strengthening Australia's global climate position, driving climate adaptation and resilience. Emissions reduction progress is monitored and reported in various inventories such as the National Inventory Reports, National Greenhouse Gas Inventory: Quarterly Updates, State and Territory Greenhouse Gas Inventories, and National Inventory by Economic Sector.[711]

707 Pacific Islands Forum. (2022). *2050 Strategy for the Blue Pacific Continent*. https://forumsec.org/2050

708 Pacific Islands Forum. (2022). *2050 Strategy Implementation Plan 2023-2030*. https://forumsec.org/sites/default/files/2024-03/2050-Strategy-Implementation-Plan_2023-2030.pdf

709 Solomon Islands Government Ministry of Environment Climate Change and Disaster Management. (2023). *The Solomon Islands Long-Term Low Emissions Development Strategy (LEDS)*. https://solomons.gov.sb/wp-content/uploads/2023/10/SI-LEDS.pdf

710 Pacific Islands Forum. (n.d.). *Blue Pacific 2050 Dashboard*. Retrieved January 29, 2026, from https://blue-pacific-2050.pacificdata.org/people-centred-development

711 Australian Government. (2025, November 27). *Australia's climate change action*. Retrieved February 6, 2026, from https://www.dcceew.gov.au/climate-change/action

Box 7.4. The Solomon Islands Low Emissions Development Strategy

The Solomon Islands is facing increasing vulnerability to climate change and natural disasters. It ranks among the world's top 20 countries most economically at risk from multiple hazards such as tropical cyclones, volcanic eruptions, earthquakes, tsunamis, landslides, floods, and droughts. The country is projected to have achieved net negative emissions in 2022, primarily due to the extensive coverage of tropical forests. Forests cover approximately 87% of the nation's total land area (25,000 km2 out of 29,000 km2). The carbon dioxide removed from the atmosphere by these forests surpasses the emissions produced by human activities.

In 2023, the Long-Term Low Emissions Development Strategy (LEDS) was developed to provide a vision and a pathway for Solomon Islands to achieve its long-term economic, environmental, and social goals. To support the vision of maintaining net zero emissions by 2050, the LEDS identifies 18 actions across six sectors—energy, transport, forestry and land use, agriculture, livestock, and waste management—to lower emissions with an equitable and resilient pathway. This strategy is supplemented by the National Climate Change Policy 2023-2032, which sets out the short-term objectives and strategic actions. A central component of these national strategies is to use climate actions as an opportunity to strengthen the nation's low emission status and enhance economic growth and resilient development. Among all the climate actions, the actions that reduce forest degradation and loss are considered to have the greatest impact on facilitating net national emissions. A significant enabling mechanism identified is the development of carbon markets, especially forest carbon markets, which can direct resources and revenue to support the low emissions pathway. Notably, forest carbon markets are expected to provide income for local communities, such as through blue carbon opportunities from sea grass, mangrove, seaweed, and other nature-based transactions, while ensuring the preservation of forest and mangrove ecosystems.

Image source: Pacific Islands Forum

Source: Solomon Islands Government Ministry of Environment Climate Change and Disaster Management. (2023). *The Solomon Islands Long-Term Low Emissions Development Strategy (LEDS)*. https://solomons.gov.sb/wp-content/uploads/2023/10/SI-LEDS.pdf; Solomon Islands Government Ministry of Environment Climate Change and Disaster Management. (2023). *Solomon Islands National Climate Change Policy 2023-2032*. https://solomons.gov.sb/solomon-islands-national-climate-change-policy-nccp-2023-2032-and-long-term-low-emission-development-strategy-lt-leds/

Box 7.5. Net Zero Initiatives in Australia

To reach net zero emissions by 2050, decarbonisation programmes and policies have been developed at various government levels. At the national level, the *Net Zero Plan* sets out emissions reduction plans and pathways for the whole economy, covering 6 sectors, including electricity and energy, industry, resources, built environment, agriculture and land, and transport. Five decarbonisation priorities are identified:

Clean electricity across the economy.
Lowering emissions by electrification and efficiency.
Expanding clean fuel use.
Accelerating new technologies.
Net carbon removals scaled up.

Several funding schemes are established at the national level to facilitate decarbonisation such as a A$5 billion Net Zero Fund to support major investments in decarbonisation technologies, and over A$170 million to help households and communities to decarbonise, improve energy efficiency, and expand electric vehicle charging. Aligning with the national plan, states and territories have established both short- and long-term emissions reduction goals, supported by policies and focused investments to facilitate the optimal transition for their areas. Local governments support emissions reductions and climate adaptation through land use planning, local transport, waste and recycling services, and managing municipal buildings and infrastructure, directly contributing to lowering emissions and strengthening community capacity. Low carbon precincts are being implemented in Barangaroo South, Sydney, and Arden, Melbourne.

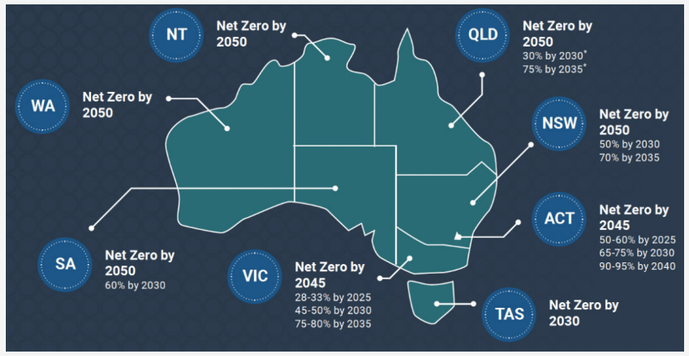


Image source: Australian Government

Source: Australian Government. (2025). *Australia's Net Zero Plan*. https://www.dcceew.gov.au/sites/default/files/documents/net-zero-report.pdf; Infrastructure NSW. (n.d.). *Decarbonising Infrastructure Delivery | Delivering on an upfront embodied carbon target – Barangaroo South precinct*. https://www.infrastructure.nsw.gov.au/media/cl3pixz1/case-study_barangaroo-south-precinct.pdf; Victorian Planning Authority. (2022). *Arden Structure Plan*. https://vpa-web.s3.ap-southeast-2.amazonaws.com/wp-content/uploads/2022/07/Arden-Precinct-Arden-Structure-Plan-July-2022-Approved-and-Gazetted..pdf

Similarly, New Zealand has announced legislated targets to reach net zero by 2050. New Zealand has established two Nationally Determined Contribution (NDC) targets for the whole economy. For example, NDC1 aims to cut emissions by 50% from 2005 levels by 2030; NDC2 targets a 51–55% reduction below 2005 levels by 2035.[712] To guide the transition towards net zero, New Zealand government has developed and updated the five-yearly national emissions reduction plans. The first Emissions Reduction Plan (ERP1) was established in 2022, outlining the roadmap to meet emissions reduction target by 2025.[713] The second Emissions Reduction Plan (ERP2) was released in 2024 and recently amended it in January 2026. The ERP2 provides a comprehensive range of policies and initiatives to reduce emissions across all sectors of the economy accelerate the adoption of new technologies and promote innovation across seven sector policies (energy, building and construction, transport, agriculture, forestry and wood processing, non-forestry removals, and waster) to meet decarbonisation targets by 2030.[714]

The ERP2 adopts a technology-led approach, which leverages technology and innovation to accelerate New Zealand's transition to net zero while increasing productivity, exports, market access, and jobs. Emissions reduction progress is tracked and reported quarterly.[715] Funding policies and initiatives focus on increasing green investment and removing market barriers. Aligning with the national emissions reduction plans, several cities such as Auckland (Box 7.6), Dunedin, and Porirua, have developed low-carbon city strategies to guide local actions to meet their emissions reduction targets.

712 New Zealand Government. (2025). *Greenhouse gas emissions targets and reporting*. Retrieved January 30, 2026, from https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reductions/emissions-reduction-targets/greenhouse-gas-emissions-targets-and-reporting/; New Zealand Government. (2023). *Nationally Determined Contribution*. Retrieved January 30, 2026, from https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/nationally-determined-contribution/#the-second-nationally-determined-contribution

713 New Zealand Government Ministry for the Environment. (2022). *Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's First Emissions Reduction Plan*. https://environment.govt.nz/assets/publications/Aotearoa-New-Zealands-first-emissions-reduction-plan.pdf

714 New Zealand Government Ministry for the Environment. (2026). *Our journey towards net zero New Zealand's second emissions reduction plan 2026–30*. https://environment.govt.nz/assets/publications/climate-change/ERP2/New-Zealands-second-emissions-reduction-plan-Amended-January-2026.pdf

715 New Zealand Government Ministry for the Environment. (2025, September 1). *Government Target 9 quarterly reporting*. Retrieved February 6, 2026, from https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reductions/emissions-reduction-targets/government-target-9-quarterly-reporting/

Box 7.6. Auckland, New Zealand: Low Carbon Community Development

In 2018, Auckland launched the Becoming a Low Carbon Community – An Action Plan. This action plan works together with two precedent citywide policies, the *Auckland Plan* (a 30-year strategic plan) and the *Low Carbon Auckland: Auckland's Energy Resilience,* to lay the foundation for Auckland's transformation to a highly energy resilient, low carbon city. These plans set an aspirational target of a 40% emissions reduction by 2040 (based on 1990 levels). The Action Plan adopts a community-driven approach to empower residents, businesses and communities to support decarbonisation across seven action areas:

- Championing change: Developing a low carbon network with regular get-togethers designed to empower and enable local climate champions to meet Auckland's low carbon targets.
- Low carbon food: Supporting local food initiatives in Tamaki Makaurau / Auckland through Kai Whau by creating a free food map, connecting surplus food to those in need, reducing food waste, eliminating single-use plastic bags, and promoting composting.
- Low carbon homes and buildings: Supporting the development and uptake of energy-efficient homes through increased delivery of the Home Energy initiative.
- Shop low carbon: Promoting the carbon footprint tool to help residents track emissions and use this data to guide Low Carbon Network projects.
- Low carbon economy: Developing a low carbon economy network to help businesses and social enterprises adopt low carbon business models and practices.
- Low carbon transport: Supporting the development of shared workplace hubs which are within 20-minute travel by walking, cycling and public transport, and promoting the use of sustainable travel modes.
- Green spaces: Encouraging residents to support tree planting activities to increase green spaces and the resulting carbon capture capacity, biodiversity, and well-being.

In each action area, specific targets, actions, and flagship low carbon projects are developed. The plan also suggests a monitoring framework for measuring progress against these targets.

EcoHub and Store – low carbon business model in Auckland

Image source: Auckland Council

Source: Auckland Council. (2018). *Becoming a Low Carbon Community – An Action Plan*. https://www.aucklandcouncil.govt.nz/content/dam/ac/docs/about-council/local-boards/whau/whau-becoming-low-carbon-community.pdf

Box 7.7. Blue Pacific 2050 Dashboard

The Blue Pacific 2050 online dashboard presents and visualises data in participating countries across seven thematic areas of the 2050 Strategy for the *Blue Pacific Continent*. For each thematic area, indicators are aligned with specific objectives established in the Implementation Plan and supplemented by regional and global monitoring frameworks identified by the 2050 Monitoring, Evaluation and Learning Working Group. The data presented has been compiled from multiple sources, such as national household census and survey collections, civil registry records, health information systems, regional education assessments, satellite imagery, SDG custodian agencies, and published reports from countries and development partners.

For the thematic area of Climate Change and Disasters, the dashboard summarises implementation progress measured by three indicators: reduced economic loss attributed to disasters, increase renewable energy share, increase installed renewable electricity, and colour coded (green, orange, red). Across the 18 Pacific Forum countries, only a small share has achieved or is on track to achieve the targets (indicated by green colour) for reduced economic loss, increased renewable energy share, and increased installation of renewable electricity-generating capacity. About one-third of the countries are progressing but the rate of change is not sufficient to meet the target (indicated in orange), while a notable share is not progressing towards the target (indicated in red).

Image source: Pacific Islands Forum

Source: Pacific Islands Forum. (n.d.). *Blue Pacific 2050 Dashboard*. Retrieved January 29, 2026, from https://blue-pacific-2050.pacificdata.org/people-centred-development

Although countries in Oceania are implementing climate actions at both regional and local levels, progress towards decarbonisation and climate resilience remains inadequate. Australia's net zero transition faces significant challenges in achieving 82% renewable energy by 2030 (energy sector accounts for about 80% of Australia's emissions), hampered by slow infrastructure deployment, supply chain constraints, and grid reliability issue.[716] Another challenge is intergovernmental coordination to

716 Wood, T. (2025, October 22). The stumbling block to our energy ambitions. *Financial Review*. Retrieved February 5, 2026, from https://www.afr.com/policy/energy-and-climate/the-stumbling-block-to-our-energy-ambitions-20251007-p5n0mx

accelerate city-level climate actions.[717] New Zealand's low carbon development progress is hindered by several interconnected issues such as the projected decline in domestic natural gas supply, the paradox of mining critical minerals, and the increasing battery wastes from electric vehicles and solar systems.[718] Low carbon development challenges in Pacific Island countries include infrastructure barriers (e.g., high costs and logistical issues for geographically isolated islands), capacity constraints (e.g., human resources, financing), and policy challenges (e.g., legal setbacks).[719]

717 Farsangi, E. N., & Morrison, G. (2024, November 13). Net Zero Cities: what Australia can learn from international success stories. *The Policymaker*. Retrieved February 5, 2026, from https://thepolicymaker.appi.org.au/net-zero-cities-what-australia-can-learn-from-international-success-stories/

718 Deloitte. (2025). *Accelerating Net-Zero: Unlocking New Zealand's climate potential*. https://www.deloitte.com/content/dam/assets-zone1/nz/en/docs/services/consulting/2025/ap-accelerating-net-zero.pdf

719 DeFreese, M. (2024, May 31). *The small island states making big strides towards 100% renewable energy. World Economic Forum*. Retrieved February 5, 2026, from https://www.weforum.org/stories/2024/05/small-island-states-making-big-strides-towards-net-zero/; Jena, L. P., & Chaturvedi, A. (2025). Renewable energy financing in the Pacific Island Countries. *Energy for Sustainable Development, 85*, 101642. https://doi.org/10.1016/j.esd.2024.101642

Chapter 8

Global Transition Trajectories

Chapter 8: Global Transition Trajectories

According to Euromonitor International, future urban trends are heavily focused on the need for innovative and sustainable solutions to enhance urban liveability, accelerate resilience, and foster efficiency.[720] Against the continued pressures of climate change and rapid expansion of urbanisation and internet usage, accelerating climate action, strategic planning and digital cities are some of the projected trends shaping cities in the coming decades. Three of these key drivers are discussed in this final chapter: urbanisation, technology and climate action. Although discussed separately, these forces are often interlinked, occurring at the same time.

8.1 Urbanisation, growing and shrinking cities

The United Nations has projected that a key driver is urbanisation. Urban growth is expected to continue. By 2050, 68% of the world's population is projected to live in urban areas; 90% of this growth will occur in developing Asia and Africa where smaller towns and cities are growing faster than major metropolises.[721] Urban growth is, however, uneven. While the number of new cities including megacities is expected to increase, some regions, notably Europe, East Asia, and North America, are experiencing shrinking cities where urban population is declining. Whether cities are growing or shrinking, the impact of urbanisation is pervasive—urbanisation is transforming how people live and how societies provide for housing, transport, and basic services.

Global transition trajectories demonstrate distinct patterns of divergence between mature urbanised and rapidly urbanising regions, shaped by different stages of economic development, demographic shifts, infrastructure maturity, and governance priorities (Table 8.1). In mature urbanised regions such as much of Europe, parts of East Asia, North America, Australia and New Zealand in Oceania, urban growth has largely stabilised, populations are ageing, and the dominant challenges relate to housing affordability, retrofitting ageing building stock, and renewing or optimising long-established infrastructure systems. In these contexts, urban policy and governance tend to focus on optimisation and transition towards sustainable, smart, low carbon development: improving energy efficiency, decarbonising existing urban systems, upgrading infrastructure for resilience and sustainability, and managing complex trade-offs between liveability, affordability, and climate goals through smart and sustainable urban planning.

Table 8.1. Regional urbanisation trajectories

Dimension	Mature regions	Rapidly urbanising regions
Region/country	Europe, parts of East Asia, North America, Australia, New Zealand	Africa, large parts of Asia, Latin America, Pacific Islands
Urban growth	Slow / stable	Fast / accelerating
Demographics	Ageing	Youthful
Economic development	Developed, high income	Developing, low income
Housing challenge	Affordability, retrofitting	Informality, access
Infrastructure challenge	Ageing assets	Basic provision gaps
Urban development priorities	Optimisation, sustainable transition	Sustainable urban planning, skills and capacity building

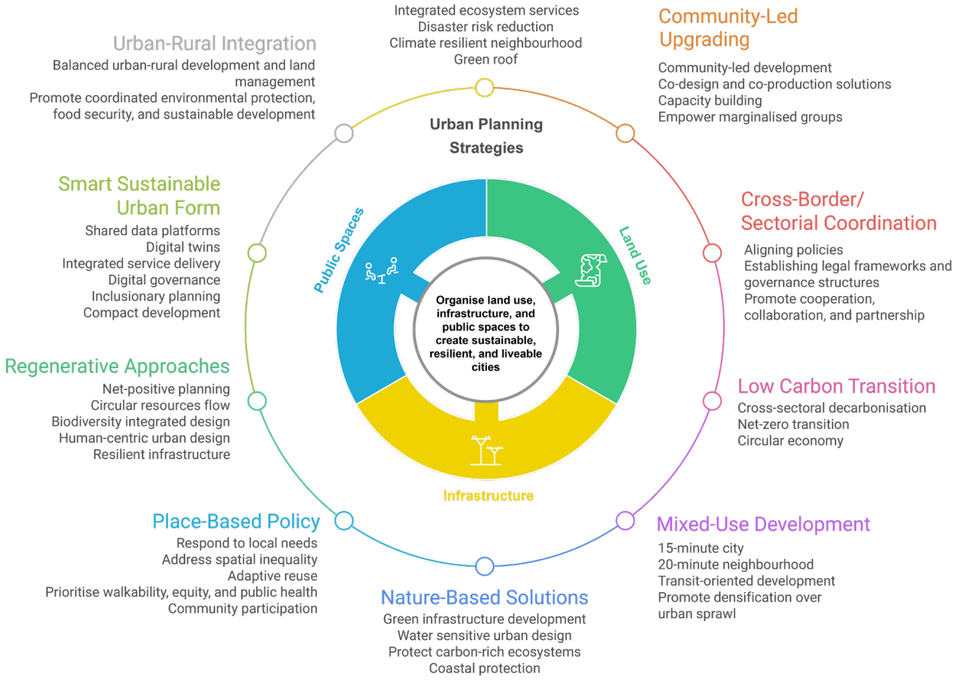
A key strategy is moving from outward, automobile-dependent expansion to high-density, mixed-use compact development that reduces resource consumption, e.g., the 15-minute city (Figure 8.1). Many older industrial cities are embarking on structural transformation, regenerating abandoned brownfields and disused built environments into compact, live-work-play spaces to increase land-use efficiency and create more socially equitable urban spaces. For example, Bilbao has invested in culture and built an iconic, wow-factor architecture, the Guggenheim Museum Bilbao, to transform a

720 Svidler, A. (2024, June 27). Key Trends Shaping the Future of Cities. *Euromonitor*. https://www.euromonitor.com/article/key-trends-shaping-the-future-of-cities

721 OECD (2025). *Africa's Urbanisation Dynamics 2025: Planning for Urban Expansion*. https://doi.org/10.1787/2a47845c-en; Dahiya, B. (2014, September). *Southeast Asia and sustainable urbanization*. Global Asia. https://www.globalasia.org/v9no3/feature/southeast-asia-and-sustainable-urbanization_bharat-dahiya; United Nations Economic and Social Commission for Asia and the Pacific. (2023). *Crisis resilient urban futures: The future of Asian and Pacific cities 2023*. United Nations. https://www.unescap.org/our-work/environment-development/cities-for-a-sustainable-future/asia-pacific-urban-forum; Matsumoto, T., & Daudey, L. (2014). *Urban green growth in dynamic Asia: A conceptual framework* (OECD Regional Development Working Papers No. 2014/12). https://doi.org/10.1787/5js7svlw8m0x-en

declining industrial city into a global tourism destination. Birmingham has repurposed a former custard factory into a hub for creative and digital businesses while London has turned the former Battersea power station into a mixed-use— residential, retail, and office complex, and a 19th-century concert hall into the Tate Modern art gallery. Others have used sport-based solutions in urban regeneration. Seoul has transformed ageing or abandoned sport venues into multifunctional, eco-friendly complexes to boost local economy and improve quality of life, e.g., Dongdaemun Design Plaza. Vancouver, London, among others, have leveraged the Olympic Games to drive urban regeneration, creating new homes, jobs, infrastructure and green spaces. The expanding focus on sustainability has spurred the development of green spaces and eco-friendly infrastructure and the adoption of clean energy solutions that foster equity and enhance resilience and well-being. Cities like Hamburg, Berlin, New York, Chicago, among others, have implemented green roofs and green schoolyards to reduce urban heat islands, manage stormwater, increase biodiversity and improve climate-resilience and community well-being in urban areas.

Figure 8.1. Planning for resilient, sustainable, liveable cities



By contrast, rapidly urbanising regions, particularly across Africa, large parts of Asia, Latin America, and small island nations in Oceania, continue to experience fast and often accelerating urban growth driven by natural increase and rural-to-urban migration. The critical pressures include housing shortages, proliferation of unplanned informal settlements, and strained public services and infrastructure such as transport, energy, water, and sanitation. In many cases, infrastructure has failed to keep pace with population growth, leading to increased disaster vulnerability, public health risks, social and economic inequality. Many countries are implementing sustainable urban planning to manage growth, prioritising infrastructure investment, especially in informal settlements, and strengthening institutional capacity and inclusive governance.

Key strategies include transit-oriented development (TOD), nature-based solutions and green infrastructure. Following the success of BRT in Curitiba, a growing number of cities are implementing TOD along BRT corridors to increase accessibility and reduce reliance on private vehicles, e.g., Jakarta, Lagos, Dar es Salaam, and Johannesburg. Combining green and "grey" (built) infrastructure and local materials is gaining popularity for enhanced resilience. For example, communities in Sril Lanka and Senegal, among others, are using mangrove restoration and permeable groynes made from local materials to address coastal erosion and create economic opportunities. Increasingly, priorities are shifting from managing growth alone to balancing inclusion, resilience, and long-term sustainable urban transformation. Emerging economies, e.g., China, are moving from low-level, rapid, point-axis edge expansion to high-density, compact development, often bypassing the slower development speed of Western counterparts. Indonesia is building a new sustainable, "smart forest city" capital (Nusantara Capital City, 256,000 hectares), with the aim for completion and net-zero emissions by 2045, through renewable energy and green transportation.

8.2 Technology and smart urban growth

A second driver is technology, with cities worldwide increasingly adopting smart technologies for urban management and innovation by enabling real-time data analysis—often through IoT sensors, AI, cloud platforms, and urban data hubs. These tools work towards improving quality of life, and the sustainability and efficiency of urban services, from mobility and energy to planning and public safety. Globally, smart city development is shifting from technology-led pilots towards more institutionally embedded, people-centred approaches that align digital investments with wider goals such as climate action, resilience, and social inclusion. Key strategies shaping these trends and trajectories include building interoperable digital infrastructure (e.g., shared platforms and digital twins), strengthening data governance and cybersecurity, scaling public–private partnerships and sustainable business models, and expanding digital inclusion so that smart services do not deepen existing inequalities (Figure 8.2).

Figure 8.2. Transitioning to smart cities

Globally, smart city development has become widespread but uneven. Most regions now engage in some form of smart city agenda, even if depth, scale, and institutionalisation vary significantly (Table 8.2). In Europe, East Asia, and leading cities in North America, technology adoption in smart city development is maturing and increasingly consolidated and embedded within long-term urban governance systems, supported by stable public funding, regulatory frameworks, and institutional capacity. Cities such as Vienna, Singapore, New York, and Toronto have moved beyond pilots towards citywide digital platforms that integrate mobility management, digital public services, urban data platforms, and participatory governance. In contrast, Africa, South Asia, Latin America, Central Asia, and Pacific Island cities are predominantly in emergent or ongoing phases, where smart city initiatives remain project-based, sector-specific, or externally driven, often focused on e-government, service efficiency, surveillance, or mobility management rather than systemic urban transformation. The Middle East and Oceania exhibit polarised trajectories: Gulf cities and Australian/New Zealand cities display advanced, infrastructure-heavy smart city systems, while smaller cities and Pacific Island nations lag significantly due to capacity and financing constraints. As a result, while a growing number of cities globally have actively implemented smart cities, only a smaller subset has achieved consolidation.

Table 8.2. Regional smart city development patterns

Region	Stage of Development	Systemic Pattern	Initiatives and Challenges
Africa	Emergent	Unconsolidated	Smart city initiatives are largely pilot-based and donor- or vendor-driven, focused on basic service delivery, digital government, and leapfrogging (e.g. Rwanda). Limited municipal capacity, financing constraints, and informality prevent consolidation into citywide systems.
Middle East	Ongoing	Polarised	Advanced, state-led smart city systems co-exist with exclusionary labour and housing structures. Cities such as Dubai, Abu Dhabi, and Riyadh show highly integrated digital governance and infrastructure, but benefits are unevenly distributed, especially for migrant populations and peripheral areas. Other key challenges include high financial costs, reliance on imported technology, data privacy concern.
South Asia	Emergent/ Ongoing	Unconsolidated	Smart city initiatives focus on creating sustainable, technologically advanced urban hubs, e.g., India, Sri Lanka. Large national programmes and city pilots in India emphasise command-and-control centres and service digitisation. Key challenges include poor financial sustainability, digital privacy concern, and unequal, non-inclusive development.
East and Southeast Asia	Ongoing/ Maturing	Polarised	Smart city initiatives are aimed at integrating AI, IoT, and data analytics to improve urban management, transport, and environmental resilience. Strong national frameworks and rapid scaling in countries such as China, South Korea, Japan, Singapore, Indonesia**,** Thailand, Philippines**.** Despite rapid adoption, challenges remain including funding gaps, weak legal frameworks, fragmented infrastructure, data privacy concern.

Central Asia	Emergent	Unconsolidated	Smart city development is state-led and infrastructure-centric with Smart City Strategies in Kazakhstan and Russia. Engagement has begun in capital cities and major economic hubs: Almaty, Astana, Ashgabat**,** Bishkek, Dushanbe**,** and Tashkent. Focus is on surveillance, traffic, and e-government. Key challenges include high operational costs and reliance on external funding, weak integration across social and environmental domains, digital skills gaps, data security and privacy concerns.
Europe	Maturing	Consolidated	Smart city agendas are embedded in climate neutrality, digital rights, and urban governance frameworks. EU countries such as Spain, Germany, and Austria show integrated, citywide approaches aligned with EU policy, standards, and long-term funding mechanisms. Key challenges include digital skills gap, interoperability, digital inclusion and data privacy issues.
Latin America and the Caribbean	Emergent/ Ongoing	Unconsolidated	Smart city development is governance-led and problem-specific (e.g., mobility, security, disaster response) in cities such as Santiago, Mexico City, Bogotá, Buenos Aires, Rio de Janeiro, Curitiba, Medellín, and Montevideo, but scaling is constrained by fiscal limits, inequality, and institutional fragmentation.
North America (United States and Canada)	Maturing	Polarised	Leading cities (New York, Toronto**,** Columbus) operate sophisticated data-driven and climate-linked smart systems. But progress is uneven, often reproducing socio-spatial inequalities, with technology-driven improvements concentrating in affluent districts, leaving marginalised communities underserved. Other challenges include fragmented governance, budget constraints, digital divide, data privacy and public trust concerns.
Oceania - Australia and New Zealand	Ongoing/ Maturing	Consolidated	Australia and New Zealand cities (Sydney, Melbourne, Christchurch) pursue mature smart city agendas linked to sustainability and data analytics for service efficiency. Key challenges include financial and funding constraints, data silos and interoperability, digital divide, data privacy concern.
Oceania - Pacific Islands	Emergent	Unconsolidated	Pacific Island cities remain at an emergent stage, focused on basic digital access (enhancing ICT infrastructure and connectivity) and resilience, with limited capacity to consolidate systems. Key challenges include limited resources, fragmented regulatory frameworks, inadequate technical capacity, and high infrastructure cost.

Across regions, this uneven smart city expansion is, nevertheless, producing a converging set of smart city targets, benchmarks, and indicators, which increasingly define global norms. Common targets include the digitalisation of public services, interoperability of urban data systems, real-time monitoring of mobility and utilities, improved service efficiency, cybersecurity readiness, and enhanced citizen access to digital platforms.[722] Benchmarking is frequently structured around internationally recognised frameworks—such as smart sustainable city key performance indicators, ISO city indicators, digital government maturity models, and urban service performance metrics.[723] This allows cities at very different development stages to measure progress using comparable indicators. Core indicators increasingly prioritised across regions include broadband and digital access rates, uptake of e-government services, platform interoperability, data governance and privacy safeguards, mobility system performance, and citizen engagement through digital tools. This shared measurement architecture is shaping a global smart city trajectory defined by standardised indicators but differentiated outcomes, where divergence appears through their ability to scale pilots, integrate systems, and translate digital capability into inclusive, citywide benefits. What is evident is that global smart city trends are increasingly shaped by governance capacity and institutional maturity rather than technology availability alone. The emerging trend is towards ensuring that technology serves as a foundation for better urban living, not just efficiency.

722 Anthony Jnr, B. (2024). Enabling Seamless Interoperability of Digital Systems in Smart Cities Using API: A Systematic Literature Review. *Journal of Urban Technology*, *31*(4–5), 123–156. https://doi.org/10.1080/10630732.2024.2427543; International Telecommunication Union. (2025). ***Building digital public infrastructure for cities and communities***. United for Smart Sustainable Cities (U4SSC).

723 Serrano, M., Griffor, E., Wollman, D., Dunaway, M., Burns, M., Rhee, S., & Greer, C. (2022). ***Smart cities and communities: A key performance indicators framework*** (NIST SP 1900-206-Upd1; p. NIST SP 1900-206-upd1). National Institute of Standards and Technology (U.S.). https://doi.org/10.6028/NIST.SP.1900-206-upd1; ***ITU's implementation of the U4SSC KPIs on Smart Sustainable Cities***. (n.d.). ITU. Retrieved February 5, 2026, from https://www.itu.int:443/en/ITU-T/ssc/Pages/KPIs-on-SSC.aspx; ***ISO - Smart cities***. (n.d.). ISO. Retrieved February 5, 2026, from https://www.iso.org/sectors/environment/smart-cities

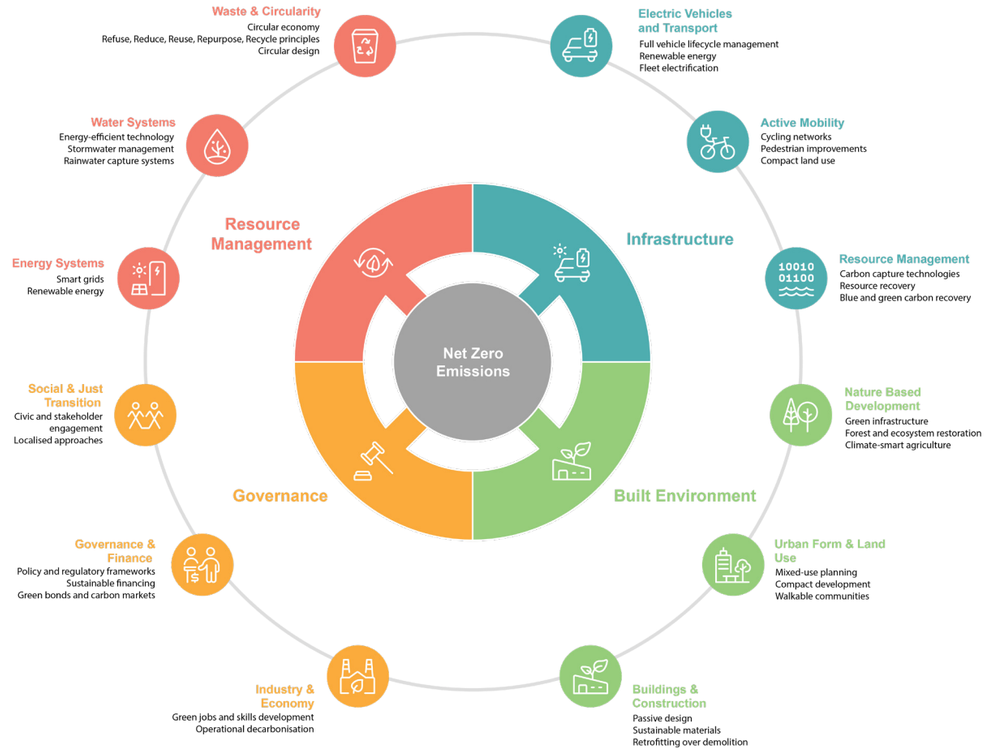
8.3 Climate action and low carbon transition

The third driver is climate action. Climate action is a top global priority, fuelled by the urgent need to adapt and mitigate the impacts of climate change, e.g., rising sea levels, ocean heat, and extreme weather events. Key climate actions centre on reducing greenhouse gas emissions to net zero by 2050, primarily through transitioning to renewable energy, enhancing energy efficiency, and adopting sustainable, clean transport (e.g., active mobility and transport electrification). Cities in both the developed and developing regions are expanding public transit, walking and cycling infrastructure, and incentivising electric vehicle use to reduce congestion and pollution. Increasingly, global (e.g., Sustainable Development Goals) and national goals are pivoting towards circular economy transition and implementing low carbon solutions to minimise waste and optimise resource consumption.

The low carbon development trajectory is evolving from early, sector-specific mitigation (e.g., efficiency upgrades and renewables deployment) to more comprehensive, whole-system transitions embedded in national development plans and urban policy. This transition is marked by the mainstreaming of net-zero targets, "just transition" principles, and co-benefits framing (e.g., cleaner air, public health, energy security), alongside growing use of digital tools to track emissions and optimise urban systems. Over the next decades, the low carbon transition is expected to accelerate through integrated approaches across energy, buildings, mobility, waste/circular economy, and land use—supported by stronger governance, financing mechanisms, and coordinated implementation. This shifts cities from incremental decarbonisation efforts towards deeper structural transformation of urban infrastructure, consumption patterns, and economic model through regenerative approaches, e.g., adopting biophilic design and nature-based solutions. Nature-based solutions (NbS) are actions to protect, sustainably manage, and restore ecosystem (like forests, wetlands, soil). Strategies include using urban green infrastructure (e.g., green roofs, parks, wetlands), sustainable land management (e.g., agroforestry, regenerative agriculture, traditional practices), ecosystem protection and restoration (e.g., conserve forests, clean up rivers, restore urban wetlands) (Figure 8.3).

Low carbon city development is now a widespread but uneven global trend, characterised by differing stages of maturity and levels of institutionalisation across regions (Table 8.3). Europe represents the most consolidated and prevalent model, where low carbon city development is mainstreamed through EU-wide frameworks such as the European Green Deal and climate-neutral city missions, resulting in broad city participation and systematic scaling.[724] Asia and North America exhibit a polarised pattern, where a subset of cities and countries such as China, Japan, Singapore, and leading United States and Canadian cities have advanced low carbon urban strategies, while adoption elsewhere remains partial or uneven. In Africa, Latin America and the Caribbean, and Pacific Island States, low carbon city development is largely emergent or ongoing, often driven by pilot projects, international networks, or donor-supported programmes rather than fully embedded municipal or national systems, indicating lower overall prevalence but growing uptake despite challenges.

Figure 8.3. Activating low carbon development



724 *The European Green Deal—European Commission*. (n.d.). Retrieved January 6, 2026, from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

Table 8.3. Regional low carbon development patterns

Region	Stage of Development	Systematic Pattern	Initiatives and Challenges
Africa	Emergent/ Ongoing	Unconsolidated	Cape Town (Carbon Neutral 2050); Ethiopia (Long-Term Low Emission & Climate-Resilient Development Strategy); ICLEI Africa city programmes; donor- and network-supported urban climate action. Key challenges include limited financing, weak infrastructure, over-reliance on fossil fuels, urgent poverty reduction needs, high vulnerability to climate impacts.
Middle East	Ongoing/ Maturing	Polarised	NEOM (Saudi Arabia); UAE Net Zero 2050 Strategy; Middle East Green Initiative; large-scale low-carbon power, district cooling and state-led urban megaprojects in Gulf cities. Key challenges include high fiscal dependence on oil, extreme vulnerability to climate impacts, high-carbon infrastructure.
Asia	Ongoing/ Maturing	Polarised	China (Low Carbon Pilot Cities and Provinces); Japan (Eco-Model Cities, FutureCity Initiative); Singapore (Green Plan 2030); India (Ahmedabad Climate Resilient City Action Plan, national low-carbon missions). Key challenges include heavy dependence on fossil fuels, rising energy demand, financing gaps for green infrastructure, industrial decarbonisation.
Europe	Maturing	Consolidated	EU Green Deal; Climate-Neutral and Smart Cities Mission; Amsterdam (integrated climate resilience); Barcelona (Climate Plan); Lisbon (urban electrification and green infrastructure). Key challenges include high initial costs, infrastructure and technical bottlenecks, outdated energy grids, geopolitical and energy security, social equity and acceptance issues.
Latin America and the Caribbean	Emergent/ Ongoing	Unconsolidated	Chile (CTF-backed clean energy transition); Costa Rica (REDD+ results-based finance); Brazil (RenovaBio and transport decarbonisation). Key challenges include economic dependence on emissions-intensive sectors, reliance on polluting energy sources, limited financing for energy transition, capacity and institutional constraints.
North America (United States and Canada)	Ongoing/ Maturing	Polarised	United States (IRA-enabled city action, e.g. New York City Local Law 97); Canada (Net-Zero Emissions Accountability Act); Vancouver and Toronto (buildings, mobility, and climate planning). Key challenges include political volatility, high infrastructure costs, ageing electrical grids, building the supply chains for clean technology.
Oceania – Australia and New Zealand	Ongoing/ Maturing	Consolidated (national) / Polarised (urban–regional)	Australia (national net-zero framework; city-level renewable integration); New Zealand (Emissions Reduction Plan; urban climate and transport decarbonisation aligned with national targets). Key challenges include balancing rapid infrastructure rollout with energy reliability, decarbonising mining and transport, economic reliance on high-emission agricultural sectors, capacity, knowledge, and investment gaps.
Oceania – Pacific Island States	Emergent	Unconsolidated	Blue Pacific 2050 Dashboard covers seven thematic areas of the 2050 Strategy for the Blue Pacific Continent. For the thematic area of Climate Change and Disasters, more work needs to be done. Key challenges include high financial and initial investment costs, geographic isolation and infrastructure constraints, capacity and technical expertise gaps, high vulnerability to climate impacts.

As with smart city development, across regions, low carbon city efforts are increasingly converging around a common set of targets, benchmarks, and indicators aligned with global climate commitments. The most prevalent target referenced in this global scan is achieving net-zero greenhouse gas emissions by mid-century, typically 2050, alongside interim emissions-reduction milestones (e.g. 40–55% reductions by 2030–2040).[725] Benchmarks are commonly sector-based, focusing on decarbonisation of electricity supply, energy-efficient buildings, low-carbon and electrified mobility systems, and the integration of nature-based or green infrastructure.[726] To monitor progress, cities and regions increasingly rely on standardised indicators, including citywide greenhouse gas inventories, emissions intensity (per unit of GDP), renewable energy capacity,

725 *Paris Agreement on climate change*. (n.d.). Consilium. Retrieved January 6, 2026, from https://www.consilium.europa.eu/en/policies/paris-agreement-climate/

726 Institute for Global Decarbonization Progress. (n.d.). *Sustainable cities*. https://www.igdp.cn/sustainable-cities/; Alisjahbana, A. S. (2022, December 7). *Low carbon cities: Engines for driving carbon neutrality in Asia and the Pacific*. United Nations ESCAP. https://www.unescap.org/op-ed/low-carbon-cities-engines-driving-carbon-neutrality-asia-and-pacific

per-capita energy consumption, and the share of green-certified buildings.[727] Reporting and benchmarking are frequently supported through internationally recognised frameworks such as the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories[728], CDP-ICLEI Track[729] for sustainable and low carbon cities, enabling comparability across regions despite differing levels of implementation maturity.

The urbanisation-technology-climate action nexus is a critical area of 21st-century development. The drivers of urbanisation, technology, and climate action do not occur in isolation but are often interlinked, reinforcing the need to consider and balance trade-offs and co-benefits. Equally, actions through urban planning, smart city technologies and low carbon development are not singular but often overlap as triple transition strategies. While pathways to successful transition, e.g., through integrated planning, regenerative approaches, exist and are experimented in various cities, challenges remain. Of concern is fragmented action, e.g., current efforts in urban planning often lack the necessary integration of technology and climate goals while Global South vulnerability requires concerted action.

727 *Fit for 55*. (n.d.). Consilium. Retrieved January 7, 2026, from https://www.consilium.europa.eu/en/policies/fit-for-55/; Alisjahbana, A. S. (2022, December 7). *Low carbon cities: Engines for driving carbon neutrality in Asia and the Pacific*. United Nations ESCAP. https://www.unescap.org/op-ed/low-carbon-cities-engines-driving-carbon-neutrality-asia-and-pacific; Samarripas, S., Jarrah, A., Runge, E., ... & Sachson, W. (2024). *The 2024 City Clean Energy Scorecard*. https://www.aceee.org/sites/default/files/pdfs/2024_city_clean_energy_scorecard.pdf

728 Fong, W. K., & Doust (C40), M. (2014). *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*. https://www.wri.org/research/global-protocol-community-scale-greenhouse-gas-emission-inventories

729 C40. (n.d.). *CDP-ICLEI Track: A climate reporting tool*. Retrieved February 2, 2026, from https://www.c40knowledgehub.org/s/article/CDP-ICLEI-Track-A-climate-reporting-tool