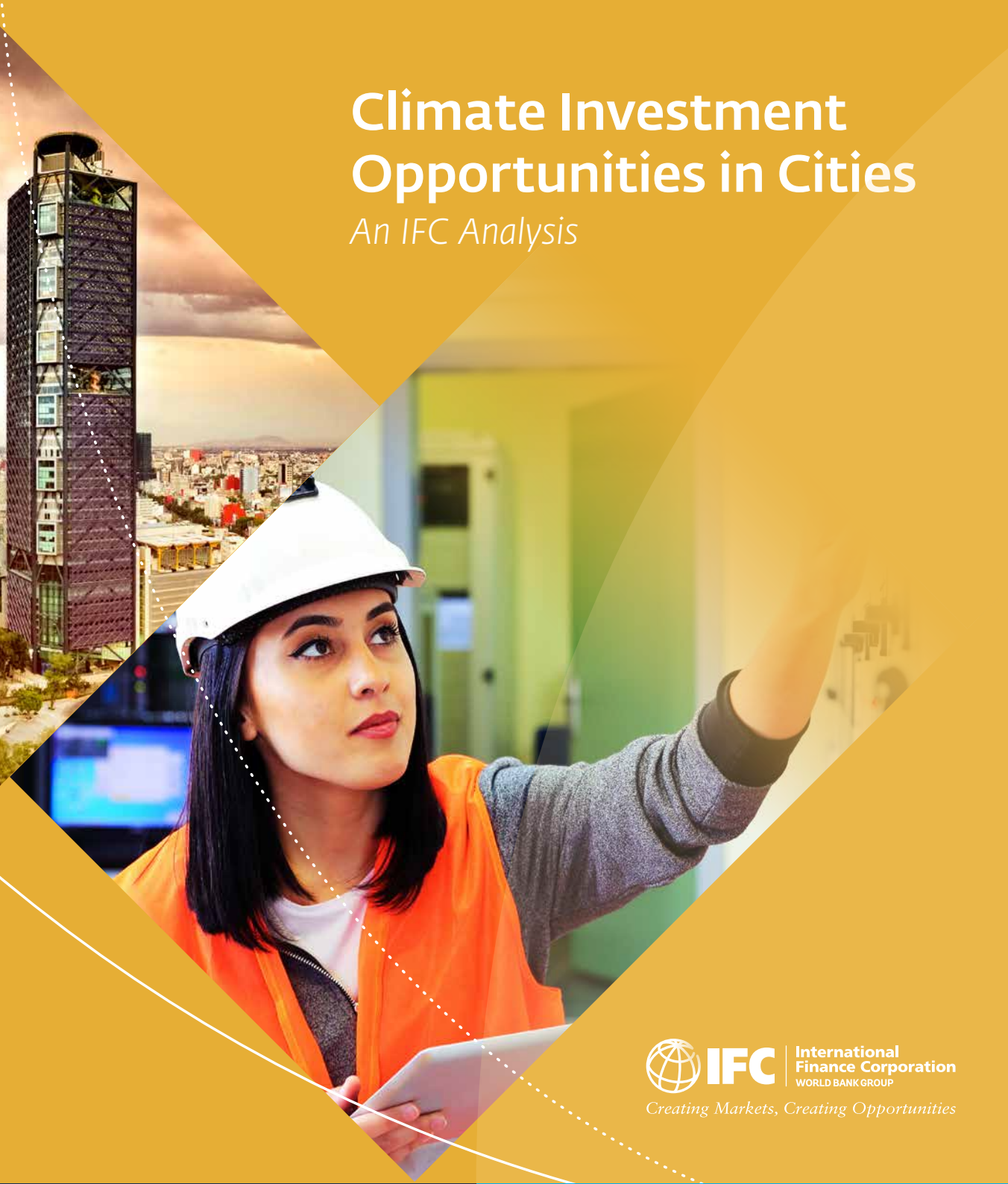
Climate Investment Opportunities in Cities

An IFC Analysis



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Creating Markets, Creating Opportunities

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IFC—a sister organization of the World Bank and member of the World Bank Group—is the largest global development institution focused on the private sector in emerging markets. We work with more than 2,000 businesses worldwide, using our capital, expertise, and influence to create markets and opportunities in the toughest areas of the world. In fiscal year 2018, we delivered more than $23 billion in long-term financing for developing countries, leveraging the power of the private sector to end extreme poverty and boost shared prosperity. For more information, visit www.ifc.org.

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CROSS-CUTTING THEMES

Foreword

Philippe le Houérou
Chief Executive Officer, IFC

The success of the Paris climate agreement rests on many factors, but much depends on what happens in cities. As we have seen in the Inter-Governmental Panel on Climate Change's reports, cities' abilities to address climate change is critical to limiting global warming to 1.5 degrees Celsius.

There is no doubt that the magnitude of investment required to fulfill growing commitment of cities to climate action far exceed public budgets. Clearly there will always be a need for public investment in green, resilient infrastructure and services. But much more attention now needs to be put on enacting the right reforms to leverage private sector innovation, management know-how, and capital. As municipal governments create space for private companies to invest in reducing emissions and building resilience, there is also growing interest from the private sector to invest in climate-smart infrastructure and services.

We estimate in this important report a cumulative climate investment opportunity of $29. 4 trillion in six urban sectors in emerging markets cities by 2030. The bulk of these opportunities — $24.7 trillion — rests with green buildings, which covers both new construction and retrofits. But there also are trillion-dollar opportunities in public transport infrastructure, electric vehicles, improved management of water resources, renewable energy, and better handling of waste.

The report also describes various approaches and new and innovative models that cities can deploy to narrow the financing gap for climate-smart investments, including Public-Private Partnerships, land value capture mechanisms, and green bonds.

Cities are at the forefront of climate impact. We must do everything we can to support them in their ambitions to create a green and resilient environment for everyone.

Executive Summary

Executive Summary

Cities Stand at the Forefront of Climate Action

Our efforts to successfully limit global warming hinge on cities. More than half the global population lives in urban areas and this share will continue to rise over the next 30 years. Crucially, cities consume much of the world's energy and produce more than 70 percent of global carbon emissions.

As a result, the decisions made by city governments can have a direct and immediate impact on people—perhaps more so than national or international policies. Cities' efforts to mitigate the impacts of climate change and build their resilience can have a disproportionate effect because they are densely populated areas with economies of scale and significant potential for climate co-benefits. This is particularly relevant for emerging markets, as about 60 percent of the area expected to be urbanized by 2030 globally remains to be built, and much of this growth will be in these markets.

As cities grapple with meeting the needs of their growing populations and tackling challenges such as housing, air pollution, congestion, and energy access, they have the opportunity to take a green, climate-friendly approach to urbanization and invest in green transport, buildings, and other low-carbon and resilient infrastructure. Cities are recognizing the potential, creating a groundswell in commitments to climate action.

Almost 9,400 cities have committed to over 20,000 actions alongside the private sector to address climate change across a range of sectors, including energy, water, transport, industry, and buildings.

However, cities cannot achieve their climate ambitions alone and must collaborate with all stakeholders, including business and investors, to meet the ambition of the Paris Agreement to limit global warming and build urban climate resilience. City governments play a key role in creating enabling conditions to attract private investment to reduce emissions, manage risks, and build climate resilience. The private sector can play a central role in supporting cities through a combination of innovation, know-how, financing, and new service delivery models, and there is growing interest from the private sector to invest in climate-smart cities.

Urban Climate Resilience

Building urban resilience means improving a city's capacity to survive, adapt, and grow despite chronic and acute risks and shocks, which are often cross-cutting and arise from a variety of sources. Services, people, and systems such as transport, energy, water, and communications are particularly connected in urban areas, which results in a co-dependent system that needs to be made resilient at every link. City planning and infrastructure investments made today will have long-term impacts and shape the direction of urban growth and development for decades.

The first step for cities to develop strategies to build resilience, manage climate risk, and explore climate opportunities is to understand their exposure and sensitivity to different climate impacts. Each city's climate resilience strategy should be uniquely tailored to its specific requirements and characteristics, based on geography, population density, and other local considerations. Cities around the world are at various stages of planning, with 210 cities already having a climate change adaptation plan in place and 111 cities in the process of creating one as of 2016.

Investment in urban infrastructure for developing countries tends to be funded by the public sector, but the sheer scale of the required investment

Photo: © Dominic Chavez / IFC

necessitates the unlocking of private sources of financing. Forward-thinking companies are already seizing opportunities in this space.

Financing Climate-Smart Investments in Cities

Connecting cities with financing is an essential component of building urban resilience strategies and achieving mitigation targets. A city's ability to make climate-smart investments, particularly in emerging economies, often relies on the reallocation of existing budgets and the ability to raise revenue. However, the investment barriers faced by cities, such as creditworthiness, bankability, and the lack of a viable project pipeline, limit what they can do on their own and pose an obstacle to attracting private finance. Despite these fundamental issues that constrain investment in climate-smart urban infrastructure, cities can narrow this financing gap by taking advantage of a wide range of established mechanisms to access funding, and by deploying new and innovative models of finance and investment tailored to their specific context.

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Cities and companies are structuring multi-purpose, and consequently multi-benefit, interventions that can be monetized more easily than in the past to attract private finance, especially for projects that help build climate resilience. Tapping into institutional investment in resilient infrastructure will be invaluable in helping cities access the finance they need to adapt to climate change. The success of these approaches is contingent on the cities having a long-term vision and commitment to green investment, with a clear pipeline of projects.

Public-private partnerships are a primary mechanism used to finance capital-intensive, sustainable infrastructure. Targeted taxes and incentives can also be used to encourage investment in such infrastructure by favoring density over urban sprawl or low-carbon energy over fossil-fuel sources. Land value capture mechanisms can encourage green infrastructure development while leveraging private finance. Debt financing instruments such as green bonds have great potential to drive climate-smart investment by allowing cities to acquire long-term debt at stable prices. With support from national and international partners, cities are developing dedicated vehicles to enable private green investment.

In addition to these traditional approaches, innovative financial mechanisms to bridge the gap between resilient infrastructure needs and financing such as resilience bonds and climate insurance are already being piloted, particularly in cities in developed countries.

While these financing approaches will largely benefit creditworthy metropolises and megacities, the vast majority of intermediary cities will require sustained and disciplined attention to policies underpinning their creditworthiness, and support to establish solid and stable climate finance ecosystems and integrate climate considerations into development frameworks. Innovative financial and collaborative approaches will be key to preparing bankable projects, developing domestic financial markets, and mobilizing private financing for local investment. A range of initiatives are already attempting to fill these gaps.

To effectively deliver on the promise of climate-smart cities, it is critical to move from planning to pilots, from pilots to projects, and from projects to partnerships.

Climate Investment Opportunities in Cities

This report focuses on estimating the scale of the investment opportunity associated with fully achieving cities' currently stated sector-specific mitigation goals to 2030. In addition, it synthesizes the current landscape of support relating to investment in climate-smart solutions for cities, mapping over 30 initiatives, most of which are

Investment potential in cities by region and sector to 2030

	East Asia Pacific	South Asia	Europe & Central Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America & Caribbean	Total
Waste	$82 billion	$22 billion	$17 billion	$28 billion	$13 billion	$37 billion	$200 billion
Renewable energy	$266 billion	$141 billion	$88 billion	$31 billion	$89 billion	$226 billion	$842 billion
Public transportation	$135 billion	$217 billion	$116 billion	$281 billion	$159 billion	$109 billion	$1 trillion
Ciimate-smart water	$461 billion	$110 billion	$64 billion	$79 billion	$101 billion	$228 billion	$1 trillion
Electric vehicles	$569 billion	$214 billion	$46 billion	$133 billion	$344 billion	$285 billion	$1.6 trillion
Green buildings	$16 trillion	$1.8 trillion	$881 billion	$1.1 trillion	$768 billion	$4.1 trillion	$24.7 trillion
TOTAL	**$17.5 trillion**	**$2.5 trillion**	**$1.2 trillion**	**$1.7 trillion**	**$1.5 trillion**	**$5 trillion**	**$29.4 trillion**

INCREASING INVESTMENT

hosted by international organizations or are financing initiatives that support project preparation and pilots.

IFC estimates a cumulative climate investment opportunity of $29.4 trillion across six urban sectors in emerging market cities to 2030.

The lion's share of the opportunity is in green buildings ($24.7 trillion), covering both new constructions and retrofits, as cities race to accommodate their growing populations. Improvements in low-carbon mobility solutions, driven by public transport infrastructure and the expected surge in electric vehicles, account for $1 trillion and $1.6 trillion respectively. The availability and management of water resources is a consistent primary concern for cities, presenting a $1 trillion opportunity in climate-smart water and wastewater management and infrastructure.

The regional variations in the size of the investment opportunity by sector reflect both the range in the ambitions of targets set by cities and the differing costs for technologies and implementation. Cities across these regions have prioritized sectors for climate-smart investment depending on their size, population, and specific climate, development, and financial considerations. Deep dives into the following six cities reveal some examples of how cities are working to achieve their climate goals, and what the potential climate investment opportunities look like in different contexts:

JAKARTA

Meeting its objective to drastically reduce groundwater extraction and secure access to piped water for its citizens will require an estimated $3 billion investment in Jakarta's water and wastewater sector. The Indonesian capital's public and electrified transport priorities create an investment opportunity of $660 million and almost $7 billion respectively. Increasing the energy-efficiency of its buildings and meeting its Green Building Code requirements contribute to an estimated opportunity of over $16 billion in the green buildings sector.

RAJKOT

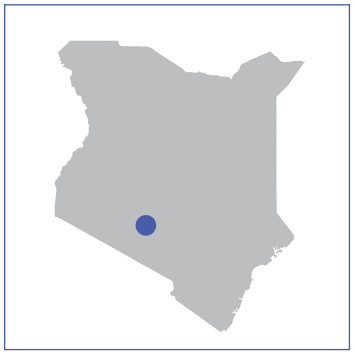
In India, achieving Rajkot's smart city and affordable housing targets will require almost $2 billion of investment in green buildings. Implementing the city's Low-Carbon Comprehensive Mobility Plan and electric bus rapid transit system will create investment opportunities of $520 million and $700 million in public transport and electric vehicles respectively. Managing its water supply and meeting wastewater and sewerage targets creates a potential investment opportunity of over $220 million.

BELGRADE

Belgrade's commitment to sourcing its district heating from renewable energy will create an investment opportunity of $740 million in the renewable energy sector. Achieving the Serbian city's transit-oriented development plans will require estimated investments of over $1.2 billion in public transport and almost $620 million in electric vehicles. Making its buildings more energy-efficient and green will create an investment opportunity of almost $2 billion.

AMMAN

In Jordan, getting businesses involved in solid waste management is key to realizing Amman's $385 million investment opportunity in the sector. Recycling the city's groundwater and improving its water infrastructure will contribute to the $550 million investment opportunity in the water and wastewater sector. Achieving its goal to catalyze a modal shift to public, non-motorized, electrified transportation will require a total investment of almost $7 billion.

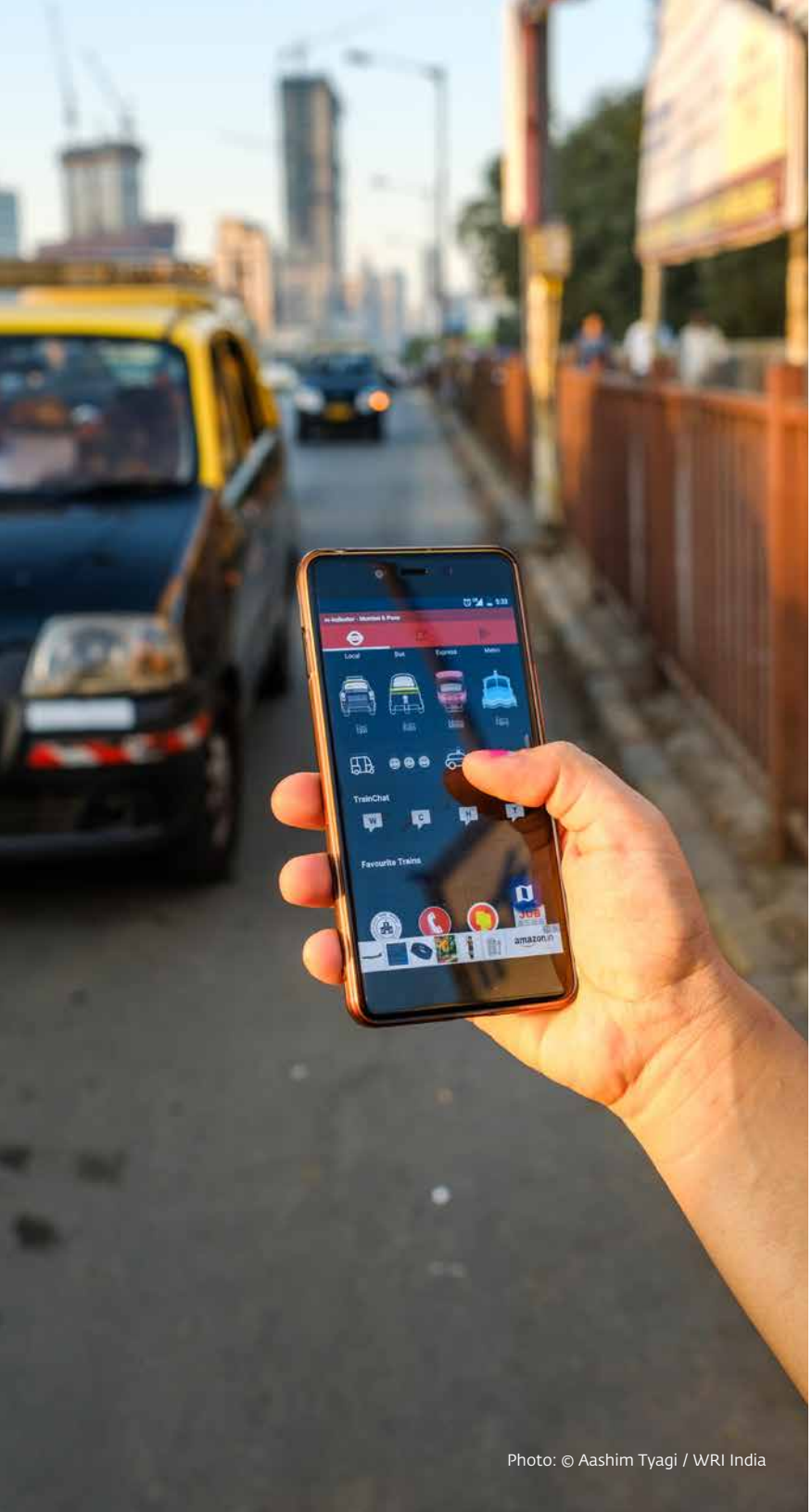


NAIROBI

Nairobi's water demand is expected to more than double by 2035, contributing to the $360 million investment opportunity in the water and wastewater sector. The Kenyan city expects a sharp rise in housing construction, leading to an investment opportunity of over $1 billion in greening those buildings. Meeting the city's non-motorized and sustainable transport goals will create an investment opportunity of $1.6 billion in infrastructure including bike lanes, a bus rapid transit system, and commuter rail, with a further $5 billion to catalyze city-wide electric vehicle adoption.

MEXICO CITY

Managing Mexico City's large-scale groundwater extraction while ensuring adequate water supply to its residents creates an investment opportunity of almost $6 billion in the water and wastewater sector. Continuing with the overhaul of its transport sector to reduce air pollution and congestion creates an investment opportunity of $2 billion in public transport and $7 billion in electric vehicles. Implementing efficiency standards in the 50,000 new homes expected annually to 2030 will contribute to the $18 billion investment opportunity in green buildings.



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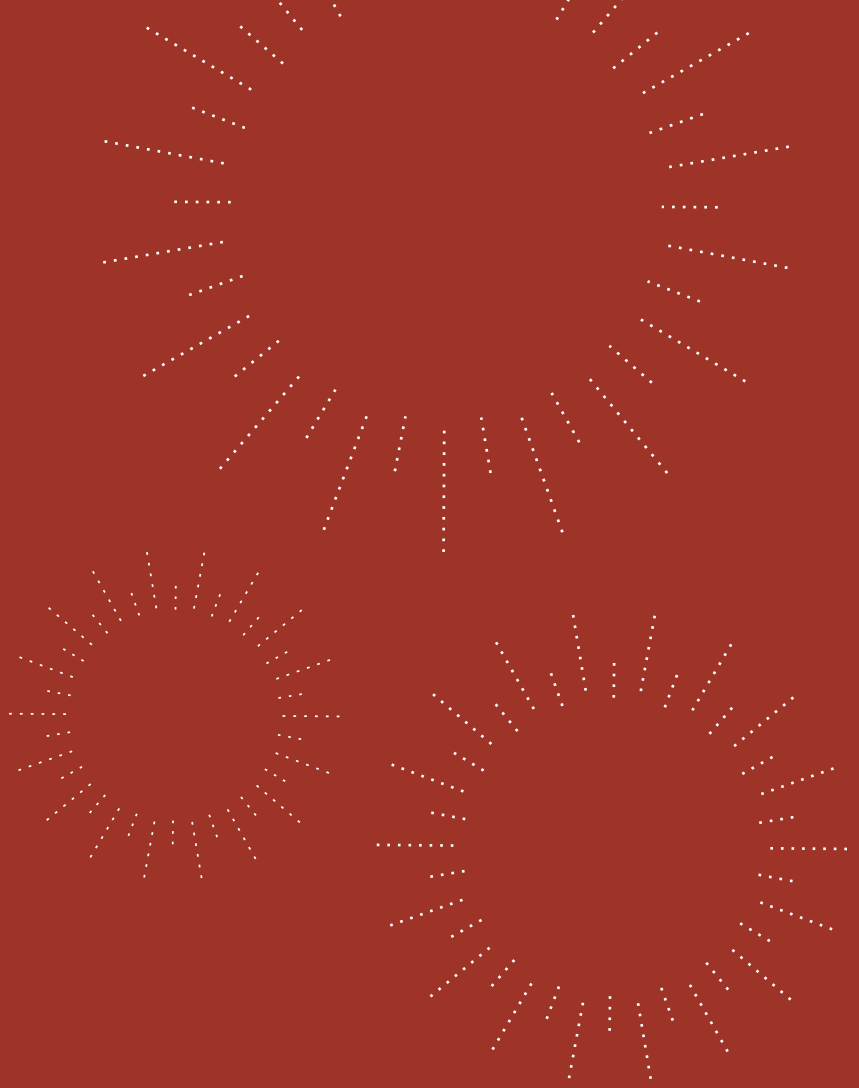
Cities will be at the epicenter of climate action to limit global warming to 1.5°C. By showcasing the role of good public policies and conditions conducive to shaping incentives, attracting private investment, and greening profits, IFC seeks to help catalyze the creation of green, resilient, and technology-based cities of the future, and stands ready to support cities on this vital journey.



Cities and Climate Change

Cities and Climate Change

Photo: © Hanoi Mark

Cities are at the Forefront of Climate Impact

We are living in the century of cities. Today, more than half the global population lives in urban areas. And this is expected to increase to 70 percent (6.7 billion people) by 2050. Cities are also the engine of the global economy, contributing over 80 percent of global gross domestic product (GDP).[1] They are centers of innovation and prosperity, but they will also bear the brunt of today's challenges such as climate change, inadequate infrastructure, population growth, and social and economic inequity.

Cities are hotspots for climate change. They consume over two-thirds of the world's energy and account for more than 70 percent of global carbon emissions. And with 90 percent of the world's urban areas situated on coastlines, cities face the risk of devastating climate change impacts such as rising sea levels and powerful coastal storms.[2] Urban heat islands—areas that are much warmer than surrounding areas because of human activity—often amplify heatwaves in cities. Cities' efforts to address climate change are pivotal to efforts to limit global warming to 1.5 degrees Celsius (°C), according to the Inter-Governmental Panel on Climate Change.

Limiting global warming to 1.5°C will require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems. The changes needed are unprecedented in terms of scale and require large emissions reductions

in all sectors, a wide portfolio of mitigation options, and a significant increase in investment. Cities also have a range of adaptation options they can use to reduce the risks of sea level rise (such as coastal defense and hardening) and the risks to health, livelihoods, food, water, and economic growth in urban areas (such as green infrastructure, sustainable land use and planning, and sustainable water management).[3]

Consequently, the decisions made by city governments can have a direct and immediate impact on large numbers of people, perhaps even more so than policies made at a national or international scale. To meet the urgent challenges faced by their residents on a daily basis, cities are defining their own development trajectories, and the paths they take will have dramatic consequences. Because of cities' density and economies of scale, urban mitigation efforts can have a disproportionate effect, with significant cost reductions and co-benefits[4] when carbon is reduced. Their decisions on what to prioritize politically, on what to build, and how to build it will reverberate globally, with significant implications for millions of people and for the planet as a whole.[5]

This is particularly relevant to emerging markets, as urban population growth is expected to be concentrated in just a handful of countries. Together, India, China, and Nigeria will account for 35 percent of the world's projected urban population growth to 2050. By 2030, the world is projected to have 43 megacities, each with more than 10 million inhabitants, and most of them in developing regions. However, the fastest-growing cities are those with fewer than 1 million inhabitants, many of them in Asia and Africa.[6] These swelling urban populations will place additional demands on resources and services, particularly in poorer nations with large and growing informal settlements that lack basic services and are increasingly at risk of climate disasters. The world's informal settlement population is expected to triple to 3 billion by 2050.[7]

Globally, about 60 percent of the area expected to be urban by 2030 remains to be built. Urban policy decisions made by 2020 could account for up to a third of the remaining global carbon budget that is not already "locked in" by past decisions.[8] As cities, particularly in developing countries, grapple with meeting the needs of their growing populations and tackling challenges such as housing, air pollution,

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congestion, and energy access, they have the opportunity to leapfrog historical approaches to urbanization by putting their scarce resources into clean transport, zero-carbon buildings, and training people to deliver green infrastructure. Ensuring an integrated approach to urban planning and investing in climate-smart city projects will be essential. Cities that don't change will not be viable in years to come.

Surging Climate Commitments by Cities

Recognizing the opportunity to address both development priorities and the climate challenge, 440 mayors and subnational leaders pledged to deliver up to 3.7 gigatons of urban greenhouse-gas emissions reductions annually by 2030, in the margins of COP 21 in Paris in 2015. As part of their commitments under the historic Paris Agreement, 113 national governments[9] also signaled their ambitions to grow low-carbon, resilient cities by targeting improved solid waste management, efficient street lighting, and sustainable urban planning, among other investments, through their Nationally Determined Contributions (NDCs).

Since then, there has been a groundswell in city commitments to climate action. According to the United Nations (UN) Global Climate Action Tracker, almost 9,400 cities have committed to over 20,000 individual and cooperative actions, including with the private sector, to address climate change across a range of sectors.[10] These cities of differing sizes, structures, geographies, and priorities are committing to climate-smart plans, partnerships, and investments in high-impact sectors such as green buildings, public transport, renewable energy, waste, climate-smart water, and electric vehicles, with the support of a range of global initiatives.

Cities in Africa, Latin America, and South Asia have accelerated their commitments to tackle climate change in the last two years. Through ICLEI—Local Governments for Sustainability, over 1,500 cities across 124 countries are receiving support to develop robust and resilient low-to-no emissions development strategies, green their procurement, and catalyze finance for transformative actions. Through the Global Covenant of Mayors, over 9,000 cities have committed to registering and tracking their climate-related actions and emissions, with many using a newly released harmonized standard for reporting data that helps cities plan, implement, and monitor their actions in a transparent manner.[11] The decarbonization commitments already made by these cities, if fully implemented, could achieve annual reductions of 1.4 gigatons of carbon dioxide equivalent (CO_2e) by 2030. From a business-as-usual level, that's equivalent to taking all the cars in the United States off the road for one year. These city-level commitments exceed the current ambitions of NDCs, showing that alignment across levels of government can pave the way for greater ambition—and action.[12]

While many of these commitments are overall emissions reduction targets, cities are going further and trying to identify sector-specific targets. Through the One Planet Charter, 815 cities from 65 countries, including 25 emerging markets, made commitments where the private sector can play a key role in supporting implementation. These commitments range from pledging to procure only zero-emission buses from 2025 and ensuring that a major area of the city is a zero-emission zone by 2030 (Medellín, Colombia),[13] to moving towards 100 percent renewable electricity city-wide by 2035 (Malmö, Sweden),[14] to pledging to reduce the amount of waste sent to landfills and incineration by 50 percent and increase the diversion rate[15] to 70 percent by 2030 (New York, United States).

Cities are moving from pledges to action, with 27 of the world's largest cities in the C40 Cities Initiative having achieved at least 10 percent lower emissions than their peak as they work towards decarbonization by 2050. Through this initiative, cities are starting to develop Paris Agreement Compatible Climate Action Plans. Seven C40 cities have already published climate change strategies designed to deliver on the 1.5°C goal, and a further 65 have committed to do so, helping lead cities worldwide towards a low-carbon future.

The ability of cities to make such commitments and act on them is determined by their access to data about sector-specific emissions and resource potential, which is necessary for them to set their mitigation goals and identify reduction opportunities.

Data: A Critical Lynchpin to Climate Action

The Environmental Insights Explorer—a new tool to assist cities with developing a greenhouse-gas emissions inventory—was announced at the 2018 Global Climate Action Summit in San Francisco. It is the first result of a new long-term partnership between the Global Covenant of Mayors, Bloomberg Philanthropies, and Google through the Innovate4Cities Accelerator. Almost two-thirds of the Global Covenant of Mayors member cities have yet to develop a greenhouse-gas emission inventory. The tool is a new addition to the suite of solutions that will assist with this, and over time will expand its coverage to include thousands of cities globally, allowing local governments to instantly and freely access the data they need to develop city greenhouse-gas emissions inventories—a process that used to cost a megacity between $250,000 and $700,000 and take up to two years to complete.

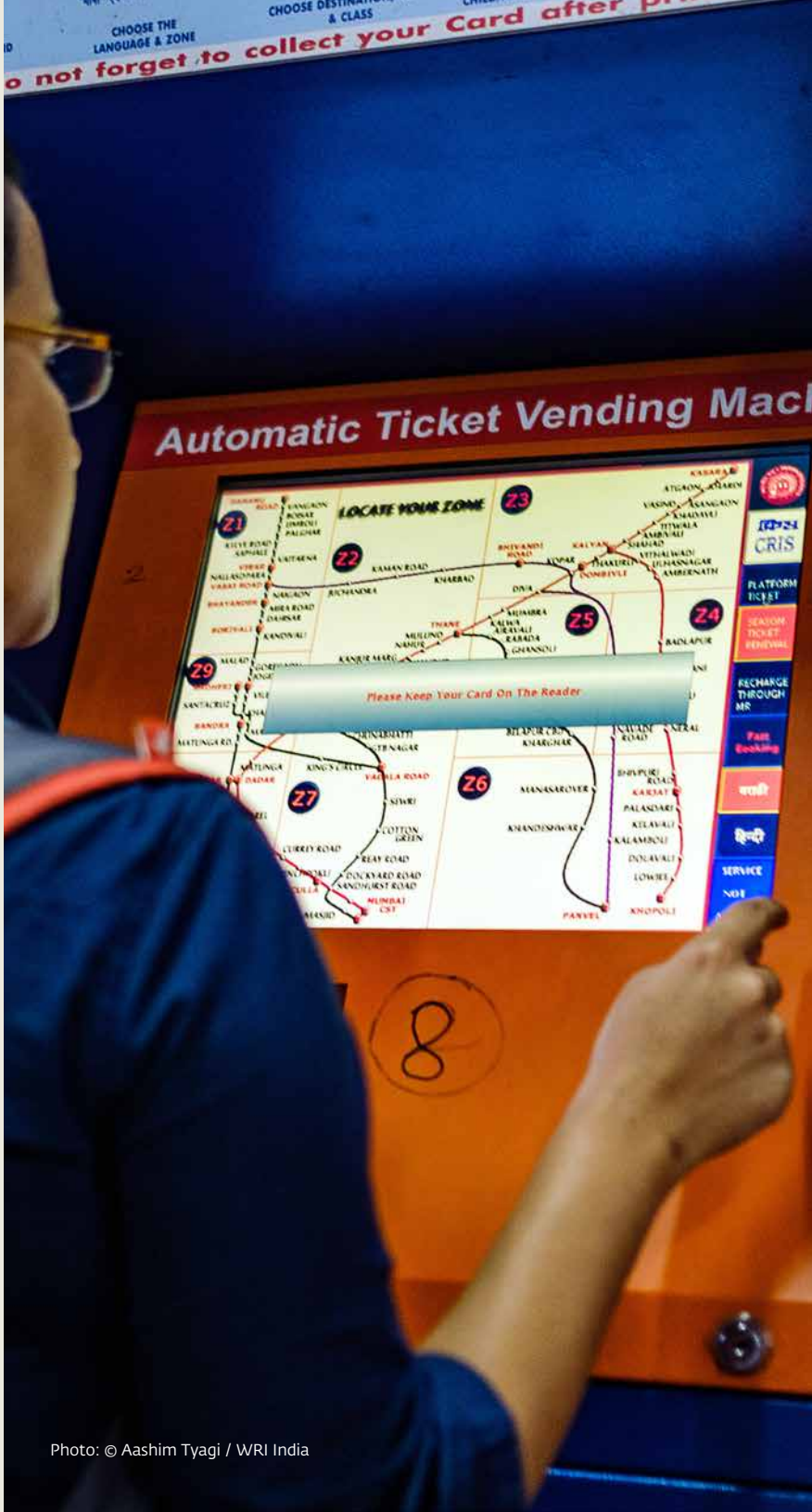
Through the partnership, Google will work with the Global Covenant of Mayors' network partners and committed cities to develop tools and insights based on its proprietary data, providing cities with high-quality and action-oriented information on areas such as transportation and building emissions, weather forecast models, and rooftop solar potential. The tool will be a web-based application that allows cities to freely explore aggregated data and plan climate action. It currently exists in beta release (https://insights.sustainability.google/) with data for Buenos Aires (Argentina); Mountain View, California (United States); Pittsburgh, Pennsylvania (United States); Victoria, British Columbia (Canada); and Melbourne, Victoria (Australia). The partnership is working to quickly expand its global coverage, aiming to have high-quality data online for the next 50 cities by the end of 2018 and adding another 2,000 cities in 2019, with a focus on emerging economies. Cities are invited to provide comments and feedback, and nominate their city to be next on the site.

"To overcome the gap cities face between their climate ambition and full-scale implementation, we must mobilize all the resources and knowledge already available to provide cities with the tools, information, and partnerships they need. The Innovate4Cities agenda is a starting point for the Global Covenant of Mayors and all the cities it represents. By working together, we can make significant progress in securing a climate safe world and meeting the goals of the Paris Agreement."

— **Tri Rismaharini,** Global Covenant of Mayors Board Member, Mayor of Surabaya, Indonesia

"Google's innovative new tool is an initial response to this call and will provide cities of all sizes with the data they need at no cost—saving cities valuable time and money and enabling them to redirect those resources toward further actions."

— **Don Iveson,** Mayor of Edmonton, Canada



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The Role of the Private Sector in Cities

Cities have long been responsible for creating and maintaining environments that are conducive to business prosperity. Municipal governments have traditionally been responsible for policies, planning, design, and financing of urban infrastructure projects and service delivery. Climate change has added a new dimension to this responsibility, which, to be managed effectively, requires cooperation across the public and private sectors, as municipalities face both capacity and funding constraints in fulfilling this role. This coincides with a proliferation of new technologies, from artificial intelligence to big data, which can help cities become more livable, resilient, and better able to respond to challenges. Businesses can play a key role in supporting cities through a combination of innovation, know-how, financing, and new service delivery models in addition to the traditional benefits they bring to cities, such as jobs and tax revenue. Research by Siemens suggests that the economic opportunities arising from upgrading public transport infrastructure alone is about $800 billion per year.[16]

Businesses are reliant on public infrastructure and environmental policies to support and guide their operations. In Thailand, Hitachi and Lite-On Technology identified frequent and intense rainfall as a serious risk to doing business in Bangkok. Both companies reported that they had to shut down their factories for over a month when the city flooded in 2011, which impacted transport systems and their supply chains, and resulted in a combined loss of nearly $96 million. The city of Bangkok now categorizes climate change risks from flooding as extremely serious, forecasting that the economic damage from flooding could rise four-fold.[17]

Delivering climate-smart city infrastructure at the scale required poses a significant investment challenge, given the high upfront capital investment and operations and maintenance expenses involved. The global financing needed to implement the Sustainable Development Goals (SDGs) is estimated to be between $5 trillion and $7 trillion per year, with a $2.5 trillion annual financing need in developing countries for key infrastructure sectors and related areas.[18] By consensus, the Organisation for Economic Co-operation and Development, Boston

Consulting Group, and the World Bank Group estimate the annual global infrastructure investment need to be about $3.7 trillion—of which only about $2.7 trillion is currently met.[19] At $1 trillion per year, this makes the financial deficit larger today than it has ever been.

Urban infrastructure has received only a fraction of total private infrastructure investment, highlighting the challenge for cities to deliver on the ambition of the Paris Agreement, especially for those with constrained public budgets. IFC analysis of private sector investment and the availability of capital from new types of investors, including pension funds and insurance companies, indicates untapped potential for the private sector to finance and sponsor urban infrastructure investments. In the last 15 years, less than 20 percent of private investment in infrastructure has been directed to urban infrastructure, and there has been a declining trend in the number of projects with private investment. Given the scale of the financing gap, the constraints on city budgets, and the potential for activating these underused funding sources, city governments have a key role to play in creating enabling conditions to secure the required private sector investment.

There is, however, growing interest from the private sector to invest in climate-smart cities. According to the UN, 170 companies have made almost 400 individual commitments specifically tied to supporting the SDG 11 commitment to building sustainable cities, and almost 1,700 companies have committed to almost 3,000 actions addressing climate change.[20] Businesses from around the world, alongside cities and regions, have signed the Net Zero Carbon Buildings Commitment, led by the World Green Building Council. The signatories include businesses throughout the building and construction supply chain, and leaders from some of the world's biggest cities plus two major regions. Collectively, the signatories are ready to eliminate 209 million metric tons of CO_2e from their buildings by 2050—equivalent to taking 44.7 million cars off the road.[21]

City policies are creating the space for companies to innovate and invest. For example, Beijing in China is attracting investment due to its use of smart technologies in transport. Mobike and Ofo are providing urban mobility solutions through dockless bike services, resulting in 50 million bike journeys a day and fewer cars on the road. In 2017, the

Photo: © Kentaro IEMOTO

city announced plans to replace its fleet of 70,000 fossil-fuel-powered taxis with electric cars, creating the space for further private investment. India's Smart Cities Mission has provided $15 billion to develop 100 smart cities and rejuvenate another 500 over the course of five years, with each city receiving about $15 million per year. To win the funding, cities have to showcase the feasibility and impact of a project and establish a new private company/special purpose vehicle to oversee the implementation.[22]

The financial sector is also increasingly interested in investing in cities. For example, Swiss multinational bank Pictet has launched the first investment fund targeting smart cities, seeded with €652 million. Similarly, HSBC screens its climate solutions database for stocks with a minimum market capitalization of $500 million from categories in sectors where new technologies, inventions, and ideas are allowing cities to work better. It has identified 37 stocks, of which over 60 percent are from emerging markets, particularly in China. HSBC, ANZ, and the Autonomous Community of Madrid have issued SDG bonds, with proceeds from all three funding SDG 11.[23]

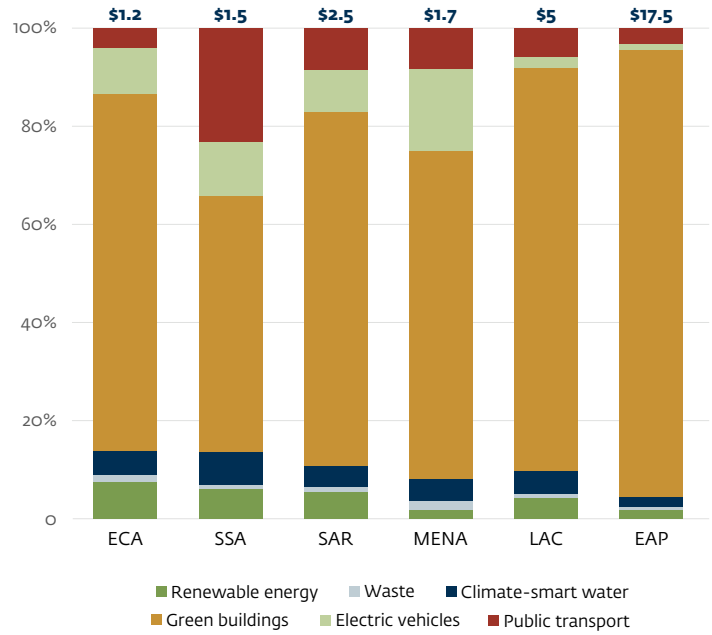
With 400 cities having submitted almost 1,150 projects for support worth close to $60 billion,[24] there is scope to build a pipeline of

investments that are attractive for bond finance. Cities need resources to prepare their projects, particularly in the early stages and know-how in terms of access to finance.

Traditional fiscal instruments such as tax and spend approaches are unlikely to meet the financing needs for city-level climate action[25] and subnational borrowing constraints and lack of creditworthiness often restrict direct access to debt instruments.[26] Central governments and provincial and municipal bodies are unlikely to fund the required infrastructure developments alone given large budgetary deficits and levels of debt. Commercial and institutional investors need attractive returns on investment and are therefore unlikely to commit funds to infrastructure unless there are tangible opportunities that meet their risk-reward criteria.[27] Filling the funding gap will require new and additional sources of finance, with country governments setting out adequate fiscal safeguards to service debt and manage public risks and liabilities. See the section on Financing Climate-Smart Investments in Cities for details on the necessary underpinning conditions and innovative instruments being used by municipal governments to attract private capital for infrastructure projects.

A range of initiatives led by local, international, private, and public actors are already attempting to address these challenges in accessing finance. Local authorities and municipalities can encourage collaboration internally because urban infrastructure considerations often overlap across various departments and state and national agencies, requiring coordination at different levels of government to achieve policy alignment. Central governments could support cities in their efforts through adequate regulatory frameworks and incentives, and by encouraging best practice in public sector governance and finance management.[28] The private sector, including financial institutions and investors, can share expertise in financing infrastructure and provide direct financing support. Multilateral and national development banks can also share expertise in designing and structuring infrastructure projects across and within sectors to build a pipeline of bankable investments. Institutions and initiatives operating in finance, cities, and sustainability, including civil society and academia, need to continue their efforts to identify gaps, disseminate best practice and lessons learned, and encourage multi-stakeholder dialogue.[29]

$29.4 Trillion Climate Investment Opportunity in Cities by Region ($ trillion)



Estimating the Climate-Smart Investment Opportunity in Emerging Market Cities

This report aims to help cities, project developers, and investors better understand the investment opportunities in climate-smart urban infrastructure in developing countries. As future urban population and emissions growth will be concentrated in emerging markets, the report attempts to assess the climate investment opportunity in cities in these markets, informed by real city pledges, targets, and investment plans contained in city action plans or NDCs for each of the sectors analyzed. The analysis is related to the opportunities associated with cities' current stated ambitions and does not make any judgment as to their alignment with the 1.5°C or 2°C emissions pathway identified by the Intergovernmental Panel on Climate Change. The focus is on cities in the countries that IFC operates in and is not intended to provide

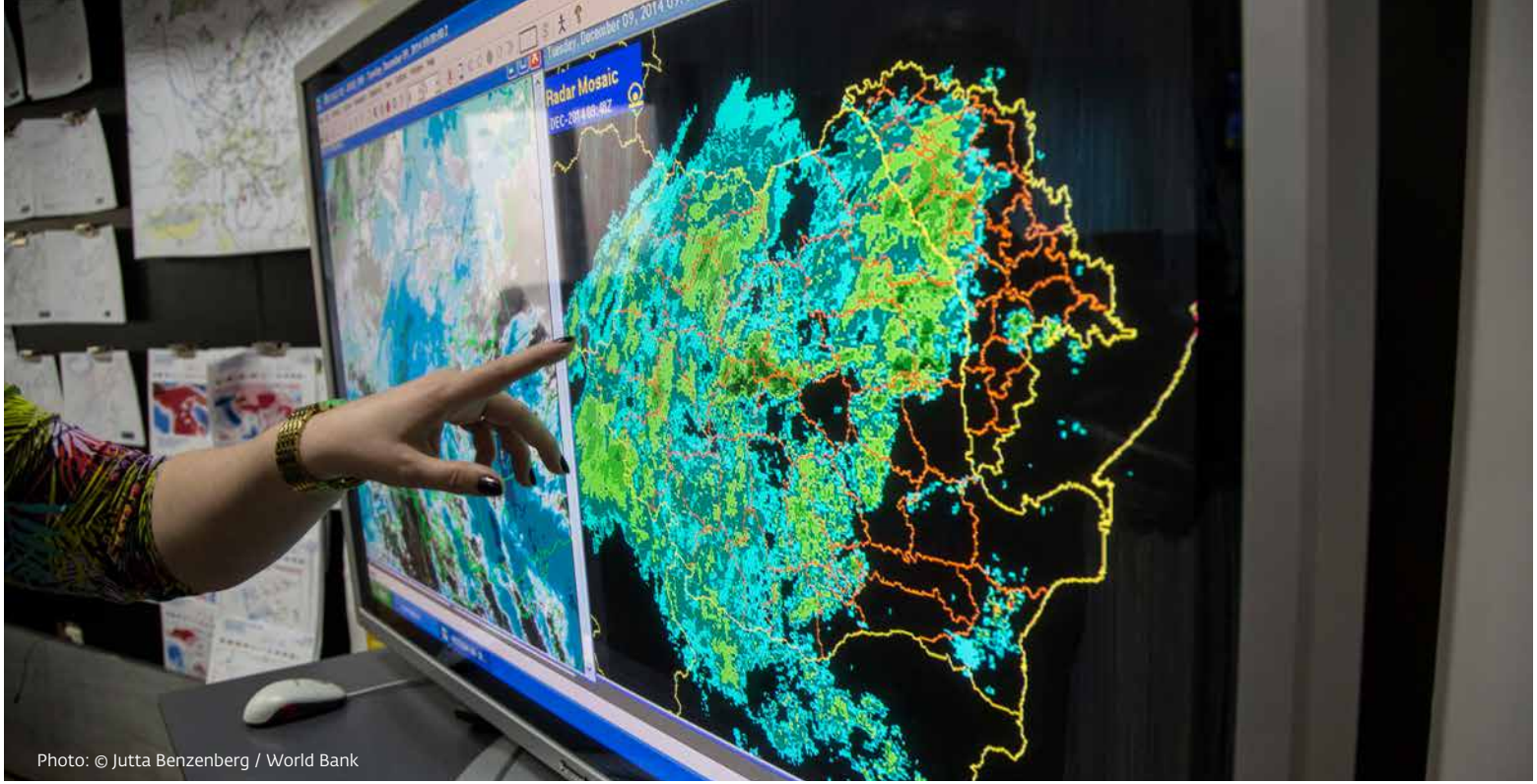


Photo: © Jutta Benzenberg / World Bank

a total estimate of the urban infrastructure gap globally. Rather, the report indicates the relative scale of the different climate investment opportunities across sectors and regions, namely East Asia and the Pacific, South Asia, Europe and Central Asia, Middle East and North Africa, Sub-Saharan Africa, and Latin America and the Caribbean.

Methodology

The analysis is based on a database of prioritized urban interventions and cost estimates for their implementation across six high-impact sectors: green buildings, public transport, electric vehicles, waste, climate-smart water, and renewable energy. A sector-specific methodology was used for the calculations depending on the level of available information, the details of which are available in Annex 1. This entailed measuring current and targeted sectoral estimates of usage and uptake of technologies and infrastructure required for each sector, and applying regionally disaggregated costs. To arrive at a cumulative sectoral investment estimate up to 2030, these estimates were then scaled then scaled by projected urban populations by region in 2030.

Research into emissions reduction targets and commitments indicated a range of ambition across cities and regions. Benchmark cities with available targets and pledges have been used to represent cities of different sizes in each region and results have been aggregated into a global figure, ensuring that there is no double counting. The analysis only covers a limited number of sectors relevant to climate action, which do not include general road infrastructure, civil and defensive infrastructure, or major capital projects.

Regional results have been scaled using the projected total urban population in each region in 2030. Climate action plans or commitment data points were consulted across 21 cities of different sizes in the six regions, ranging in population from 500,000 to megacities with more than 5 million inhabitants, to inform the benchmarks for further scaling and aggregation. These climate-related ambitions were seen to be mostly

TABLE 1: Total investment opportunities by 2030 in cities by region, based on urban population projections and emission reduction targets

Region	Total urban population in IFC region	Total national population in region	Urban population share	Average GHG reduction targets reported in city plans	Average reduction target reported in country NDCs	Total scale of investment to 2030 (USD)	Regional proportion
East Asia Pacific	1,440 M	2,207 M	65%	35%	35%	17,550 B	60%
South Asia	819 M	2,046 M	40%	51%	21%	2,462 B	8%
Europe and Central Asia	180 M	268 M	67%	32%	23%	1,212 B	4%
Middle East and North Africa	355 M	522 M	68%	24%	21%	1,689 B	6%
Sub-Saharan Africa	682 M	1,465 M	47%	31%	27%	1,475 B	5%
Latin America and Caribbean	596 M	713 M	84%	27%	18%	5,046 B	17%
Total	**4,072 M**	**7,221 M**	**56%**	**-**	**-**	**29,434 B**	**100%**

Note: These and all subsequent numbers across the report follow rounding conventions to the nearest billion, which might lead to differences in summing to the total.

in line with the countries' NDC targets. The investment opportunity estimates identified assume that these targets and commitments will be achieved in full.

IFC estimates a cumulative climate investment opportunity of $29.4 trillion by 2030 across six urban sectors in emerging market cities. Over half of this investment will be required in East Asia Pacific cities. The analysis assumes a total population of 7.5 billion in 2030, of which 4.1 billion are expected to be living in urban areas based on UN projections. The average overall rate of urbanization is assumed to be 56 percent, ranging from 40 percent in South Asia to over 80 percent in Latin America. More than half of the 4.1 billion people are expected to live in Asia, across South Asia and the East Asia Pacific regions, consistent with the scale of the investment opportunity in these regions.

The results indicate that, with much of urban population growth occurring in Sub-Saharan Africa, South Asia, and East Asia Pacific, there is an opportunity for a low-carbon transition in cities that are not yet well established. Megacities in South Asia and East Asia Pacific also have significant potential for investments that yield emission reductions.

The global, regional, and sectoral investment estimates for cities represent the total market opportunity for fully implementing all stated climate-related commitments in all locations. While there is leadership and commitment behind cities' climate policies, targets, and goals, fully achieving all these objectives by 2030 may be unlikely. Some of the targets

TABLE 2: Shades of green: Investment potential in cities by region and sector to 2030

	East Asia Pacific	South Asia	Europe & Central Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America & Caribbean	Total
Waste	$82 billion	$22 billion	$17 billion	$28 billion	$13 billion	$37 billion	$200 billion
Renewable energy	$266 billion	$141 billion	$88 billion	$31 billion	$89 billion	$226 billion	$842 billion
Public transportation	$135 billion	$217 billion	$116 billion	$281 billion	$159 billion	$109 billion	$1 trillion
Ciimate-smart water	$461 billion	$110 billion	$64 billion	$79 billion	$101 billion	$228 billion	$1 trillion
Electric vehicles	$569 billion	$214 billion	$46 billion	$133 billion	$344 billion	$285 billion	$1.6 trillion
Green buildings	$16 trillion	$1.8 trillion	$881 billion	$1.1 trillion	$768 billion	$4.1 trillion	$24.7 trillion
TOTAL	**$17.5 trillion**	**$2.5 trillion**	**$1.2 trillion**	**$1.7 trillion**	**$1.5 trillion**	**$5 trillion**	**$29.4 trillion**

INCREASING INVESTMENT

are likely to be aspirational and lack real political will for implementation. In some cities or regions there may be an upward or downward bias in the project cost estimates due to the lack of city-specific data or the absence of comparable projects in the country. These estimates do not make any judgment on the proportion of the investment opportunity that will be delivered by the public and private sector.

Summary of Key Findings

The lion's share of the investment opportunity is in green buildings ($24.7 trillion), as shown in the chart above. This includes both new constructions and retrofits as cities race to accommodate their growing populations. Improvements in low-carbon mobility solutions, driven by public transport infrastructure and the expected surge in electric vehicles, also hold significant investment opportunities ($1 trillion and $1.6 trillion respectively).

The availability and management of water resources is a primary concern for cities to meet the needs of their communities and ensure that they continue to attract private investment from businesses that rely on the resource for their operations, reflecting the $1 trillion opportunity in climate-smart water. The regional variations in the size of the investment opportunity by sector reflect both the range in the targets set by cities and the differing cost coefficients for technologies and implementation by region. The policies and opportunities across

Photo: © Mariana Gil, EMBARQ Brasil / WRI

the different sectors in each of the regions are considered in the City Deep Dives section of this report.

The Report

The following section discusses why and how cities should adapt to climate change, and the role the private sector can play in the implementation and financing of these efforts. It draws on insights from interviews with cities' Chief Resilience Officers.

The report then takes a closer look at six cities, one in each of the six regions of focus, reflecting a range of sizes and priorities. The analysis delves into the current context and policy frameworks in each, estimates the investment potential in key sectors, and identifies the key financial and policy instruments being used to unlock this opportunity for private investment. Each of these city deep dives is preceded by an overview of the investment opportunities in that specific region, looking at the policies and ambitions of cities across sectors, alongside examples of investments being undertaken. These chapters are interspersed with themes of interest to city policymakers and the private sector, linked by the common thread of addressing urban challenges.

The final section focuses on financing climate-related actions in cities, identifying the necessary criteria for attracting private financing and showcasing the primary financial instruments that can support these efforts, with innovative examples of how they have been applied by cities. Collectively, the report showcases the wealth of actions already taking place by both the public and private sector, and highlights scalable and replicable examples to deliver on the investment potential and need identified in the climate action plans and ambitions of cities.

Urban Climate Resilience

Urban Climate Resilience

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For the first time in three years, global carbon emissions increased in 2017 rather than remaining flat.[30] Managing cities' climate risks becomes increasingly important when considering that 70 percent of the world's population is expected to be living in urban areas by 2050, up from 50 percent today.[31] Their exposure to extreme weather events such as heavy monsoon rains, hurricanes, rising temperatures, inland flooding, and rising sea levels puts the majority of the global population at risk, especially vulnerable groups living in informal, unstable structures. Given that one in seven people live in informal settlements in urban areas,[32] there is a huge opportunity for cities to help these communities build their resilience.

A study conducted by the University of Washington estimates that the world will likely experience a median temperature increase of 3.2°C by 2100.[33] Analysis suggests that rising sea levels present the greatest threat to cities globally, with 275 million people worldwide living in areas that will be flooded should the temperature increase.[34] Asian cities will be worst affected, including 17.5 million people in Shanghai, 8.4 million in Hong Kong, and 5.2 million in Osaka, but every region will feel the effects.[35]

Climate-related risks are conservatively expected to cost cities an average of $123 billion annually in losses to projected economic output or GDP, according to the Lloyd's City Risk Index.[36] Improving resilience in the 279 indexed cities could decrease the GDP at risk by as much as $73.4 billion per year. Much of this risk to GDP and economic growth is the result of the concentration of businesses in urban areas,

which create employment, generate tax revenue, and provide goods and services to the city. The physical effects of climate change could disrupt supply chains, lead to lost productivity resulting from health issues, and incur costs associated with rebuilding or repairing physical assets such as buildings and transport infrastructure. Cities are also increasingly seeing a higher concentration of physical, financial, and human resources within their boundaries, raising the stakes for both cities and businesses to understand climate risks and opportunities, and invest in urban resilience.

Although cities across the globe will face the effects of climate change, the nature of the impact will depend on the geography and context of each city. Given their extreme vulnerability to the effects of climate change, it is essential that cities implement policies, invest in projects, and develop strategies for building long-term, sustainable, urban resilience.

Why Cities Should Act

With climate change exacerbating cities' exposure to economic and physical impacts, there is a strong imperative for cities to ensure that they develop in a climate-smart way over the coming decades by investing in resilient infrastructure now. Achieving developmental goals in rapidly urbanizing areas over the next few decades will only be made more difficult by the challenges of climate change. Cities need to act; services, people, and systems such as transport, energy, water, and communications are particularly interlinked in urban areas, which results in a co-dependent system that needs to be made resilient at every link to prevent the failure of the whole chain.[37]

Building urban resilience means improving a city's capacity to survive, adapt, and grow despite chronic and acute risks and shocks, which are often inter-sectoral and arise from a variety of sources.[38] Achieving development objectives such as improved health, access to water and electricity, and reduced poverty that reduce vulnerable populations' sensitivity and exposure to stresses and shocks can increase their capacity to adapt to climate impacts and build climate resilience. This requires a holistic approach that enhances social, economic, and environmental development across populations (see box on economic, social, and environmental resilience in cities).

City planning and infrastructure investments made today will have long-term impacts and shape the direction of urban growth and development for decades. Infrastructure built now will need to anticipate the climate impacts and needs of the future. These decisions can ensure that urban assets and residents can withstand climate impacts, while helping to shape urban economic and demographic growth for a sustainable, responsible, resilient future.

Investing in and paying for resilience and prevention upfront can help avoid much greater damages and costs in the future. Every dollar spent on pre-disaster mitigation measures where urban areas intersect with wildlands in the United States, for example, results in savings of six times that amount in post-disaster recovery.[39] Even spending on improving building codes will result in four times that amount saved in dollar terms.[40] Measures that help make a city more resilient can also have co-benefits for mitigation, which can help cities access much-needed climate finance for reducing their emissions.[41]

How Cities are Building Resilience

The first step for cities to build resilience, manage climate risk, and explore climate opportunities is to understand their exposure and sensitivity to different climate impacts. They can then develop strategies to adapt to these.[42] Building resilience involves avoiding adverse events, limiting their impact, or enhancing recovery,[43] and adapting to climate change means reducing the vulnerability of people or systems to climate impact and climate-variability risks by maintaining or increasing adaptive capacity and resilience.[44]

As the effects of climate change increase in frequency and intensity, the performance of investments and assets is being affected in many cities (as shown by increasing insurance losses worldwide, many concentrated in urban areas).[45] The rising risks and costs are pointing to the urgent need for assets that are climate resilient—assets and investments that incorporate in their design and operation the best available information about the impacts expected during their lifecycle and design remediating actions to ensure they avoid financial, environmental, and social underperformance.


Photo: © ADB

Each city's climate resilience strategy should be uniquely tailored to its specific requirements and characteristics, based on geography, population density, and other local considerations. For example, the city of Ahmedabad, India, is increasingly exposed to heat waves, so it has developed a Heat Action Plan that includes an early warning system and an Interagency Disaster Risk Reduction Plan.[46] Accra, Ghana, is implementing an integrated smart flood management framework to build resilience against flooding.[47] Larger cities with higher population densities than their smaller counterparts are not only more energy-efficient, but also tend to have lower per capita emissions.

Cities around the world are at various stages of planning, with 210 cities already having a climate change adaptation plan in place and 111 cities in the process of creating one as of 2016.[48] They are using a variety of tools to develop and mainstream their adaptation strategies and activities. One such tool is the Climate Risk and Adaptation Framework and Taxonomy developed by the Compact of Mayors and partners, which helps cities plan and implement their adaptation actions through a standardized framework for reporting climate hazards and impact, as well as risk and vulnerability assessments.[49] Another is the City Strength Diagnostic developed by the World Bank and the Global Facility for Disaster Reduction and Recovery, which helps city planners and stakeholders identify the range of climate impacts that a city might face, the critical gaps and potential weaknesses within the city, and the high-priority actions and investments needed to address those gaps and build resilience.[50] Since the resilience requirements and adaptive capacity of each city differ, tools such as the City Resilience Index allow cities to benchmark their progress against themselves rather than by comparison with others, through over 50 indicators that draw on both qualitative and quantitative data to measure and assess resilience.[51]

Cities are also working together and participating in global initiatives that help them assess their vulnerability, develop strategies, provide technical assistance for implementation, and find financing. These initiatives also hold cities accountable to their own climate and resilience commitments. As of March 2017, 28 cities have taken the 10% Resilience Pledge, which commits participating mayors to earmark 10 percent of their cities' existing annual budgets, without raising additional public funds, for resilience-building projects and activities.[52] Members of 100 Resilient Cities are collaborating with and learning from each other. For example, Surat has a memorandum of understanding with Rotterdam Partners to collaborate on projects to make both cities more resilient, with a focus on wastewater recycling, waste-to-energy systems, and smart city information technology.

HOW TO MAKE CITIES MORE RESILIENT:
UN International Strategy for Disaster Reduction and Global Facility for Disaster Reduction and Recovery checklist[53]

The Ten Essentials for Making Cities Resilient Checklist Summary

1. Put in place organisation and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build local alliances. Ensure that all departments understand their role in disaster risk reduction and preparedness.
2. Assign a budget for disaster risk reduction and provide incentives for homeowners, low-income families, communities, businesses, and the public sector to invest in reducing the risks they face.
3. Maintain up-to-date data on hazards and vulnerabilities. Prepare risk assessments and use these as the basis for urban development plans and decisions, ensure that this information and the plans for your city's resilience are readily available to the public and fully discussed with them
4. Invest in and maintain critical infrastructure that reduces risk, such as flood drainage, adjusted where needed to cope with climate change.
5. Assess the safety of all schools and health facilities and upgrade these as necessary.
6. Apply and enforce realistic, risk-compliant building regulations and land-use planning principles. Identify safe land for low-income citizens and upgrade informal settlements, wherever feasible.
7. Ensure that education programmes and training on disaster risk reduction are in place in schools and local communities.
8. Protect ecosystems and natual buffers to mitigate floods, storm surges and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk-reduction practices.
9. Install early warning systems and emergency management capacitites in your city and hold regular public preparedness drills.
10. After any disaster, ensure that the needs of the affected ppulation are placed at the centre of reconstruction, with support for them and their community organisations to design and help implement responses, including rebuidling homes and livelihoods.

City-Specific Approaches to Urban Water Resilience

TOO MUCH WATER (LONDON, ENGLAND)

To manage tidal flood risk in the short, medium, and long-term, London has developed the Thames Estuary 2100 Plan (TE2100).[54] This plan seeks to protect London and surrounding areas from rising sea levels, from the 90 centimeter rise predicted by 2100 to a worst-case scenario rise of up to 2.7 meters, and an increase of 40 percent in peak river flood flows.[55]

TE2100 sets out options for adaptation, finding that the preferred intervention is a staged long-term modification of the existing Thames flood barrier combined with local measures to manage flooding, including flood forecasting and emergency planning.[56]

The plan seeks to protect 1.3 million people and $360 million[57] worth of property from flood risk, and work has already started on implementing the first 10 years of investment in flood defenses.[58] After a competitive bidding process involving five firms, the UK Environment Agency awarded its largest single flood management contract for the delivery of the $392 million[59] program to private engineering and construction company, CH2M Hill.[60]

The city has also worked with insurers to create Flood Re, a publicly funded reinsurance pool that covers properties at high risk of flooding. Since 2016, households with low to normal flood risk have standard insurance, and those with the highest risk are passed on to Flood Re by insurers. The goal is to help incentivize flood-proof building in at-risk areas and phase out high-risk assets.[61]

TOO LITTLE WATER (CAPE TOWN, SOUTH AFRICA)

In February 2018, Cape Town faced the likelihood of running out of water within two months. It has since delayed "Day Zero"—first to 2019 and now indefinitely.[62] Heavily focusing its adaptation strategy on household users, the government instituted emergency regulations, including limiting people to 50 liters of water per day.[63] An online water dashboard allows residents to monitor daily fluctuations in dam levels,[64] weekly targets and actual water use, and updated water restrictions.[65]

To prepare for the long term and prevent this situation in future, Cape Town implemented a Water Resilience Plan in January 2018, which seeks to implement a series of water augmentation schemes in stages over a few months.[66] Procurement and commissioning have already begun for some projects, providing an opportunity for private sector investment in groundwater extraction and desalination in the first tranche, and water reuse and wastewater treatment in the second tranche.[67] Planned tenders include further desalination and augmenting the local aquifer and spring.[68]

Building Resilience: Experiences of Chief Resilience Officers

Chief Resilience Officers are senior-level city government officials that help to coordinate the resilience efforts of 100 Resilient Cities member cities. They work across government departments to help improve internal communications, bring together a broad range of stakeholders to learn about the city's challenges and resilience agenda, and lead the city's process of developing and implementing its resilience strategy.[69] These Chief Resilience Officers were interviewed to showcase a diverse range of priorities and approaches being adopted to build resilience in cities with different climate impact and economic contexts.

Cities are coming together through groupings such as C40, which brings together a network of over 90 of the world's megacities to turn their urban density into an opportunity for mitigation and resilience.[70] International organizations are also playing their part. The UN Making Cities Resilient Campaign works to raise awareness, identify city government budget allocations to invest in resilience and disaster risk-reduction activities, and help cities create and implement resilient urban development plans, while targeting private sector partners.[71] Similarly, the World Bank's City Resilience Program seeks to help city governments design urban resilience projects and access financing for such projects. In its first year of operation, the program has engaged with over 40 cities, conducted city diagnostics and investment planning workshops, and developed strategies for private capital mobilization through debt, PPPs, and land value capture.[72]

The next frontier for urban climate resilience is to expand beyond megacities, acknowledging the huge expected growth in small and medium-sized cities. According to the UN, some of the fastest-growing urban areas are Asian and African cities with populations under 1 million.[73] To accommodate this growth, these cities will need new infrastructure and buildings, presenting a compelling opportunity to ensure that this new construction is green and resilient.

DA NANG, VIETNAM

"To have better climate resilience in a city, we need to join hands not only with the government but also with the private sector and the local communities and neighborhoods. The government should be the champion of urban resilience work. However, we need private sector investment to leverage public sector funding to build sustainable urban resilient projects in Da Nang."

— **Cuong Dinh Quang,** Chief Resilience Officer, Da Nang

Da Nang sits on a low-lying coastline with its city center next to the Han River. As such, it is accustomed to extreme weather—droughts, flooding, typhoons, rising sea levels—all of which affect residents' livelihoods, local housing, and businesses.

Da Nang is the first city in Vietnam to adopt a resilience strategy against major shocks and stresses. The strategy is integrated with existing socioeconomic development strategies, climate change action planning, and urban planning to address overall resilience in the city.

While many urban resilience initiatives have been identified through the strategy, most are funded through the public sector and international donors, as climate resilience is a relatively new concept for the city and the country. However, there is a significant opportunity for private investment in some of the sector-specific initiatives, and Da Nang is seeking to leverage private funding from the tourism sector. Tourism is a key economic driver for the city, and a sector extremely vulnerable to climate shocks and stresses. Gaining private sector support for the tourism sector could pave the way for long-term resilience work in the city across a range of key sectors.

MEXICO CITY, MEXICO

"One of the most important challenges is the ability to prioritize and remain focused on long-term goals, which is critical for Mexico City in its urban resilience planning. It takes a lot of political will from essential actors to help address and solve many of the challenges the city is currently facing, whether it be sustainable mobility, affordable housing, or the extension of the aquifer. Institutions need to be in place with people who are ready to collaborate and create an agenda to achieve long-term change."

— **Arnoldo Matus Kramer,** Chief Resilience Officer, Mexico City

Mexico City is one of the most populous cities in the world, with about 22 million inhabitants in the greater metropolitan area.[74] Due to its location, it is vulnerable to flooding, mudslides, and earthquakes. As a result, the city has a keen interest in building its future resilience—and it is doing just that.

Mexico City established its Resilience Agency in 2016, with an articulated strategy to develop and implement resilience projects throughout the city, and mainstream resilience into the city's urban planning, with a focus on good governance, environmental management, and risk reduction. Resilience has since been embedded into the city's new constitution created in 2017, which forms a legal mandate for government agencies to work across sectors to help develop and implement these projects.

The day after its Resilience Agency was established, a major earthquake struck the city. Although the agency's main focus over the past 12 to 18 months has been largely on projects related to seismic resilience, it is also focusing on broader resilience projects.

Beyond seismic resilience, the city's Resilience Plan identifies additional priority areas, all of which present opportunities for private sector participation, including:

- Mobility (private bike-sharing and car-sharing schemes)
- Water management systems to prevent leaks
- Access to markets for agri-products
- Public spaces.

As part of the Resilience Plan, a monitoring and evaluation system has been developed. This system will help create a learning platform and coordinate efforts between relevant stakeholders. It will also help identify opportunities for projects to move from a pilot to a full-scale program for potential private sector investment. The city's Resilience Plan has identified three time horizons for identifying and implementing resilience projects—the end of 2018, to 2025, and to 2040, the last of which takes a longer perspective linked to promoting transformational adaptation.

PORTO ALEGRE, BRAZIL

"Climate resilience in Porto Alegre is about supporting an integrated way of life, and building resilience is about bringing together environmental sustainability and economic development, helping each understand the drivers for the other."

— **Rodrigo de Souza Corradi,** Chief Resilience Officer, Porto Alegre

Porto Alegre aims to use enhanced economic resilience as a means to strengthen climate resilience by extensively involving the private sector in cultivating the innovation industry within city limits and connecting to other parts of the district. With the help of the World Bank's City Resilience Program and Deloitte, Porto Alegre is putting together a pipeline of projects for private investment in resilient infrastructure. Like previous projects in the city, these will not carry the "resilience" label, but they will seek to mitigate climate concerns such as reducing displacement due to climate impacts, connect to the needs of the community by creating jobs, and appeal to the interests of both the city government and the private sector. It is hoped that the city can identify and implement these "anchor projects" between the city government and the private sector to catalyze more investment in resilient infrastructure and help preserve the urban farmland within Porto Alegre, which is the second largest in the world.

Porto Alegre intends to finance these projects through traditional infrastructure financing models and private investment through public-private partnerships (PPPs). The city is also working with the World Bank to develop approaches for municipal access to international funding and resilience finance, potentially with a local bank assuming risk and acting as a go-between.

The city's urban resilience agenda has been driven predominantly by the local government. The Chief Resilience Officer's team is helping to connect partners from industries and interest groups to engage with the local government. The government of Porto Alegre has recently allowed legislative flexibility for financing resilient urban projects in an attempt to use public resources to attract private investment. Until early 2018, legislation capped PPP investment to between 1 percent and 2 percent of public GDP, but this has now increased to match the 7 percent available at federal level.

QUITO, ECUADOR

"When defining urban resilience strategies, a city must be willing to adapt and adjust to its climate risks both now and in the future. For holistic urban resilience development to take shape, there is a need to focus on developing less attractive public spaces where resources are most scarce. Usually, these are the parts of the city where the most vulnerable populations live and where urban resilience development is needed most."

— **David Jácome Polit,** Chief Resilience Officer, Quito

Quito is working rapidly to address the effects of climate change. Increased rainfall, ongoing flooding, and accompanying landslides have resulted in many deaths and damage to housing in the most vulnerable sectors of the city. Rising temperatures have created harsher conditions, particularly affecting the agricultural sector. The city also faces mobility challenges due to scattered and uncontrolled urban sprawl.

To help address these challenges, the city of Quito hired a Chief Resilience Officer in 2016, who sits on the city's General Planning Agency. In 2017, the city established a resilience strategy based on broad consultations with stakeholders.

One of the projects arising from Quito's resilience strategy is the city's first metro line, designed to achieve an integrated and efficient transportation system that is resilient to the city's climate risks. This metro line is being financed by the local and central governments, as well as CAF—the Development Bank of Latin America, the Inter-American Development Bank, and the World Bank. As part of the metro line project, the government established a regulation to encourage private sector development in the nodes around the metro. The city intends to conduct an international tender to attract private sector investment to construct eco-efficient buildings, and thereby attract economic activity, in these nodes.

The public and private sectors are also working together to design how the city's agroindustry should be developed to be more environmentally friendly and inclusive, and to avoid adverse events related to food security.

In addition to transit-oriented development and agriculture, the city is focused on establishing special development zones near the Quito airport to create jobs by providing incentives to certain industries. The city is also working on a project to clean Quito's major river, the Machángara. In both projects, there are opportunities for private sector engagement and investment.

SEMARANG, INDONESIA

"To continue moving climate action forward, Semarang looks to the national level government to put relevant policies in place. The city also needs to think about urban climate resilience more practically and transfer these concepts and know-how to the related agencies and local communities to achieve enhanced impact."

— **Mohammad Luthfi Eko Nugroho,**
Development Planning Agency of Semarang/
Resilience Team

Semarang is a coastal city in Indonesia with both hilly areas and coastal plains. One of its most pressing concerns is water—the city experiences tidal flooding and flash floods. In recent years, flooding has intensified due to sea level rise, coastal erosion, and land subsidence. At the same time, the city's population is growing rapidly, exacerbating traffic congestion and urban sprawl.

To help address these issues, Semarang developed a City Resilience Strategy in 2016. It focuses on encouraging sustainable energy and water management practices, integrated mobility, preparedness for disaster and disease outbreaks, new economic opportunities, transparent public information and governance, and competitive human resources. Urban resilience strategies are also embedded in the city's Medium-Term Urban Development Plan, which are then applied to the projects and duties assigned to all government agencies across sectors.

Semarang has implemented innovative programs for enhancing the adaptive capacity of vulnerable communities along the city's West Flood Canal, initiated the use of renewable energy and rainwater harvesting, planted vetiver grass to prevent landslides, rehabilitated mangroves to protect coastlines, and invested in early warning systems for floods and vector-borne diseases. Some of these projects, such as urban farming, integrate a gender component to ensure women are involved in these economic opportunities. The city is also working to improve its public transport system—Trans Semarang—while reducing greenhouse gases and air pollutants in line with the SDGs. The city is raising awareness about climate resilience within the public and private sectors, and among local communities.

Most of the projects under way are largely funded by the city through provincial and national budgets, as well as donor agencies and universities. This presents an opportunity for national government policies to encourage private investment in climate-smart projects. Semarang is also proposing a PPP for a street lighting project, which would involve energy service companies, supported by the Ministry of Energy and Mineral Resources.

SURAT, INDIA

"Any type of resilience project will have to hit multiple birds with a single stone. And no one project makes a climate change program. They must be integrated and well-orchestrated."

— **Kamlesh Yagnik,** Chief Resilience Officer, Surat

Surat is a delta city near the Arabian Sea. For the past 100 years, it has experienced notable floods every four years. A flood in 2006 caused an estimated loss of about $2 billion. But the city is also heavily reliant on water—its synthetic fabric and diamond industries, which are key economic drivers for the city—require large volumes of water to operate.

The Surat Municipal Corporation has created the Surat Climate Change Trust to formalize and institutionalize resilience, and allow the municipality to access external financing. The first of its kind in the country, the trust includes multiple stakeholders, including elected officials and public sector representatives. The trust developed an Urban Resilience Strategy, with a focus on water, mobility, affordable housing, and economic and social resilience. Projects implemented under the strategy range in size from a few thousand rupees to $180 million.

To date, financing for these projects has been dependent mainly on local and central government funds. But there are potential opportunities for the private sector in water, solid waste management, and affordable housing. For example, it takes 1 billion liters of water each day to produce 40 million meters of synthetic fabric. To bridge the gap in water supply, private companies are invited by tender to set up tertiary treatment plants.

In 2010, the city established that any new commercial developments need to have a water harvesting facility, but this decree has not been enforced. The Surat Municipal Corporation is conducting an audit, which, once complete, will inform an enforcement policy that may include tax incentives and concessional pricing. An aquifer mapping was recently completed to identify site construction for French wells, which would give the city access to about 150 million liters of potable water per day at a lower cost than traditional methods. The Surat Municipal Corporation is also setting up state-of-the-art sewage treatment plants, which will supply 115 million liters of treated or recycled wastewater per day for industrial use by March 2019.[75]

Waste management is another major challenge for the city. Up to 85 percent of solid waste is taken to a dumpsite and there is no segregation at the source. Opportunities also lie in affordable housing. Housing is being built for low-income communities living in vulnerable areas, but it is not energy-efficient. The city is accepting special proposals from the private sector through a tender process to bring them into some of these projects. The main challenge has been awareness and enforcement, and the city's seven zonal chiefs have been given the legal mandate to improve awareness and enforcement of climate-smart practices and urban management across sectors.

The Role of the Public and Private Sector

City governments can play a central, catalytic, and convening role in building resilience. They can invest directly in projects to increase city resilience, such as the flood walls commissioned by Cologne, Germany,[76] or the transformation of Shenzhen, China, into a water supply catchment area through the adoption of the "sponge city" concept.[77] Similarly, city governments can ensure that all infrastructure and other developmental projects that they invest in are planned and implemented in a way that enhances the city's ability to adapt to climate change, while creating a pipeline of resilient projects for private sector investment.

By introducing building codes and other mandatory regulations, as well as launching fiscal and non-fiscal incentives, city governments can create a policy environment that encourages resilient urban development. Planning initiatives that prioritize adaptation of urban infrastructure and habits can also play a part in bringing together communities, businesses, and people in a way that helps those cities prepare for the future.

City governments will have to work beyond their territorial limits and coordinate across geographies, jurisdictions and systems to comprehensively build resilience, as the effects of climate change are not restricted by municipal boundaries.

The private sector has an important role to play in urban resilience. With many competing priorities for public finances and limited budgets, cities will need to unlock vast private sector investment in resilience. Climate change presents both risks and opportunities for the private sector. Companies face physical risks such as disrupted supply chains and extreme weather events: regulatory and compliance risks associated with expected future climate and carbon-related laws and regulations like carbon taxes; other transitional risks including reputational impact from being perceived as irresponsible corporate citizens; and declining worker productivity due to bad air quality, lack of adequate water and other infrastructure, and adverse climate impact. At the same time, investments in green products as well as in resilience-building infrastructure such as green buildings and floodwalls present potential new business and revenue opportunities. So, it makes sense for businesses to invest in and support urban resilience. Companies and cities' disclosures to the CDP (formerly known as the Carbon Disclosure Project) revealed that, despite some variation in expected severity and timing, cities and businesses are aligned in their recognition of local climate risks. 76 percent of the 207 cities that disclosed their environmental data in 2014 reported that climate change would impact business, and cities are taking action to reduce climate risks that businesses have also separately assessed as serious risks.[78] Strategies implemented and actions taken by local governments to improve the city's adaptive capacity also help build business resilience and prevent the relocation of business operations to urban areas with less climate risk exposure.

Forward-thinking companies are already seizing opportunities. For example, Siemens, the European electrical engineering conglomerate, has developed a practice area focused exclusively on resilient cities, providing services and products that range from remotely controlled distributed energy systems to decentralized wastewater treatment to engineered flood defenses.[79] Global infrastructure and engineering company AECOM offers integrated resilience solutions for cities, working on projects to provide water to 2.6 million people through green infrastructure in San Francisco, defend Edinburgh from flooding, build a network of smart, sustainable cities along the Delhi-Mumbai industrial corridor, and regenerate and renew Kuala Lumpur's waterfront.[80] In Caieiras, Brazil, state-owned enterprise Sabesp, recognizing the risk flooding poses to its operations, has developed a Corporate Climate Change Adaptation Plan and jointly invested in a $22 million fund to support research on water management across São Paulo.[81] Businesses are recognizing that making cities resilient is no longer an option, but a necessity, which has created a market for innovative, climate-smart business models, products, and projects.

Planning for climate change effects may soon impact cities' creditworthiness and rates at which they can borrow. Credit rating agency Moody's has announced that it will be considering a city's long-term adaptation and resilience measures against extreme weather events as part of its rating methodology.[82] Any downgrades to a city's credit rating due to a lack of preparedness for climate shocks will make it more expensive and difficult to access financing, not only for resilience-building investments but for all projects.

Photo: © Almin Zrno / World Bank

Financing Resilience

Connecting cities with financing is an essential component of building urban resilience strategies. Investment in urban infrastructure for developing countries tends to be funded by the public sector, but this is often insufficient given competing priorities and limited resources. According to a report by the World Bank and the Global Facility for Disaster Reduction and Recovery, without significant investment in resilience, cities worldwide may face $314 billion each year in damages by 2030, up from the $250 billion they face today.[83] By some estimates, required global investment in low emission and climate resilient urban infrastructure amounts to between $4.5 trillion and $5.5 trillion annually.[84] The sheer scale of the requirement necessitates the unlocking of alternative sources to government financing. The Global Facility for Disaster Reduction and Recovery report finds that the financing needed lies with the private sector, with up to $106 trillion in capital available from institutional investors such as pension and sovereign wealth funds, but only 1.6 percent of this is used for infrastructure investments.[85]

One of the barriers to increased private sector participation in resilience-building projects, particularly large infrastructure investments, is the challenge of monetizing the benefits of such projects. This is due to the combination of several factors, such as the inherent difficulty in monetizing socioeconomic benefits, the often large and diverse stakeholder groups including vulnerable populations without the ability to pay for the benefits from the interventions, and uncertainties related to climate effects and the timing of benefits that depend on when an extreme climate event might occur. Existing large protective projects are

Photo: © Danilo Pinzon / World Bank

largely publicly funded due to the difficulty in monetizing them, such as the Dutch Delta Works or the Thames Barrier. However, new potential projects are exploring other financing options that may make private investment feasible through innovative ways of structuring multi-purpose, and consequently multi-benefit, interventions with benefits that can be easily monetized, such as the New York Harbor Storm-Surge Barrier, whose final feasibility report is expected by 2022.

Tapping into institutional investment in resilience-building and resilient infrastructure will be invaluable in helping cities access the finance they need to adapt to climate change. Institutional investors are relatively risk averse when it comes to infrastructure, primarily due to the political risk,[86] cost overruns, and long tenors associated with such projects.[87] This has also limited their interest in investing in infrastructure projects that build urban resilience. But multilateral climate finance has reduced the risk profile of resilient infrastructure, which presents an investment opportunity of more than $52 trillion between 2015 and 2030 in the core sectors of power, transport, wastewater, and energy-efficiency, according to a study by the Brookings Institution.[88] The report finds that multilateral entities like the Climate Investment Funds, the Green Climate Fund, and the Global Environment Facility have been instrumental in de-risking low-carbon resilient infrastructure projects, delivering concessional climate finance, and crowding in private finance.

Innovative financial products to bridge the gap between resilient infrastructure and financing are already being piloted, primarily in cities in developed countries, such as the municipal bonds and green bonds discussed below. A new financial mechanism suggested by the Global Infrastructure Basel Foundation proposes the creation of a new asset class to match institutional investors' finances for resilient infrastructure projects.[89] The proposed hybrid sustainable infrastructure asset class will merge the incomes of equity and debt providers over the lifespan of infrastructure, securing sustainable cash flows with a risk/return profile between the two sources.

Cities are finding innovative ways to use existing financial products and alternative funding sources to finance their resilience projects. Washington, D.C.'s municipal water utility issued a $350 million

bond in 2014 that helped the city build resilience to flooding, improve water quality, and promote biodiversity and waterfront restoration.[90] This was extended in 2016 through a performance-based $25 million variable-rate green bond for green infrastructure and storm water absorption, which rewards investors if the city exceeds its wastewater reduction targets.[91] In 2017, Pune, India, raised funds through its municipal corporation to revamp the city's water supply system.[92] Mexico City became the first Latin American city to issue a green bond for $50 million to be used to build resilience through energy-efficiency, water management, and sustainable transport initiatives.[93]

Several institutions are attempting to develop "resilience bonds" or similar financial products that are focused on adaptation and resilience. The World Bank Group is developing a set of resilience metrics that may be used to help define and structure such financial products.[94] The Climate Bonds Initiative is developing an adaptation and resilience framework.[95] In another concept under development, the insurer accounts for the expected impact of a planned investment into a resilience-building project and lowers the premium that the city will have to pay, allowing the cost savings to finance the project.[96] The dividend from a resilience bond can also theoretically be used to finance projects beyond infrastructure, such as awareness campaigns and community-building exercises.[97] Cities can link insurance coverage, such as catastrophe bonds, with capital investments in resilient projects and systems like flood barriers and green infrastructure to anticipate and reduce the impact and losses from potential climate-related events.[98] In 2015, design firm re:focus adopted this concept and created the RE.bound program in partnership with private financial institutions. The program adapts the catastrophe bond model to climate risk and creates resilience bonds.[99]

Innovative financing is expanding in developed countries but is still difficult to access for municipalities in emerging markets. Few cities in emerging markets are able to issue bonds, and those that can are likely to be deterred due to higher underwriting and modeling costs associated with catastrophe or resilience bonds.

While cities can mitigate the impact of natural disasters, flooding, and other climate-related extreme events, they still have to rebuild after the fact. Insurance is a key mechanism for ensuring that the economic and financial repercussions of physical climate effects are kept at a manageable level. These products must be designed and priced to be most effective to support cities in their rehabilitation and rebuilding efforts, provide coverage for business continuity, and buffer lost public sector tax revenue and assets. The underlying asset should account for both current and future climate impacts and baseline thresholds so that it is independent of subsidies, with adequate coverage and affordable deductibles. International insurance companies such as Swiss Re and AXA are recognizing the potential of such products, and are providing insurance packages and services specifically for climate adaptation and disaster risk mitigation. Lloyd's of London has proposed four new methods to encourage investment in resilient infrastructure, including an insurance-lined loan package with interest payments that factor in the implementation of resilience measures.[100] By reissuing high-yield catastrophe bonds, insurance companies provide long-term financial risk coverage for local governments in the case of a disaster.[101]

Sharing the risk through PPPs can also be an attractive way for cities to leverage private sector capital and expertise for resilience-building projects. The World Bank recently supported a PPP to help build energy resilience in Zambia through investments in scaling solar energy.[102] Similarly, IFC is supporting a PPP in Córdoba, Argentina, through a $300 million financing package in partnership with commercial banks. The project seeks to construct and improve critical road infrastructure, which will help build urban transport resilience.[103] Cities can also use their existing budgets to prioritize resilient investments, and embed resilience in non-climate-related projects that they are already investing in. Developing country cities are also adapting other, more traditional forms of infrastructure financing to build more resilient assets. Financing alternatives include capturing increases in land value, embedding resilience standards for procurement, and accessing targeted funds for resilience. Some of these climate finance methods are explored further in the chapter on financing climate-smart investments in cities.


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FLOOD MANAGEMENT IN JAKARTA (WORLD BANK)

In 2012, the World Bank initiated a program to build urban resilience to climate change in East Asia using a risk-based approach to public investment decisions. Indonesia is one of the world's fastest growing economies, and its capital city Jakarta is the country's political and economic center. About 40 percent of the city is below sea level and there are 13 rivers that flow through the area. Combined with insufficient infrastructure, these topographic features put the city in a vulnerable position. The World Bank mapped all 2,688 neighborhood boundaries in Jakarta for the first time to assess their flood preparedness. It also partnered with Indonesia's National Agency for Disaster Countermeasure and the Australian government to introduce InaSAFE, a software program to understand the impact of a disaster and to adequately prepare for it. In 2013, the World Bank supported Indonesia's efforts to automatically assess the damage and loss from flood disasters with additional software.


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COASTAL TOWN INFRASTRUCTURE IN BANGLADESH (ASIAN DEVELOPMENT BANK)

An estimated 8.6 million people in Bangladesh's coastal regions are highly vulnerable to rising sea levels. These towns also suffer from large infrastructure deficits and natural resource constraints that exacerbate their sensitivity to climate change. The Asian Development Bank (ADB) has initiated a project to support climate resilience and disaster preparedness in eight coastal towns (each with populations of 15,000 to 60,000 people). The project grant is funding the construction of climate resilient infrastructure (roads, drains, and cyclone shelters). It will also be used to develop an integrated drainage plan and a solid waste and fecal sludge management plan that will incorporate a PPP business model.


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METRO MANILA FLOOD MANAGEMENT PROJECT (WORLD BANK)

The Philippines is expected to suffer long-term and repetitive damage from extreme weather patterns brought about by climate change. In Metro Manila, the need for climate change adaptation measures is particularly dire. Solid growth in the capital region has attracted an increasing number of migrants from rural areas, who typically move to informal settlements in danger zones. With one out of every five people in Metro Manila now living in informal settlements, worsening flood events are having devastating effects for those without adequate shelter. The World Bank is providing $207.6 million to improve flood management in selected areas of Metro Manila. The project is investing in a range of flood protection measures, including constructing 20 new pumping stations, modernizing 36 existing pumping stations, improving the associated waterways and drainage channels, and expanding water retention capacity across the city through green infrastructure, where suitable. The loan is also supporting the design and execution of asset management and maintenance plans, as well as resettlement away from the estimated 16 drainage areas.

Photo: © ADB

INTEGRATED FLOOD AND ENVIRONMENTAL RISK MANAGEMENT IN THE CHONGQING LONGXI RIVER BASIN (ADB)

The Longxi River Basin in China's Chongqing Municipality is a sub-basin of the Yangtze River and forms part of the primary buffer zone of the Three Gorges Reservoir. Because the reservoir is the main source of drinking water and fresh fish for millions of people, the Chinese government has prioritized environmental pollution control and ecological security in the buffer zone. The Longxi River Basin has experienced increasingly intense and frequent floods, water quality degradation, and ecological disruption in recent years. The ADB's $150 million loan will demonstrate a flood and environmental risk management approach that emphasizes the flood-waste-ecosystem relationship, risk mapping, and accountability mechanisms in the Longxi River Basin. This includes a range of measures, such as ecological dikes, waste collection and treatment facilities, temporary water retention facilities, wetlands, bio-shields, and emergency shelters. The project's approach can be replicated in similar watersheds along the Yangtze River Basin and other countries in the region.

Photo: © Scott Wallace / World Bank

FLOOD-RESILIENT INFRASTRUCTURE IN BARRANQUILLA, COLOMBIA (IFC)

Barranquilla is a city in northern Colombia on the Caribbean Sea. For decades, street flooding ("urban creeks") caused by heavy rainfall has been one of the main issues affecting the city. IFC has established a long-term strategic partnership with the municipality under the Latin America and Caribbean Cities Initiative, which comprises a combination of investment and advisory services to further develop the city's infrastructure. The investment component will likely support Barranquilla's urban infrastructure capital expenditure program, focusing on the construction of its storm water drainage system. The advisory services package is focused on knowledge sharing in sustainable cities solutions; capacity building for the introduction of green building standards in a new urban development area called Ciudad del Río; introducing energy-efficiency standards; and capacity building to share best practices in environmental and social standards for infrastructure projects.

Economic, Social, and Environmental Resilience in Cities

Three converging trends have come to characterize the 21st century: urbanization, globalization, and climate change. The world today is more densely populated and interconnected than ever before, which requires new models of governance to respond to challenges old and new. From extreme weather to refugee crises to disease pandemics to cyber-attacks, planning reactively and making decisions in silos will not give cities the fundamental strength and flexibility they need to thrive in the face of shocks and stresses.

Acute shocks are sudden, sharp events that threaten a community, such as earthquakes, disease outbreaks, or acts of terrorism. Chronic stresses—such as high unemployment, overtaxed or inefficient public transportation systems, or recurrent flooding—weaken the fabric of a community over time and exacerbate shocks when they occur. Cities rarely have the luxury of tackling just one shock or stress at a time, but rather are confronted by interdependent combinations at the same time.

Urban resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. A focus on resilience will allow cities to prosper and prepare them for challenges both expected and as-yet unimagined.

Resilience thinking requires cities to look holistically at their capacities and risks. The current approach to urban development is to work in silos, with one team designing disaster recovery plans, another exploring sustainability issues, another focused on livelihoods and well-being, and yet another on land-use planning and infrastructure. While that may be an efficient way to structure the work of a city, it is not the most effective way to grapple with the diverse challenges we face today. Planning for a resilient future entails tackling challenges and creating solutions in an integrated, inclusive, risk-aware, and forward-looking manner. This will allow cities to enjoy the multiple benefits that such solutions offer.

An investment in resilience-based planning, projects, and practices will return cost-savings, cost-avoidance, and multiple benefits across city systems. Decision-makers and investors need to be explicit about maximizing the co-benefits of their investments and deploy projects that serve communities in both the good times and the bad.

JAKARTA, INDONESIA—DECENTRALIZED WASTEWATER TREATMENT

In 2017, only 62 percent of Jakarta's population had access to clean, piped water. Only 4 percent had access to the sewerage system, resulting in almost three quarters of all households relying on ground water or river water, which is frequently polluted. Jakarta has prepared a Wastewater Master Plan, which, if fully implemented, will ensure that 65 percent of its residents will be covered by the piped sewerage system by 2022.

Jakarta's city government is investigating the management and operation of decentralized, odorless wastewater treatment plants on government-owned public space across the city. Such a system would help close the gap between a large-scale centralized system and inadequate onsite solutions, especially in low-income neighborhoods. This would improve sanitation and access to clean water for communities, while reducing health costs and emissions. The city has identified potential pilot sites and is reviewing the opportunities, constraints, and relevant technologies for each location, with the expectation of implementing the pilot in several sites in 2018, and plans to expand across the city in time. Partners could help address issues surrounding decentralized systems, such as solving procurement challenges, connecting to the city-wide water supply plan, ensuring financial feasibility, and engaging communities.

MONTEVIDEO, URUGUAY—MASTER PLAN FOR PANTANOSO STREAM BASIN

The Pantanoso Stream Basin, spanning 77 square kilometers (km^2) in the city of Montevideo, covers agricultural rural areas, residential zones, and informal settlements, with nearly a third of households in the zone falling below the poverty line. The lack of services and infrastructure in informal settlements contribute to water and air pollution, while the flood risk and poor perception of the area discourage much-needed new investment.

Montevideo has conducted initial assessments specifying five areas for investing $500 million in the Pantanoso Basin, addressing environmental, economic, social equity, connectivity, and community engagement needs. Through various initiatives, the city aims to improve air and water quality, maintain wetland environmental services, and reduce flood risk in the target basin area. Montevideo is seeking partners and funding to pursue a circular economy and sustainable economic growth. By investing in new housing and improving existing housing stock, creating new public recreational spaces, and establishing strong community partnerships, the city aims to address social equity issues. It is also pursuing investments in new pedestrian and cycling infrastructure, as well as new bridges over the watercourses, to improve connectivity beyond the extensive existing bus network. With support, the city hopes to design and implement a citizen consultation and participation process to create a plan for Pantanoso.

SANTA FE, ARGENTINA—ESTACIÓN BELGRANO

In 2008, after 20 years of neglect, the city of Santa Fe began renovating its iconic Belgrano Railway Station through private and public investment, successfully transforming it into an important site for exhibitions, fairs, and conventions. The Argentinian government recently made a commitment to recovering derelict public lands nationwide. The city is seizing the opportunity to further bolster the value of the wider Belgrano area by developing 22 hectares of underused and flood-prone public land surrounding the now thriving station. The revitalization project will integrate this zone into the urban grid through mixed-use development including hotels, shops, restaurants, office space, and housing. The city intends to develop the site using blue-green infrastructure to reduce flooding while increasing publicly accessible green space and ensuring a sustainable environmental footprint. The World Bank, in collaboration with 100 Resilient Cities, is providing support for the pre-feasibility studies. The project is in its initiation phase in 2018, with the city focused on creating a master plan for the redevelopment of public land by 2019. Overall, the Belgrano development will require an estimated investment of $100 million.

Photo: © Marwan Namaani / World Bank

City Deep Dives

East Asia and the Pacific

Cities drive economic growth, accounting for 80 percent of the GDP in most countries in the region.[104] This economic opportunity draws people into cities, with about 1.2 billion more people expected to live in Asian cities in 35 years. Many of these urban centers, including Bangkok, Guangzhou, Ho Chi Minh City, Manila, Shanghai, and Yangon, are low-lying or coastal hubs that are vulnerable to rising sea levels, floods, and extreme weather events such as typhoons. Measured as a percentage of GDP, Guangzhou faces the highest economic risk from climate change out of all global cities, and Shenzhen ranks tenth on the list.[105] City leaders in East Asia and the Pacific are developing solutions for building urban resilience while remaining at the forefront of economic growth, with businesses playing an integral role.

The region's cities are setting their own climate agendas that will invite investment into key climate-smart sectors and projects. For example, Kuala Lumpur is committed to reducing its emissions by 20 percent by 2022, primarily by improving the energy-efficiency of its buildings.[106] The City Climate Change Action Plan for Ho Chi Minh City outlines measures to reduce emissions by 19 percent from 2013 levels by 2020 through land-use planning and the transformation of sectors including energy, transport, industry, water, waste, tourism, construction, and agriculture.[107]

Chinese cities are leading in the electrification of the transport sector, with support from national government policies and incentives for the electrification of public fleets that help manufacturers achieve economies of scale to make the production of private electric vehicles economically viable.[108] By 2030, three in 100 people in China are expected to own a private electric vehicle, creating significant opportunities in Chinese cities and the region at large.

Cities in East Asia and the Pacific are also embedding climate resilience and mitigation into their social, economic, and urban development policies. For example, Manila is reviewing an integrated flood control and transport PPP through the Manila Bay Integrated Flood Control, Coastal Defense, and Expressway Project, which seeks to mitigate the climate impact of typhoons while improving road access to the area.[109] Similarly, Semarang has introduced a bus rapid transit system that has helped women, the elderly, and disabled residents access transport, while catalyzing a modal shift towards public transport that has reduced the city's emissions substantially. The city has used the project to demonstrate how data can be collected and used to allow for sustainable and gender-equitable urban development.[110]

Such plans, policies, and projects make East Asia and the Pacific the region with the highest climate-smart investment potential in cities according to IFC estimates, amounting to a total investment opportunity of $17.5 trillion in the region's cities to 2030.

Estimated Climate Investment Opportunity in East Asia and the Pacific (2018–2030)

	$17.5T	GREEN TARGET PENETRATION
Waste	$82B	88%
Public transport	$135B	N/A
Renewable energy	$266B	35%
Climate-smart water	$461B	65%
Electric vehicles	$569B	29%
Green buildings	$16T	37%

A PUBLIC-PRIVATE PARTNERSHIP FOR LIGHT RAIL IN MANILA (IFC)

In 1984, Manila built the first light rail transit line in the Philippines. By 2014, the line was carrying half a million passengers every day along one of the city's densest traffic corridors. IFC supported the Department of Transportation and Communication in designing a PPP for a 32-year concession to upgrade and operate the light rail line, and build and operate a much-needed 12km extension. IFC helped select a private concessionaire through a competitive and transparent process to operate the existing system, and to develop and operate the Cavite extension. The winning consortium committed to investing $925 million to build the extension, which will benefit over 1 million daily passengers when it is complete. The project has yielded $512 million in fiscal benefits and will reduce CO_2 emissions by 40,000 tons per year—equivalent to taking 8,500 cars off the road—by providing transport to hundreds of thousands of daily commuters.

WASTE AND BIOGAS IN MANDALAY (ADB)

Myanmar is home to a rapidly growing urban population that is acutely vulnerable to extreme weather events related to climate change. This could have potentially devastating effects for the country given that its urban areas are projected to account for 50 percent of its GDP by 2030. The ADB provided $6.2 million in climate adaptation finance (in addition to a $4 million grant and a $60 million loan) to generate biogas at a wastewater treatment plant in Mandalay. The biogas will be used to produce electricity for the plant and sludge from the digester will be stabilized for potential reuse in agriculture or cement works. By 2023, the plant is expected to be carbon-neutral and at least 50 percent energy self-sufficient.

AIR QUALITY IN ULAANBAATAR (ADB)

In recent winters, Ulaanbaatar has suffered some of the highest levels of air pollution in the world—nearly 40 times the daily limits recommended by the World Health Organization. Rapid urbanization has resulted in a vast city with poor access to water, sanitation, heat, and public transport. In winter, most households use raw coal or solid waste as heating and cooking fuel, resulting in high levels of multi-source micro particulate pollution (PM2.5)[111] and negative health effects. With its $130 million policy-based loan, the ADB has encouraged the government to step up its investments in air pollution control measures, short-term solutions for reducing emissions and protecting public health, and long-term redevelopment efforts such as the provision of clean heating fuel and the extension of district heating through renewable sources. The policy-based loan has also prompted the Mongolian government to ensure that urban and energy planning agencies take into consideration anticipated climate impacts on urban infrastructure and future rural migration patterns.

An ongoing finance sector program will support small and medium-sized enterprises undertaking green and energy-efficient projects. The government will allocate new capital to the Credit Guarantee Fund of Mongolia to support the creation of new credit guarantee products designed to maximize potential air quality improvements and help businesses in peri-urban areas.

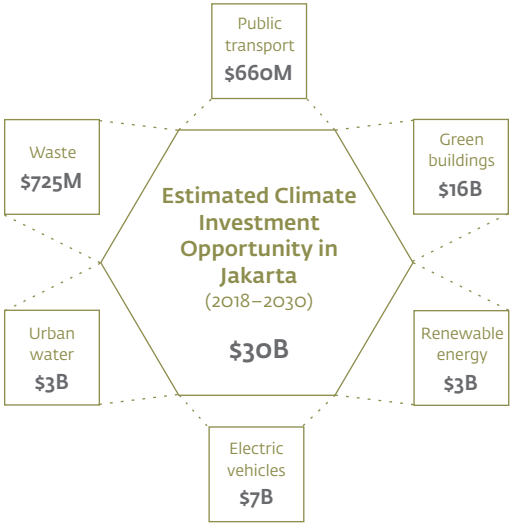
SECONDARY CITIES DEVELOPMENT (ADB)

Vietnam's population and economy are rapidly urbanizing, with a structural shift from agriculture to industry and services, which have accounted for nearly 80 percent of the economy since 2005. Adapting critical infrastructure by building climate resilience in coastal and low-lying areas will safeguard vulnerable populations, productive sectors of the economy, and its natural resources. The project cities, Buon Ma Thuot (Dak Lak province), Ha Tinh (Ha Tinh province), and Tam Ky (Quang Nam province), are provincial capitals representing Vietnam's rapidly developing secondary cities. The project includes upgrading urban roads for improved connectivity and evacuation during disasters, building flood dikes and drainage channels, and regulating basins for flood protection. The ADB provided a $95 million grant and $2 million in climate risk financing for the project.

AFFORDABLE HOUSING IN INDONESIA (WORLD BANK)

Indonesia is undergoing a major structural transformation into an urban economy, which means it is experiencing a large infrastructure deficit. Many cities have densely populated informal settlements. With more than 40 million Indonesians living within 10 meters above the average sea level, the vulnerability of lower-income households and their self-made houses in coastal cities such as Jakarta, Semarang, and Surabaya continue to increase. With the World Bank's $450 million loan, the Indonesia National Affordable Housing Program is improving access to affordable housing through a mix of demand and supply-side interventions and embedding climate change adaptation considerations into housing planning in major coastal cities. The program has set specific eligibility parameters to ensure that any housing unit purchased or improved through the program is less vulnerable to climate-related hazards. It will also introduce a simple screening process for climate and geophysical hazards when houses are identified for purchase, provide practical how-to guidance on specific home improvements, and raise homeowners' awareness of the risks. About 676,000 households are expected to benefit from this program, including 126,000 households for affordable house ownership through mortgage-linked down-payment assistance, and 450,000 households receiving house improvement/reconstruction support through government subsidy to cover up-front assistance for incremental home improvement.

JAKARTA, INDONESIA



City	Jakarta
Population	9.6 million
GDP (per capita)	$4,130
Current GHG emissions	33 million tCO_2e
GHG reduction target	30% reduction by 2030 (compared with 2005 levels)
Municipal credit rating	N/A

"One of our key ambitions is to make the city of Jakarta cleaner—and we can tackle this in a number of different ways. One such way is through green buildings. A mandatory regulation for green building codes was passed a few years ago, which will help to substantially reduce the consumption of energy and water. Because of this regulation, potential energy cost savings are estimated at $90 million annually. We want Jakarta to be known as a city of excellence for green buildings, and it will take both the public and private sectors to make this happen, as well as local communities and citizens."

— **Oswar Mungkasa,** Deputy Governor of Jakarta

Indonesia's capital city of Jakarta has a strong economy that grew by 6.2 percent in 2017,[112] higher than the national growth rate of 5.1 percent.[113] As one of the most populated cities in the region, climate hazards such as flooding and rising sea levels are likely to affect many of Jakarta's 9.6 million residents. The city is embedding climate action into its urban growth management strategies, which intend to improve air quality, reduce traffic congestion, and address increased water demand and waste generation.

Mitigation and Adaptation Plans

Jakarta has committed to reduce its emissions by 30 percent from 2005 levels and to source 30 percent of its energy from renewable sources by 2030.[114] As a member of C40, it has also pledged to become emission neutral by 2050[115] and has issued a joint statement with other cities from the Group of 20 nations asking leaders to collaborate on climate action under the Urban 20 initiative, which promotes cooperation between 25 global cities and Group of 20 nations.[116]

Jakarta's Spatial Plan 2030 prioritizes climate-smart urban development, including improving wastewater treatment, increasing the use of alternative energy-based waste management technology, developing better public mass transit, enhancing the drainage system, and building resilience to natural disasters.[117] The city's Regional Action Plan for Reduction of Greenhouse Gases seeks to gather data on the city's emissions, simulate their trajectory to 2030, and develop a Mitigation Action Plan focusing on green spaces, sustainable transport, green energy, wastewater management, and solid waste management over the same period.[118]

The city is making substantial infrastructure investments to build its resilience against flooding, the most urgent climate impact, through plans such as the Jakarta Coastal Defense Strategy and Flood Mapping, as well as the Jakarta Emergency Dredging Initiative, which seeks to unclog the city's waterways that are operating at 30 percent of capacity.[119] Jakarta is also planning to construct large sea walls, embankments, and flood canals, and to resettle residents living in informal settlements along the water.[120] While its current resilience initiatives focus on elevated construction and repairing damage, the city is working with 100 Resilient Cities to develop a strategy that addresses the causes of flooding, among other climate change impacts.[121]

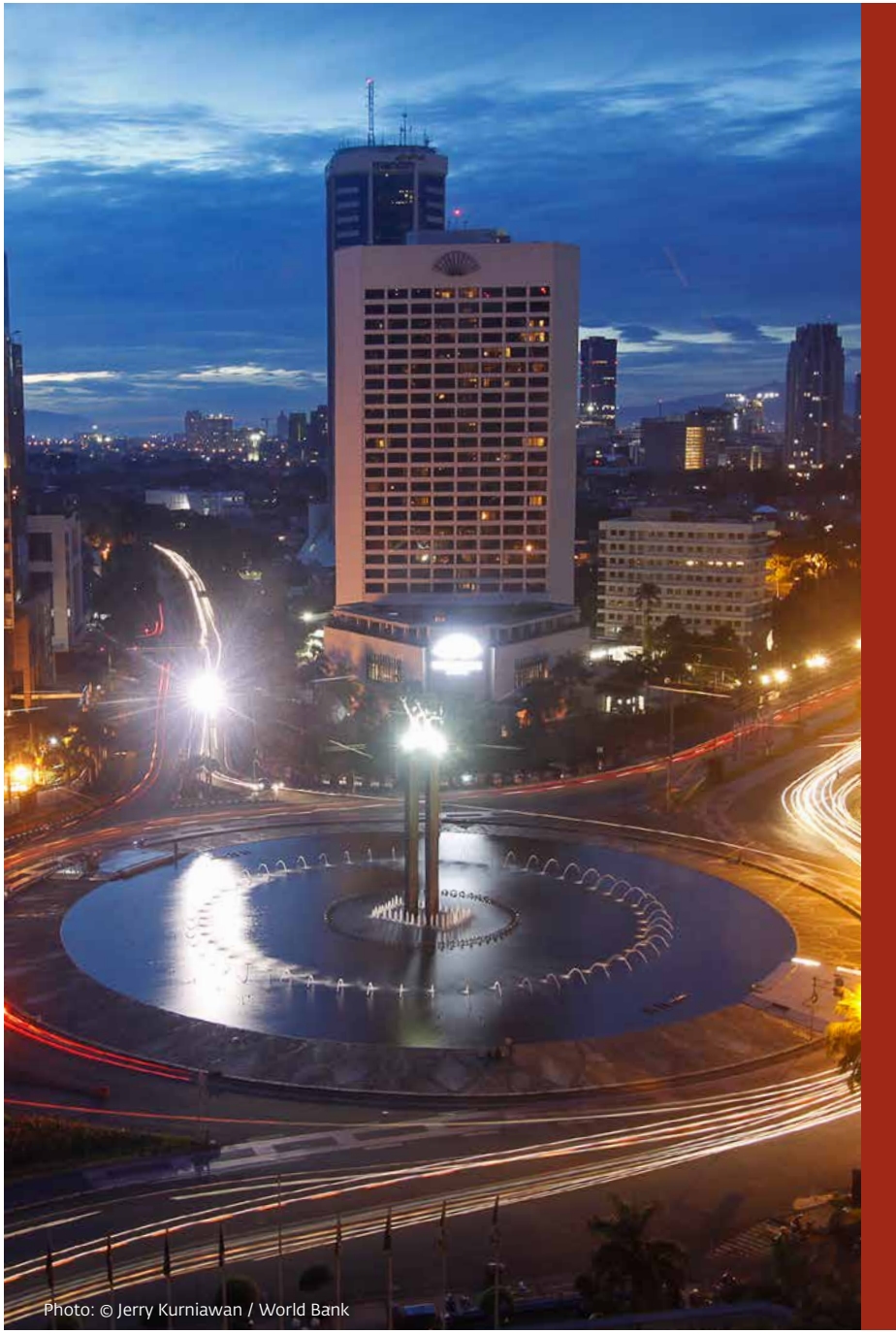
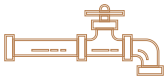


Photo: © Jerry Kurniawan / World Bank

Priority Sectors for Investment

WATER	$3B

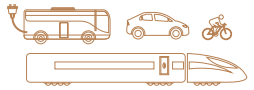


Water is a key issue for Jakarta's urban development, both in terms of supply and resilience. The city also loses an estimated 50 percent[122] of its water supply to leakage, and its public water network services about 40 percent of the city's households.[123] The city requires investments in laying 7,800km of new pipes to service the entire city,[124] creating a considerable opportunity for the private sector. Extreme groundwater extraction has had the unforeseen effect of not only draining the capital's aquifer, but also causing the ground on which it stands to sink, with some coastal areas sinking by up to 25 centimeters a year.[125] In 2009, the city created tax benefits to incentivize businesses to draw less water, leading to a 30 percent decline in groundwater extraction.[126]

With a growing population and new construction, the city is looking to implement a variety of measures to provide its residents with water while halting groundwater extraction. Northern Jakarta is mandated to have 100 percent water supply coverage and zero groundwater extraction, with similar piped water policies extending to the rest of the city for completion by 2030.[127] The city also aims to relocate large users of groundwater, such as industrial users, away from critical zones with the most groundwater depletion.

Meeting its objective to drastically reduce groundwater extraction and secure access to piped water for its citizens will require an estimated $3 billion investment in Jakarta's water and wastewater sector by 2030.

TRANSPORT	$7.7B



Jakarta has a Compact City Development Strategy for Transit-Oriented Development, which includes plans for intersecting population-dense areas with public transport, improving pedestrian and bicycle pathways, and developing mixed land-use areas that promote non-motorized transport.[128]

Given the ongoing challenges of air pollution and traffic congestion, Jakarta has been investing in improved public transport, with a focus on buses. The city launched the TransJakarta, the first bus rapid transit system in Asia, in 2004. Between 2015 and 2017, it introduced three new bus corridors spanning over 49km and 380 more fuel-efficient buses through its Sustainable Urban Transport Program.[129] Since 2016, the city has been working with the private sector to promote fuel-efficient and safe driving through the Ecodriving initiative, in conjunction with Toyota Motor Asia Pacific and Clean Air Asia.[130]

Jakarta is also constructing a mass rapid transit system, the first phase of which is expected to be completed by the end of 2018. In August 2018, the city announced its intention to issue a tender for the second phase in the coming months.[131] Once completed by 2025, the electrified network will span 112km and be integrated with the 42km-long light rail transit system being built by a consortium of companies,[132] which will also require significant investment.

The city's transport sector target for 2030 is for 60 percent of all trips to be made using public transport, with a 30 percent decrease in emissions from the sector.[133] It is participating in a scheme developed by C40 that will allow it to purchase "soot-free" engine technology and low-emissions buses from four of the world's largest bus and engine manufacturers from 2018 onwards.[134] IFC estimates an investment opportunity of $660 million in public transport and almost $7 billion in electric vehicles to 2030 for the city to achieve its plans to create a sustainable transport system.

GREEN BUILDINGS	$16B

Jakarta aims to build at least 1,000 low-cost residential towers by 2020 to house those who have been relocated out of informal settlements in the low-lying, flood-prone riverbank area.[135] The city released the Grand Design of Green Building Jakarta in 2016, which committed to reducing water and energy consumption, as well as CO_2 emissions, from buildings by 30 percent by 2030.[136]

To increase the energy-efficiency of its buildings, Jakarta worked with IFC to develop a Green Buildings Code to reduce energy consumption from residential and commercial buildings in 2013. As of May 2016, the code had resulted in changes to 260 buildings, over an area covering more than 15 million square meters.[137] The city will continue implementing these energy-efficiency measures, which will contribute to an investment in green buildings expected to total over $16 billion by 2030.

Financing and Policy Instruments

The central government of Indonesia maintains strict control over municipal borrowing and access to financing in the country, but has encouraged PPP concession models or special-purpose private infrastructure projects in Jakarta that can generate revenues for repayment.[138] The city has seen some success with PPPs, including the $6 billion Jakarta-Bandung high-speed railway project,[139] and with private sector initiatives such as Unilever's waste bank facility, which seeks to improve the solid waste management capacity of Jakarta and 16 other cities in Indonesia.[140] The city has also had support from the ADB for the East[141] and West[142] Jakarta water supply development projects.

The government of Jakarta is using policy instruments at its disposal to raise funds for its climate activities, such as taxing the consumption of groundwater to co-finance its 2030 piped water target discussed above.[143] The national government is also working with the ADB on the country's first municipal bond issuance program for infrastructure and urban development projects, which will be piloted in Jakarta and Central Java.[144]

The World Bank Group is working to support Jakarta and other cities in Indonesia on financing and policy for urban development projects. City governments are only able to use their budgets to fund projects that take less than a year to complete. The World Bank and the Asian Infrastructure Investment Bank have each approved financing of $100 million to PT Sarana Multi Infrastruktur, a state-owned infrastructure financing firm, to improve subnational governments' access to credit for infrastructure projects.[145]

Energy-efficiency in Urban Buildings


Photo: © Ecoloft

Citizens sometimes do not notice the public buildings they use on a daily basis. Yet some of the biggest challenges faced by city decision-makers when determining the best way to deliver on Paris Agreement ambitions are how to improve comfort, reduce energy and carbon use, improve air quality, and make such buildings resilient to climate change impacts. Building energy use in more developed cities accounts for 50 percent of an entire city's emissions on average, but can contribute upwards of 80 percent. In less developed cities in particular, building efficiency needs to be tackled now in order to prevent carbon from being locked in.

Research by C40 has revealed that most of the actions required for cities to align with the Paris Agreement lie in the building sector. Cities are stepping up to meet this challenge: 22 cities pledged to introduce policies and regulations to ensure new buildings operate at net zero carbon by 2030, and all existing buildings by 2050, under the Net Zero Carbon Buildings Declaration. This declaration is part of the umbrella Net Zero Carbon Buildings Commitment launched with 12 businesses and four states and regions in September 2018.

Cities are three times more likely to act if a common goal or target has been established. While no city has sufficiently adequate policies to get all buildings to net zero carbon by 2050 in place yet, many are well on their way.

MEXICO CITY, MEXICO—SUSTAINABLE BUILDINGS CERTIFICATION PROGRAM

Mexico City's Sustainable Buildings Certification Program aims to foster sustainable construction and building usage by awarding certifications for various levels of sustainability performance in different fields (energy, water, mobility, solid waste, social and environmental responsibility, and green roofs). The program targets both new and existing buildings in the commercial, industrial, and residential sector. Its voluntary certifications are a first step towards the long-term goal of developing more stringent voluntary and mandatory building codes that integrate environmental performance and energy-efficiency.

RIO DE JANEIRO, BRAZIL—INCENTIVIZING SUSTAINABLE CONSTRUCTION

Rio de Janeiro relaunched a tax incentive initiative called Qualiverde in January 2017 to incentivize the adoption of sustainability practices in construction. The initiative covers many aspects of resource efficiency (water management, energy-efficiency, and thermal performance) and resiliency in new buildings. The initiative is supported by two complementary policies that certify projects that adopt sustainability practices and actions and grant tax benefits to buildings that qualify.

CAPE TOWN, DURBAN, JOHANNESBURG, AND TSHWANE, SOUTH AFRICA—C40 SOUTH AFRICA BUILDINGS PROGRAM

Cape Town, Durban, Johannesburg, and Tshwane have signed the pledge to enact regulations and/or planning policy to ensure new buildings operate at net zero carbon by 2030 and all buildings by 2050. The cities will establish a roadmap for the commitment to achieve net zero carbon buildings, develop a suite of supporting incentives and programs, and provide annual progress reports. They have also committed to only owning, occupying, and developing assets that are net zero carbon by 2030. To achieve this goal, they will evaluate the current energy demand of and carbon emissions from municipal buildings, identify opportunities for reduction, establish an action plan, and report on progress annually. C40 is providing them with an embedded member of staff until 2020 to lay the foundation for these policies.

SYDNEY, AUSTRALIA—BUILDING PARTNERSHIPS WITH THE PRIVATE SECTOR

Sydney achieved a 52 percent reduction in emissions since 2006 through its Better Buildings Partnership with commercial office building owners who provide more than 35 percent of office space in the city. Meanwhile, owners have grown their property portfolios by 14 percent. Improving energy-efficiency and replacing conventional energy systems with renewables were key to these outstanding results. Sydney learned from Tokyo's experience of incentivizing energy-efficiency in buildings, and is now advising New York on how to expand its landlord program, using approaches like green leases and formulating shared goals between landlords and tenants.

Building on the success of the Better Buildings Partnership, Sydney launched a second collective impact partnership, the Sustainable Destinations Partnership, for the service sector. The partnership has already seen companies such as the Sydney Opera House go carbon neutral five years ahead of schedule.

QINGDAO, CHINA—ACCESSING PRIVATE CAPITAL

As part of the C40 China Buildings Program, Qingdao is looking at how to ensure the financial sustainability of further energy-efficiency retrofits for existing residential buildings. To date, such retrofits have largely relied on government subsidy. Residential building upgrades are a key step in the city's implementation of its thirteenth Five-Year Plan. The plan outlines the city's ambitions to retrofit at least another 10 million square meters of residential buildings by 2020, achieving 40 percent energy-efficiency improvements, saving at least 34,000 tons of coal equivalent in energy, and reducing CO_2 emissions by at least 92,000 tons over five years. Qingdao plans to move towards a mixed subsidy model with wider private participation by switching from upfront retrofit payments to providing an assessed retrofit subsidy at project completion.

South Asia

The urban population in South Asia grew by 130 million between 2001 and 2011, and is expected to increase by another 250 million by 2030.[146] Urbanization has helped reduce extreme poverty in South Asia, and cities in the region are now recognizing the need for urban planning to manage their sprawl and provide adequate infrastructure and services.[147] Embedding climate change into these plans is essential, as cities in the region are extremely vulnerable to the impacts of climate change. Coastal cities in particular are exposed to a range of risks, including rising sea levels, changing monsoon patterns, and shortages of potable water.[148] Cities in South Asia require adequate investment in flood protection, without which they could face damages worth more than $140 billion annually by 2030.[149]

Megacities and secondary cities in South Asia are expected to see a sharp spike in economic and population growth over the coming decades.[150] Ensuring that the expected growth in medium-sized and secondary cities in the region is planned in a sustainable manner will be key to South Asia's urban development and its ability to mitigate emissions and adapt to climate impacts. The region's city leaders are recognizing the nexus between climate change and growth across sectors, particularly in energy use, transport, and buildings. Indian cities

alone are expected to host 200 million more people by 2030 and are yet to construct almost two-thirds of the buildings that will exist in 2030, giving them a significant role to play in effective climate action and scope to attract green investment.

Cities across the region are implementing broad climate action plans and targeted goals for emissions reduction and resilience building by sector. In 2015, Chennai in India committed to reduce its emissions from the transport sector by 24 percent in three years, through measures such as increasing the share of non-motorized transport to more than 40 percent of all trips.[151] Thimphu in Bhutan aims to replace its entire fleet of public sector vehicles and taxis with electric vehicles by 2020.[152] The planned city of Hulhumale is being developed as the first smart city in the Maldives. It will be built using low-carbon climate resilient urban planning, including a sustainable transport master plan, green buildings, and renewable energy.[153] Surat in India has developed the country's first comprehensive Urban Resilience Strategy, which lists 11 initiatives on resilient mobility; 7 initiatives for affordable, sustainable housing; 13 to address water management issues; and another 14 on cross-cutting environmental issues.[154]

The expected increase in South Asia's urban population and rising per capita income will necessitate climate-smart investment across sectors to achieve the region's urban development goals in a sustainable way. IFC estimates a climate investment potential of $2.5 trillion in South Asia's cities across six key sectors.

Estimated Climate Investment Opportunity in South Asia (2018–2030)

	$2.5T	GREEN TARGET PENETRATION
Waste	$22B	76%
Climate-smart water	$110B	64%
Renewable energy	$141B	54%
Electric vehicles	$214B	29%
Public transport	$217B	N/A
Green buildings	$1.8T	12%


Photo: © Iwan Bagus / IFC

ENERGY-EFFICIENT STREET LIGHTING IN BHUBANESWAR, INDIA (IFC)

India's 35 million street lights consume 1.5 percent of the country's energy. The Urban Renewal Plan for Bhubaneswar, the capital city of India's Odisha state, requires $700 million, of which almost $400 million is expected to be sourced through PPPs. The Bhubaneswar Municipal Corporation asked IFC to design a PPP that would reduce energy consumption, improve visibility, and make the city safer for its residents. With support from DevCo, a multi-donor facility affiliated with the Private Infrastructure Development Group, IFC linked the private partner's revenue directly to the amount of energy it saved the city. The more energy the company saved the city, the more it would earn. Today, almost 20,000 street lights in Bhubaneswar have been retrofitted with energy-efficient lighting. IFC has helped the cities of Berhampur, Cuttack, Jaipur, Rourkela, and Sambalpur improve their street lights through PPPs. Together, these projects will reduce greenhouse-gas emissions by nearly 50,000 metric tons per year, bring in over $20 million in private sector investment, and make city streets safer for citizens.


Photo: © ADB

WATER AND SEWERAGE SERVICES IN KOLKATA, INDIA (ADB)

Kolkata is seeking to improve its water supply and sewerage services and reduce its high water losses. An ADB study in 2012 showed that 63 million liters per day never reached end users. As part of a three-tranche project, the ADB has provided over $125 million in climate finance. The project will support the design and implementation of the first comprehensive city-level flood forecasting and early warning system in India, and capacity development on land-use and infrastructure planning that considers climate impacts and disaster risk management. The sensors installed under the early warning system record and monitor both live flooding patterns and air quality and heat stress across the city. The data collected is maintained in a cloud-based network for all stakeholders.

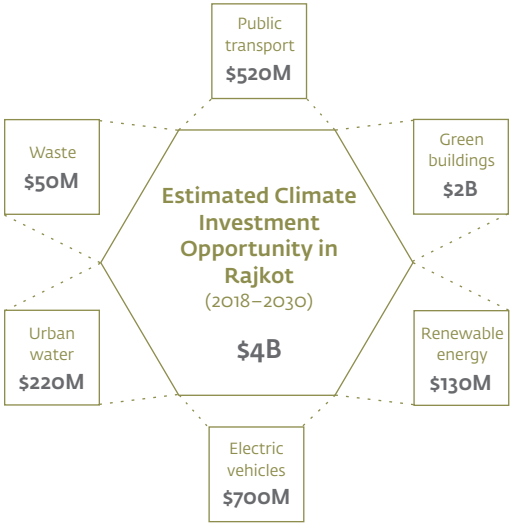

Photo: © Iwan Bagus / IFC

EFFICIENT LIGHTING IN INDIAN CITIES (WORLD BANK)

The World Bank India Energy-efficiency Scale-up Program was approved in April 2018 to develop sustainable business models and markets for LED lights and efficient cooling. The program will use a $220 million loan and an $80 million guarantee (which is expected to leverage an additional $200 million in financing) to support Energy-efficiency Services Limited, which is a joint venture of four national public sector enterprises under the Indian Ministry of Power. Energy-efficiency Services will use the funding to implement energy-saving measures in residential and public sectors, strengthen its own institutional capacity, and enhance its access to commercial financing. Energy-efficiency Services enters into long-term annuity agreements with municipalities to retrofit existing streetlights with LED lamps and fixtures, and maintain them for up to seven years. The organization's entire investment is made up front and recovered from the energy savings of municipalities/cities. Under the World Bank program, Energy-efficiency Services will deploy 219 million LED bulbs and tube lights, 5.8 million ceiling fans, and 7.2 million street lights, which will be supplied by private sector manufacturers and suppliers.

Photo: © Iwan Bagus / IFC

RAJKOT, INDIA



City	Rajkot
Population	1.4 million
GDP (per capita)	$1,710
Current GHG emissions	2.2 million tCO_2e
GHG reduction target	426,095 million tCO_2e
Municipal credit rating	A- (2016)

"Rajkot has had significant policy direction and project support from all levels of government—municipal, state, and central—which has helped the city to make progress on green buildings, renewable energy, efficient street lighting, and others. With the private sector, Rajkot has seen several successful PPPs including for solar rooftops on buildings and street lighting, and there is interest in attracting such private involvement across sectors. It is important for the city government to develop and communicate a clear strategy that articulates the needs of the city to the private sector, as well as for the private sector to outline their capacity and areas of interest, so that the two parties can align priorities and achieve better urban development."

— **Bina Acharya,** Mayor of Rajkot

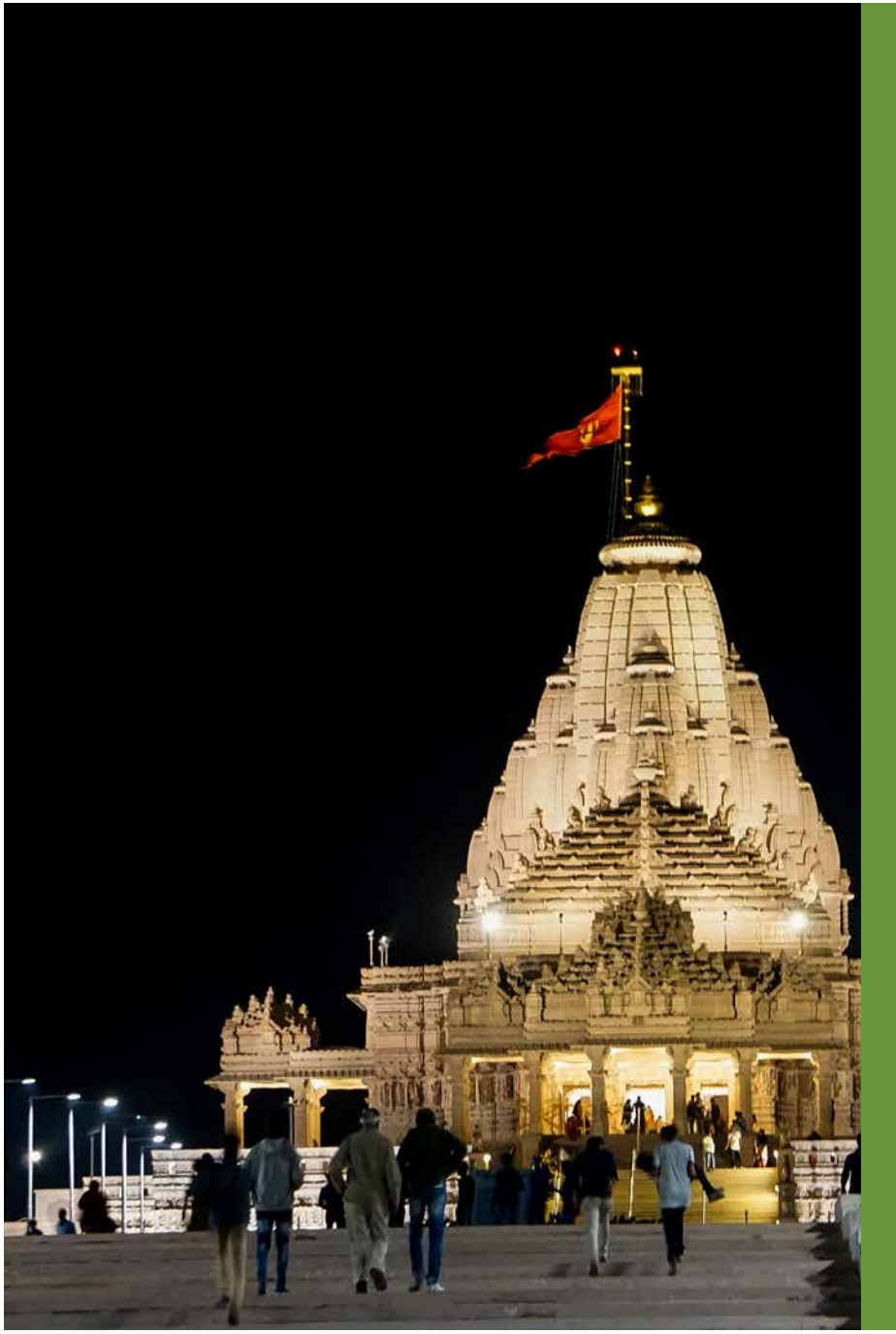
Rajkot is recognizing the need for sustainable growth and climate resilience, given the resource pressures from its rapid urbanization and the importance of the manufacturing sector in driving its economy. The city is the 22nd fastest growing city in the world. Its population grew by over 28 percent between 2006 and 2016.[155] Rajkot is integrating climate change into its urban development planning, having committed to reduce its emissions by 25 percent from FY13 levels by 2020, and to promote waste and water management, renewable energy, energy-efficiency, and sustainable mobility. The city's progress has led to it winning the World Wildlife Fund's global One Planet City Challenge for the second time in a row.[156]

Mitigation and Adaptation Plans

Rajkot has developed a Low Emission Development Strategy, which identifies the city's goals, including wastewater treatment, water supply, non-motorized and public transport initiatives, and integrating climate priorities into traditional city planning.[157] The city's Development Plan 2031 aims to implement these strategic priorities through measures including transit-oriented development, increased urban density, sustainable mobility, green networks, and water and sewerage management, which have significant implications for reducing carbon.[158] Rajkot has also been declared a "solar city" under India's Ministry of New and Renewable Energy, which commits the city to achieve a reduction of at least 10 percent in conventional energy by increasing the use of renewable energy sources, especially solar.[159]

Rajkot is one of four Indian cities that are part of the Capacity Building Project on Low Carbon and the Climate Resilient City Development project.[160] As part of this, the city developed its Climate Resilient City Action Plan 2022, which included a vulnerability assessment of various sectors, and strategies to address these vulnerabilities by building resilience.[161]

The city is one of 30 from across the country that has been shortlisted for the national Smart Cities Mission.[162] Rajkot has implemented a municipal corporation-funded SMART Society Scheme, which aims to achieve the transformation into a smart city through municipal waste management, solar energy, rainwater harvesting, tree-cover landscaping across the city, and other interventions.[163] This project, under the city's Low Emission Development Strategy, is already making progress—particularly in the waste sector through measures such as the implementation of a highly effective door-to-door waste collection initiative.



Priority Sectors for Investment

GREEN BUILDINGS $2B

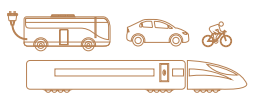
Rajkot is one of six deep-dive cities receiving technical assistance for green buildings initiatives under the Sustainable Energy for All Building Efficiency Accelerator project.[164] The residential buildings sector accounts for a third of the city's emissions, the largest share of any sector.[165]

Rajkot is integrating climate change and energy-efficiency requirements with interventions for socioeconomic development, including through green affordable housing construction. The city received national recognition for adding energy-efficiency and climate resilience to affordable housing design, extending the mandate of the national Housing for All initiative to include elements such as passive ventilation and cooling, and rainwater harvesting systems.[166] Rajkot intends to construct 10,000 affordable housing units by 2020.[167] The city is also developing a database on energy consumption in affordable housing in collaboration with the Center for Policy Research and funded by the Swiss Agency for Development and Cooperation.[168] This database will help the city to plan, design, and implement its energy-efficiency and green building policies.

The city has made it mandatory for residential buildings larger than 150 square meters, hospitals, and other public buildings to install solar water heaters.[169] It is also looking into how building shell design can reduce the need for additional cooling technologies and increased energy consumption through improved window shading, ventilation, insulation, and evaporative cooling.[170] As of 2017, the city's administration has also made it mandatory for all new buildings to install rooftop solar power units.[171]

The city invited tenders from private companies for the construction of over 1,700 residential buildings with more than seven floors each in 2015.[172] In 2018, the Rajkot Urban Development Authority authorized the creation of 32 town planning initiatives in addition to the 80 already under construction, all of which will comprise 100 apartments each.[173] As the population of Rajkot continues to grow, and the city moves to become a smart city, it will continue to see a significant growth in construction. IFC estimates a climate investment opportunity of almost $2 billion in helping Rajkot green its buildings to 2030.

TRANSPORT $1.2B

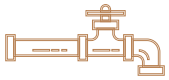


The transport sector accounts for 27 percent of Rajkot's emissions—the second largest share after residential buildings.[174] The city has developed a Low-Carbon Comprehensive Mobility Plan, emphasizing sustainable mobility through short-term measures such as the construction of footpaths and bicycle lanes, as well as long-term interventions till 2031 including integrated land-use and urban mobility planning.[175]

Rajkot's City Action Plan aims to deploy electric buses with solar photovoltaic charging, and to develop a public bike-share system. The city is planning a 63.5km bus rapid transit system under the Jawaharlal Nehru National Urban Renewal Mission,[176] of which 11km has been constructed, serving 7,500 passengers daily.[177] Rajkot is planning to introduce electric buses, with five of these expected to be running by the end of 2018.[178] The city implemented a pilot public bike-sharing initiative in four locations across the city in 2016. More than 25 private hotels agreed to provide bicycles for their guests, and the Rajkot Municipal Corporation placed bicycles in all its zonal offices and bus stations. Following a positive public response, the city plans to scale up the program,[179] the full implementation of which will require an investment of almost $1.4 million.[180] Rajkot plans to install smart bicycle-sharing and charging stations as part of its smart city agenda.

To meet the city's public transport and electric vehicle targets and objectives by 2030, IFC estimates an investment potential of $520 million and $700 million respectively, with a total investment opportunity of over $1.2 billion in Rajkot's transport sector.

WATER	$220M



As a water-scarce city, Rajkot is putting several plans in place to manage water supply and conservation. Its Development Plan for 2031 outlines the city's plans to improve water supply from the 20 minutes currently supplied each day to an uninterrupted daily supply, increase the capacity of existing water treatment plants, construct two new wastewater treatment plants and four new sewage treatment plants, lay a new network of water supply pipelines, and develop a storm water drainage system.[181] Its City Action Plan also includes interventions for water and wastewater management such as an upgrade of the existing distribution pipeline, improvement in wastewater treatment, and enhancement of the sewerage network to 100 percent coverage.[182]

Rajkot has already begun to set up a new sewage treatment plant with financing from the central, state, and municipal government. The plant's capacity is expected to be sufficient to meet the city's sewage treatment needs for the next 30 years.[183] It has also installed a solar photovoltaic system in the Aji Water Filter Plant, one of five water treatment plants that are expected to run on renewable energy. This project is expected to require an investment[184] of about $115,000.[185] The city has issued several tenders for PPPs for the construction of water supply and distribution networks through the Atal Mission for Rejuvenation and Urban Transformation Scheme.[186]

The city has also made rainwater harvesting mandatory and reduced water losses from theft and leakage from 40 percent in 2014 to 28 percent in 2017.[187] The Rajkot Municipal Corporation was the first civic body in the country to introduce a water audit system.[188] It also plans to institute smart meters in households with remote meter readings and centralized monitoring.[189]

To accomplish these objectives, IFC estimates an investment opportunity of $220 million in Rajkot's urban water sector to 2030.

Financing and Policy Instruments

Rajkot's 2031 Development Plan outlines a variety of approaches to finance the city's development projects. The local government plans to use land value capture and the sale of public land to raise municipal funds.

In addition to public funding from the state and central governments, Rajkot intends to leverage private sector funds through PPPs. The Rajkot Municipal Corporation has been innovative and successful with PPPs in the past, such as with the first-of-its-kind high-purity sewage treatment plant contract awarded to Jindal Water Infrastructure Limited on a build-operate-transfer model.[190] As part of the Atal Mission for Rejuvenation and Urban Transformation Scheme, the city issued a number of tenders to the private sector for PPPs in water and wastewater management, and the development of green spaces, parks, and sustainable transport infrastructure.[191] Through Rajkot Smart City Development Limited, a subsidiary company of the city's municipal corporation, Rajkot is offering PPPs for the development of mass transit systems, metro rails, riverfront development, and other infrastructure projects for its transition to a smart city.[192]

Rajkot has also proposed issuing a municipal bond to raise financing for its urban development, and has appointed a transaction advisor for this purpose.[193] The amount raised is expected to help finance the upgrade of smart water meters around the city to ensure 24-hour water supply.[194]

Achieving Clean Air in Cities

Air pollution is the world's fourth leading fatal health risk and the top environmental health risk.[195] One in nine deaths globally are attributed to ambient air pollution, with poor people being disproportionately affected. More than 90 percent of these deaths occur in Asia and Africa. The climate impact is also significant: "super pollutants"[196] are responsible for nearly half of the earth's accumulated warming to date.[197] They also affect crop yields,[198] solar energy generation,[199] and some aspects of rainfall patterns and storm intensity.[200]

Cities are pollution hotspots and residents are calling for rapid action for cleaner air. Local governments need to invest in addressing air pollution through clean power generation and fuel switching, industrial efficiency and controls, transport upgrades and modal shifts, and, in certain areas, agricultural improvements. Innovative financial solutions are needed to enable cities to access the funding required for these investments. Instruments such as the proposed Breathe Better Bond being developed by IFC can incentivize cities to borrow specifically to address air pollution, as the instrument incorporates results-based incentives such as lower interest rates for meeting agreed performance milestones.

While many of the policy levers and investment decisions required for clean air are beyond cities' reach, because borrowing conditions are often set at a national level, their consumption choices, positive examples, and political voices matter. Cleaning up the air ultimately requires public discourse based on scientific evidence, and integrated action across sectors and administrative geographies.[201] It also requires political stamina and neighbors to follow suit. The high cost of controlling or eliminating emissions often falls on particular industries or individuals, but the benefits of cleaner air are felt by all of us. [202]

A TWO-PART CLEAN AIR AGENDA

Local action

Much of cities' attention has been on reducing local emission sources: fossil-fuel transport, solid waste burning, high-emitting household energy sources such as coal or biomass, and control of volatile organic compounds. Reducing household emissions is often a matter of prioritizing energy access programs—households typically prefer electricity, gas, and other

locally less-polluting forms of energy when they can afford it. Solid waste burning is more challenging, since it requires not only having a comprehensive and functional system for collective solid waste, but also attention to landfill management in order to avoid spontaneous combustion. Solid waste burning is an intermittent pollution source, making it hard to build sustained action for reducing it. The 2016 fire in Mumbai's Deonar dumpsite, for example, blanketed much of the city in toxic smog and provoked a media frenzy, but as the smog dissipated, so too did attention on the issue.

Passenger and freight vehicles are often among the largest contributors to urban air pollution. Strategies for comprehensive control have three prongs: Avoid the need for transport by optimizing land use; shift to lower-emitting modes; and improve the cleanliness of vehicles through cleaner fuels and tighter emission standards. Cities are increasingly looking at traffic management interventions, such as congestion charging, vehicle restriction, and low-emission or clean air zones as options to address urban air pollution. São Paulo, for example, adopted "car-free Fridays", restricting personal vehicles from entering the downtown area on the last Friday of every month and encouraging cleaner modes of transport instead. The World Resources Institute is tracking effects locally with the city's Secretary of Mobility through an air quality monitoring project.

While drivers may protest, traffic management measures are politically popular. In China, the World Resources Institute's feasibility assessment of a low-emission zone found public opinion to be evenly split on the proposal, even before implementation.[203] The demonstrable impact often wins more support: In Stockholm, for example, only 34 percent of the residents initially supported


Photo: © Iwan Bagus / IFC

congestion charging and low-emission zone initiatives, but that percentage increased to 72 percent six years after implementation.[204] Low-emission zones can also drive broader fleet changes if strategically placed in high vehicle pass-through areas such as ports or high-density business districts.

Airshed leadership[205]

Most cities cannot achieve clean air without addressing the emission sources around them. Sometimes the flows are visible—smoke from crop burning can easily be seen from space. Other times they are subtler. Gaseous ammonia emitted from manure and excess synthetic fertilizer use can combine with vehicle, power plant, and industrial emissions to form micro particulate pollution (PM2.5) that travels downwind easily.

Cities need to collaborate with higher levels of government on policies, regulations, and approaches to reducing emissions within their boundaries,[206] as fuel quality standards are typically set by national policy. Urban infrastructure investments, which form the foundation for shifting people to low-emitting public transport, are typically financed by national and international sources.

Strategies to consider include multi-city airshed coalitions emerging as a voice in state and national policies, creative institutional design in which cities invest in emission reductions in surrounding areas as a cost-effective way to clean up their territory's air, and cities starting to use their power as consumers to demand lower-pollution supply chains.

Photo: © Almas Dissyukov / World Bank

Europe and Central Asia

Unlike other regions, populations in cities in Europe and Central Asia are declining, with 61 percent of these cities losing an average of 11 percent of their population between 2000 and 2010. Urban population growth is increasingly concentrated in a fewer number of cities.[207] On average, 67 percent of the region's population lives in urban areas. Some of these cities are attempting to alleviate infrastructure stresses from economic migration, and they might need to find ways to mitigate the need for environmental migration in future.[208]

Cities with populations over 100,000 in Europe and Central Asia are vulnerable to the effects of climate change, including heatwaves, infection outbreaks, and air and water pollution.[209] Municipalities in the region have significant autonomy as countries have decentralized and public investment decisions are increasingly made by local authorities.[210] This gives city governments significant influence over low-carbon, resilient growth.[211]

Urban water management, solid waste management, urban transport, and social inclusion are development priorities for cities looking to grow in a sustainable manner. For example, Warsaw in Poland is moving away from coal-based heating and aims to supply 50 percent of its heat from gas, biomass, and waste-to-heat sources

by 2020.[212] Tashkent in Uzbekistan is working with private company Khizmatrasonii Nagliyoti Sanitari to transform its solid waste management infrastructure with assistance from the European Bank for Reconstruction and Development (EBRD).[213] The Greater Antalya Municipality in Turkey has committed to reducing its emissions by at least 20 percent by 2020 through its Sustainable Energy Action Plan, which covers energy-efficient buildings, improved solid waste and wastewater management, and the promotion of renewable energy.[214] Cities in eight countries in the region, along with Jordan, are receiving support from the EBRD's Green Cities Facility for climate-focused sustainable development, which has received an €87 million contribution from the Green Climate Fund to help cities develop and implement Green City Action Plans.[215] The Green Climate Fund and the EBRD will work together to provide financing through concessional lending and investment grants, as well as technical assistance, as the first tranche in the €228 million Green Cities Facility.

Cities in the region are linking their climate targets with their urban development strategies. IFC estimates a climate-smart investment potential of $1.2 trillion in cities in Europe and Central Asia to 2030.

Estimated Climate Investment Opportunity in Europe and Central Asia (2018–2030)

	$1.2T	GREEN TARGET PENETRATION
Waste	$17B	87%
Electric vehicles	$46B	12%
Climate-smart water	$64B	72%
Renewable energy	$88B	47%
Public transport	$116B	N/A
Green buildings	$881B	21%

PUBLIC TRANSPORT IN ANTALYA (IFC)

Antalya is one of Turkey's most popular tourist destinations. To strengthen its sustainable future and respond to a population boom, the municipal government, with support from IFC, is investing in an 18km tram line that will connect the northern suburbs to the commercial center. IFC is spearheading a €140 million financing package for the tram line, including its own investment of €80 million. The remaining €60 million is being mobilized through the Managed Co-Lending Portfolio Program, which allows institutional investors to participate in IFC's investments. The investment is coupled with comprehensive advisory support to help the city improve the efficiency, safety, and environmental and social performance of its public transport system. Once fully operational in 2021, the new line will reduce greenhouse-gas emissions by about 35 percent as congestion drops and there are fewer vehicles on the road. The system is expected to carry 25 million commuters a year, up from 13 million a year carried by the existing two-line tram system.

INTEGRATING GREEN INFRASTRUCTURE IN ATHENS (EUROPEAN INVESTMENT BANK)

The European Investment Bank (EIB) is providing a €55 million loan and technical assistance to Athens to help the city implement its resilience strategy for 2030, developed in cooperation with 100 Resilient Cities. The loan will support projects in different sectors and areas of the city, with technical assistance to ensure that these projects are resilient to the effects of climate change and reduce greenhouse-gas emissions. Examples of technical support include integrating energy-efficiency measures into the renovation of historic buildings and schools, redesigning public spaces and streets to reduce urban heat island effects, improving water infiltration and air quality, and creating green corridors for the city's plants and animals.

GREEN SPACE IN VARNA (EBRD)

In 2018, the EBRD provided a €10.1 million loan to Varna in Bulgaria to help fund a €39.3 million project to invest in climate resilient infrastructure and establish paid parking zones in the city center. The project will also explore opportunities for privately funded climate-smart investment. The city will prepare a Green Cities Action Plan, address flooding by increasing storm water drainage capacity, and reduce fuel usage and improve air quality by installing electric vehicle charging stations and removing about 3,500 vehicles as a result of new parking zones.

Photo: © Banja Luka

BIOMASS DISTRICT HEATING PLAN IN BANJA LUKA (EBRD)

In 2018, the EBRD provided an €8.3 million loan to Banja Luka, in Bosnia and Herzegovina, to provide working capital and finance for its minority stake (49 percent) in a newly created district heating company. The company, in partnership with a local private sponsor, developed a new 49 megawatt (MW) biomass boiler plant. Previously, Banja Luka's district heating system was heavily reliant on heavy fuel oil, which, due to high prices, put pressure on the city's finances. The EBRD's loan helped the city introduce a private sector solution. It is envisaged that future dividends from the company will help to service the EBRD loan.

Photo: © Iwan Bagus / IFC

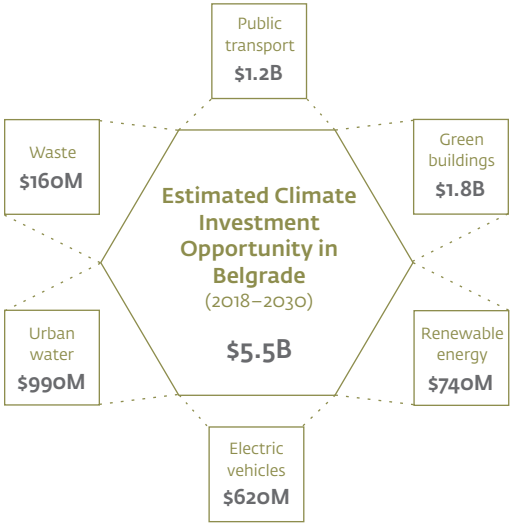
WASTEWATER TREATMENT PLANT IN IZMIR (IFC)

In Turkey, Izmir's metropolitan municipality and municipal water utility needed to raise funds to expand the utility's services in order to serve a considerably larger area. This area included districts with inadequate water supply facilities and households using septic tanks for human waste.

IFC formed a strategic partnership with the municipality and the water utility to implement high-impact infrastructure projects that support the large capital outlay needed and leverage innovative approaches to address emerging challenges. IFC's engagement opened up opportunities to raise non-sovereign-backed financing for investment in wastewater treatment and disposal. IFC provided about €48 million on commercial finance terms to support investments in the water utility.
In addition to providing finance, IFC also provided technical recommendations based on its experience with private sector solutions for improving the operations and reducing the carbon footprint of wastewater treatment plants.

Photo: © ADB

BELGRADE, SERBIA



City	Belgrade
Population	1.7 million
GDP (GDP per capita)	$10,086
Current GHG emissions	6.63 million tCO_2e (calculated based on per-capita data)
GHG reduction target	N/A
Municipal credit rating	N/A

"Belgrade is keen to improve environmental sustainability and become a smart city. We are working with IFC to attract private sector investors through public-private partnerships and we plan to implement several projects under this model, including the Vinca waste-to-energy project. We are also working to improve the energy-efficiency of public buildings and to modernize the public transport sector. These projects will benefit the citizens of Belgrade but also serve as an example for other cities in Serbia and the region."

— **Zoran Radojicic,** Mayor of Belgrade

Serbia's capital Belgrade seeks to be "the smart city on the two European rivers". Belgrade's new urban development vision provides for the design and implementation of new urban regulations; development of rivers, waterfronts, and public spaces; deployment of new technologies; and adaptation to climate change.[216] The city will apply for the European Green Capital Award in 2018, with support from Ljubljana in terms of knowledge transfer, to highlight its successes in sustainable mobility and transit-oriented development.[217] IFC estimates a climate-smart investment opportunity of almost $5.5 billion in key sectors of Belgrade till 2030.

Mitigation and Adaptation Plans

In 2015, Belgrade adopted its Climate Change Adaptation Action Plan and Vulnerability Assessment, which is linked to various plans including the National Sustainable Development Strategy, the National Environmental Program, and the Development Strategy of the City of Belgrade.[218] The Adaptation Action Plan presents a list of measures from the short term to 2025. It includes developing green infrastructure, reinforcing the city's flood protection by reconstructing the embankment, implementing urban planning and regulations for green construction and extreme temperature management, and increasing water supply capacity.[219]

While a formalized mitigation target has not yet been announced, Belgrade's Development Strategy prioritizes sustainable urban development that emphasizes the need for environmental sustainability across sectors.[220] Belgrade seeks to achieve its strategic priorities by implementing new transportation, environmental, and spatial city policies, as well as introducing urban revitalization principles.[221] A key tenet of this Development Strategy and the city's Master Plan 2021 is to focus on transit-oriented development as the primary approach to urban planning. The targeted increase in the use of public transport is one example of the measures outlined in Belgrade's urban development policies that will directly lead to the mitigation of the city's greenhouse-gas emissions.

Although the city has not yet developed formal policies for water and waste management, it is inviting and financing such projects, signaling the opportunity for investment in these sectors. In addition to the $160 million investment opportunity in solid waste management till 2030, the city has worked with IFC on a $370 million waste-to-energy PPP that will begin construction by the end of 2018.[222] In 2017, Belgrade also announced its intention to construct its first wastewater treatment facility, marking a significant shift towards better management of its water and wastewater sector, and creating positive climate-related benefits for the city.[223] Belgrade's water utility has applied to the EBRD for a loan to finance this project.[224] The city has also contracted the construction and operation of a waste-to-energy facility for the collection and disposal of its waste through a PPP, discussed in further detail below.

Priority Sectors for Investment

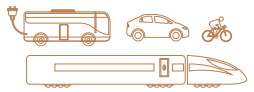
RENEWABLE ENERGY $740M

Ranked second out of all Eastern European cities in Siemen's European Green City Index, Belgrade's electricity grid has a relatively high share of hydroelectricity.[225] The city also fulfills some of its energy needs from other renewable sources, including biomass, geothermal, and solar energy. While the contribution of these sources to the city's overall energy supply is still relatively small, there is a huge potential to increase their installed capacity. To help meet Serbia's commitment to the Kyoto Protocol, Belgrade will have to at least match Serbia's target of reducing its emissions by 20 percent by 2020. Enhancing the contribution of these renewable energy sources to its energy supply will be integral to achieving this.

While much of the city's energy supply and distribution is the domain of the national energy company, the city is responsible for its own district heating and is making efforts to increase its efficiency and decrease emissions. District heating metering is mandatory for all new buildings, built since 2012, and in all public buildings. Additional support and incentives are being considered for enabling the switch to metering systems in older residential buildings. Belgrade's district heating company is already beginning to close down the city's boiler stations, currently powered through a mix of heavy fuel oil and coal. While the immediate goal is to connect the city's heating entirely to gas-fired plants, there is opportunity for Belgrade to increase the share of renewable energy to meet its heating, cooling, and electrification needs in the medium term. IFC is supporting Belgrade in preparing a pre-feasibility study for solar district heating including seasonal heat storage options to further explore this potential. In addition, the city has installed a pilot solar-powered electric vehicle charger and intends to power its electric vehicle infrastructure through renewable sources rather than coal-fired power plants.[226]

According to IFC's estimate, there is a climate investment opportunity of $740 million in Belgrade's renewable energy sector to 2030.[227]

PUBLIC TRANSPORT $1.2B



The city's Development Strategy and Master Plan 2021 both emphasize the importance of transit-oriented development. Increasing the share of and access to public transport is a key policy objective. The Development Strategy's proposed overhaul of the transport sector includes introducing the city's first metro line, enacting pedestrian zones in the city center, and constructing bridges and bypass roads. The Master Plan 2021 prioritizes the development of a peripheral tangent road, the Belgrade Bypass, industrial parks along the bypass, and the Port of Belgrade.[228] The $1.2 billion Belgrade light metro project has completed construction of line one, with lines two and three expected to be developed within the next few years.[229] The project is expected to save an estimated 300,000 tons of CO_2e over a decade.[230] Belgrade also intends to develop a network of bike lanes and city bike systems, and promote sustainable mobility.

Buses are the most popular type of public transport, but the current fleet is old and requires upgrading. The city's mayor has already announced the intention to buy 80 electric buses, up from the five that have been operating in the city since 2016,[231] and electric vehicle chargers are being rolled out across the city in anticipation of an increase in electric vehicles on Belgrade's roads.[232] The private sector recognizes the city's commitment to developing electric vehicle infrastructure and promoting the rollout of public and private electric vehicles. The Chinese company Yinlong has expressed interest in introducing its electric bus line in Belgrade as the city's existing tram network can be adapted for its needs.[233]

As part of the effort to achieve its smart-city objectives, Belgrade is also developing geospatial tools and data governance for the transport sector including e-cards and the central management of the public transport system.[234] The city is using the EkoBus program to apply the internet of things to its transport sector as a testbed for the European Union-led SmartSantander project, which aims to support research

and development into new technologies for the city. In this instance, the SmartSantander project uses public transport vehicles to collect and monitor a set of environmental parameters, including CO_2 and other emissions, and provides feedback to both the end-user and policymakers.[235]

To achieve Belgrade's smart-city objectives and implement its transit-oriented development, IFC estimates that the city will require climate-smart investments till 2030 amounting to over $1.2 billion in public transport and almost $620 million in electric vehicles.

GREEN BUILDINGS	$1.8B

Belgrade is one of two deep-dive cities in the region for the Building Efficiency Accelerator public-private collaboration, which channels global expertise to help local governments implement building efficiency programs.[236] In 2017, Belgrade launched its Energy-efficiency Fund, which is intended to support and encourage the city's residents to upgrade the energy-efficiency of residential and commercial buildings.[237] Structured as a revolving fund, with initial funding from the city itself and the intention to secure funding from commercial banks and international financial institutions, the fund will allow the city to assume all upfront financial liability for such upgrades, which will then be repaid by Belgrade's residents over several years. The project is still at an initial phase and is expected to connect up to 75 percent of the city to energy-efficient district heating systems when fully operational. Such interventions will make a significant improvement to the city's housing standards, where 40 percent of the 320,000 apartments connected to the central heating network do not meet basic standards.

The Belgrade district heating company has also launched the MOEEBIUS energy-efficiency project. The project is financed by the European Union fund Horizon 2020[238] and piloted in Belgrade, London, and Mafra.[239] It aims to monitor energy-use patterns and offer solutions for green savings, and has also led to the development of an application to provide data and advice on energy consumption to the residents of Belgrade's Stepa Stepanovic neighborhood.

IFC is using the Excellence in Design for Greater Efficiencies (EDGE) tool to improve the energy-efficiency of buildings in Belgrade. EDGE, a simple green building rating online software platform, helps developers and builders identify the most cost-effective ways to reduce energy use, water use, and embodied energy in materials. IFC has performed energy audits to assess the efficiency of public buildings in Belgrade, and used EDGE software to recommend energy-efficient solutions to the city.[240] This engagement aims to identify opportunities related to buildings, district heating, street lighting, and other urban infrastructure, as well as to help create a plan for phasing in investments and improvements.[241]

To achieve Belgrade's energy-efficiency and green building objectives, IFC estimates an investment opportunity of over $1.8 billion to 2030.

Financing and Policy Instruments

The city's Development Strategy and Master Plan include land value capture tools, such as providing new land for buildings and development, encouraging higher urban density near transit nodes through business-commercial streets, providing special zoning ordinances related to distance to public transport, and supporting iconic city projects in special districts.[242]

The Development Strategy also focuses on developing policies and passing new regulations on PPPs, land-use according to new market demands, and new models of investment for the city's priority projects.[243] IFC has been advising Belgrade on structuring and implementing PPPs for waste management and wastewater treatment.[244] One successful outcome of this engagement is the remediation of the Vinca waste-to-energy plant in Belgrade, for which IFC organized a tender through a 25-year PPP.[245] The bid to construct the $370 million facility was won by the Suez Group in consortium with a subsidiary of the Japanese company Itochu. [246]

Green Urban Development

CARBON-INTENSIVE URBAN SPRAWL

Research suggests that about 30 percent of future, committed greenhouse-gas emissions will occur as a result of new urban buildings and transport systems,[247] with inefficient urban development locking in future emissions. Controlling greenhouse-gas emissions from standalone buildings can be achieved relatively easily through better insulation, more efficient heating and cooling systems, and the installation of small-scale renewable energy sources, particularly on rooftops. Broader strategies, such as achieving optimum density, overall configuration or massing, and planning layouts to reduce wastage while ensuring comfort and affordability, require careful analysis and consideration.

Dense, mixed-use urban developments that are close to public transit nodes give people convenient and cleaner transport options. Many cities have mass transit options in place or in the planning stage, but are yet to fully adjust urban planning to maximise the benefits.

TOWARDS A GREENER AND MORE LIVABLE CITY

Green urban development typically includes the following features:

- Mixed-use development with shops, schools, other public services, and a range of housing types and prices.
- High-density and compact development to maximize land and improve affordability.
- More energy, water, and waste-efficient design of buildings and infrastructure.
- Public transit stations or transit corridors that are easy to access, reliable, and secure, as well as street and road planning for non-motorized transport.
- Public and private sector participation.

Planning and policy innovations have been critical for green urban development. In Barcelona, super blocks that combine city spaces into pedestrian-friendly, car-free mini grids have been designed.[248] Copenhagen has used a finger plan, an urban plan

composed of five well-defined, linear corridors (or "fingers"), separated by green wedges with open spaces, water sheds, and ecological preserves, to drive green growth. Curitiba created structural corridors to promote job creation and activities away from downtown and inner-city locations, and included housing and commercial density around mass transit lanes. As a result, the city has Brazil's lowest share of car use.

GREEN URBAN DEVELOPMENT CREATES VALUE FOR ALL

Developing a reliable transportation system requires large capital expenditure, but a substantial pool of users will offset the costs over time. Decreased pollution and fuel consumption will provide economic benefits to users, governments, and companies, while enhancing a city's ability to maintain its competitiveness and environmental sustainability.

Green urban developments can provide substantial cost savings for both city governments and citizens. A recent study concluded that China could save $1.4 trillion in urban infrastructure costs if its development plans optimized density over sprawl.[249]

Incorporating transit into urban design allows developers to benefit from stable or higher property values. Mixed-use settings also create commercial opportunities that benefit from increased foot traffic in the area. A developer may also be able to access government incentives for such projects.

Hong Kong, for example, has created a financially successful rail and property funding model, allowing the Mass Transit Railway Corporation to partner with individual private developers to build along new and existing rail lines.

Reducing residents' dependence on private vehicles will help decrease their overall living expenses, while improving health outcomes by increasing physical activity. Living in such developments can increase a sense of community and wellbeing for residents and help improve living standards.

MAKING IT HAPPEN

Both market and policy tools can drive value creation in green urban communities by:

- Developing a transit-oriented development policy framework for integrated infrastructure planning that develops sustainable urban growth centers with high-density mixed land use.
- Reforming land-use regulations such as single-use zoning, low-density limits, and high parking fees to encourage mixed-used, transit-oriented developments with reduced car parking.[250]
- Redefining policy definitions of affordable housing to include the combined cost of housing and transport.[251]
- Creating incentives for the private sector. Cross-subsidization using tax abatement or value capture methods could help make the higher costs of transit-accessible locations less prohibitive for private developers and investors.
- Exploring alternative implementation options, including PPPs, to leverage private sector skills and financing to develop projects.
- Encouraging corporations to locate offices within green urban developments as an anchor tenant or employer through financial and non-financial policy incentives.

The World Bank Group has created a new tool to quantify the impact of green urban developments. The Excel-based Climate Action for Urban Sustainability (CURB) tool is the first of its kind. It helps cities act on climate change through an interactive scenario planning tool. It uses local data to provide tailored analyses that will help cities evaluate low-carbon actions in six sectors, namely private sector buildings, municipal buildings and public lighting, electricity generation, solid waste, transportation, and water and wastewater. As an investment planning tool, it provides details of implementation costs, cash flow, payback, and return on investment. Users can change discount rates and cost assumptions to evaluate the impact of alternative financing conditions. The tool is an addition to the array of EDGE tools for green building projects and aims to help developers influence clients to choose green urban development designs early in the project planning process. CURB is also one of the engines of the Google city emissions calculator (see box on Data: A Critical Lynchpin to Climate Action).

Middle East and North Africa

About 62 percent of the total population in the Middle East and North Africa live in cities today, and the urban population is expected to double by 2040.[252] About 31 percent of the total population lives in just 30 of the biggest cities in the region.[253] Megacities such as Baghdad, Cairo, Riyadh, and Tehran are major regional economic drivers with significant influence in the region. Cities such as Amman and Beirut are trade and commercial hubs that incubate new technologies and attract investment.

City leaders in the region are recognizing the risks and opportunities presented by climate change and are acting on them. Most capital cities in the region are already facing sharply rising temperatures, depleting water reserves, and reduced rainfall,[254] and can expect to see up to four months of extreme heat per year if climate change is not addressed.[255] Building resilience to the effects of climate change will also require economic and social resilience, enabling people to better weather urban shocks and stresses. Cities in the Middle East and North Africa are planning their development in a sustainable way. Even cities without formalized plans are developing projects and inviting investments that have significant climate-smart benefits.

Beirut has implemented a Sustainable Energy Action Plan to reduce its emissions by 37 percent from 2013 levels by 2020.[256] Priority areas include transport, which accounts for the city's largest share of energy consumption, and residential buildings, which accounts for the second largest share, or 26 percent of Beirut's energy consumption. The city of Taiz in Yemen has worked with the World Bank for several years to mitigate the impact of flooding and strengthen critical infrastructure for water management.[257] New Cairo, a satellite city outside of Cairo, is expected to grow from 550,000 people in 2013 to over 3 million people by 2030, and has developed a wastewater PPP to boost the city's ability to meet its water demand over the coming years.[258]

The region is facing increased energy and water demand, population growth, and concentrated urbanization. As cities in the Middle East and North Africa work to address these challenges and achieve their low-carbon transition plans, they will require significant investments in climate-smart infrastructure across sectors, including more efficient industry, transport, and utilities.[259] IFC estimates a climate investment opportunity of $1.7 trillion in cities in the region to 2030.

Estimated Climate Investment Opportunity in the Middle East and North Africa (2018–2030)

	$1.7T	GREEN TARGET PENETRATION
Waste	$28B	87%
Renewable energy	$31B	29%
Climate-smart water	$79B	68%
Electric vehicles	$133B	14%
Public transport	$282B	N/A
Green buildings	$1.1T	23%


Photo: © Javier Mateo-Sagasta / IWMI

A PPP FOR WASTEWATER MANAGEMENT AND WATER EFFICIENCY IN CAIRO (IFC)

New Cairo, a satellite city of Cairo, was established to alleviate overcrowding in Cairo's city center. IFC helped Egypt's government structure the country's first PPP to finance, design, construct, operate, and maintain a wastewater treatment plant with capacity of 250,000 cubic meters (m^3) per day to improve sanitation services for New Cairo's residents. The New Cairo Wastewater Treatment Plant serves more than 1 million people and treated wastewater from the plant is being used to irrigate agricultural land and urban green areas.


Photo: © Aziza El Effas

THE FIRST ECO-CITY IN MOROCCO (EIB)

The EIB has provided a €150 million loan to help Morocco develop Zenata, a new town situated north of Casablanca. The development is government's response to uncontrolled urbanization, with 30,000 people settling in the area across 26 informal settlements. The project aims to create 100,000 new jobs and house 300,000 residents over the next 30 years. Up to 30 percent of the land is reserved for public parks to moderate high temperatures and promote biodiversity. The building plans include energy-efficient lighting and building construction. The design has also been adapted for harsh natural conditions, storing seasonal flood water in retention ponds to better manage rainwater.


Photo: © ADB

SUSTAINABLE BUS TRANSPORT IN PESHAWAR (ADB)

Peshawar, the capital city of Khyber Pakhtunkhwa in Pakistan, has experienced rapid population growth as a result of internal displacement and Afghan refugee migration. Traffic conditions on key arterial roads have become unmanageable, increasing air and noise pollution. The ADB provided a $335 million loan to restructure the 26km bus rapid transit corridor. Improvements will include building bicycle lanes along the corridor, introducing a bicycle-sharing system at Peshawar University, and implementing a modern fare-collection system using smart cards to enable distance-based fares. Satellite imagery will be used to map the corridor and inform the engineering design.

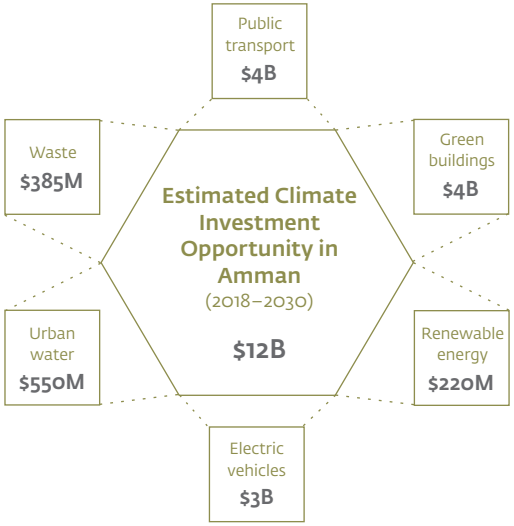
YEMEN INTEGRATED URBAN SERVICES EMERGENCY PROJECT IN SANA'A (WORLD BANK)

In 2017, the World Bank designed and approved the $150 million Yemen Integrated Urban Services Emergency Project, which aims to restore access to critical urban services in Yemeni cities affected by ongoing conflict. This project is being implemented with the help of the UN Office of Project Services, which has partnered with three local entities to preserve and improve the capacity of national institutions.

The project targets four sectors, namely solid waste management, water and sanitation, urban roads, and electricity. The linkages between these urban sectors necessitate an integrated approach to restoring urban service delivery.

This approach has shown results already. The project has improved the energy supply and efficiency of Sana'a's largest public hospital by installing off-grid solar energy systems, replacing about 6,000 indoor LED lamps, and supplying street and outdoor lighting. Other interventions under way include a solid waste cleaning campaign that will help reduce health hazards and improve quality of life, as well as neighborhood-level projects that improve services (such as sanitation) and provide temporary local employment.

AMMAN, JORDAN



City	Amman
Population	4 million
GDP (GDP per capita)	$10,531
Current GHG emissions	7.2 million tCO_2e
GHG reduction target	N/A
Municipal credit rating	N/A

"In the past, there was not enough awareness of the effects of climate change on society and the negative impacts that any disruption of this system could cause. In Amman, we are working to address these effects both within local communities and among officials, partners, and institutions. We must unite in our efforts to work towards the United Nations Development Goals 2030—and to stay committed to the cause."

— **Yousef Shawarbeh,** Mayor of Amman

The Greater Amman Municipality is the first city in the Southern and Eastern Mediterranean region to join the Green Cities Framework, to identify and address priorities for green development.[260] With close to 4 million people, Amman is home to over 42 percent of Jordan's population[261] within 800km^2.[262] Its annual emissions of almost 7.5 million tons of CO_2e (equivalent to 1.6 million passenger vehicles driven for one year) are attributed primarily to buildings (64 percent) and transport (31 percent).[263] Meeting the needs of an unexpected surge in population due to the migration of refugees into the city presents a significant opportunity for investment in Amman.[264]

Mitigation and Adaptation Plans

Amman is developing its first public climate action plan with support from the World Bank, committing the city to near-zero emissions by 2050 and outlining pillars for action to achieve this target. This is expected to be launched in early 2019. As part of its involvement with the Green Cities Framework, the Greater Amman Municipality is working with the Ministry of Environment in Jordan and the EBRD to develop a Green City Action Plan.[265] The plan will focus on addressing key climate change-related challenges and providing opportunities for investment in solid waste management, water and wastewater, urban roads and lighting, urban transport, and public building energy-efficiency. Broader goals include reducing local pollution, improving energy and resource efficiency, and promoting climate adaptation.

The action plan is expected to be fully aligned with Jordan's National Green Growth Plan, which is structured around five interlinked outcomes, namely sustained economic growth, social development, ecosystems services, resilience, and emissions reduction and avoidance.[266] The Green Growth Plan prioritizes the development of Amman, particularly through the establishment of a green growth corridor between Amman and Aqaba, which will emphasize inter-sectoral transit-oriented projects using solar and other renewable energy, as well as smart urban clusters.[267] The Jordan Economic Growth Plan 2018–2022 seeks green construction growth as the Greater Amman Municipality strives to meet its housing targets. Green measures include updating building regulations, introducing new requirements for energy-efficiency in buildings and linking them to obtaining building and construction permits, and providing more specific density and zoning guidelines in the area.[268]

The Greater Amman Municipality has also signed a memorandum of understanding with the EBRD for help with transforming into a smart city. It establishes a framework for strategic and operational cooperation that will address major environmental, economic, and social challenges.[269] Achieving this transformation will require large investments in infrastructure across sectors, providing a significant opportunity for the private sector to both finance and execute projects.

Amman has developed a resilience strategy, which aims to build a smart, innovative, inclusive, and environmentally proactive city.[270] In addition to building economic resilience for its most vulnerable groups, including youth, the strategy seeks to increase access to public transport, upgrade aging infrastructure, and reduce traffic congestion. It also seeks to improve access to and the sustainable use of limited natural resources like water and energy. To implement this, Amman seeks to institutionalize an integrated urban planning approach to reduce the impact of climate change and find green approaches to energy generation. A key pillar of the strategy is to work through PPPs across sectors, building a network of private sector actors, including foreign companies, to address resilience needs.

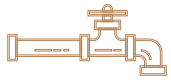
Priority Sectors for Investment

WASTE **$385M**

Integrating private involvement in solid waste management is a key strategic goal of Amman's resilience strategy as it seeks to improve the cost effectiveness of the sector. The city intends to update its legislation and improve physical assets and infrastructure to strengthen the operational, financial, and environmental performance of the city's waste management system. Currently, only the Al Ghabawi landfill site in Amman is lined, and the city seeks to prevent potential hazards to the environment and public health by ensuring that other landfill sites are similarly protected. Upgrades and construction of new waste management infrastructure presents an opportunity for the private sector, as does the potential for harnessing the energy potential of waste.[271]

Companies are recognizing the government's commitment to unlocking private investment in the sector and are taking advantage of the opportunities being created. For example, China Tianyign Inc. and Acwa Power won the 2016 tender for a design-build-operate-transfer contract offered by the Greater Amman Municipality for a municipal solid waste-to-energy facility in the city.[272] Another project in the pipeline is a PPP to develop an organic compost production project at the Al Ghabawi landfill site to be used as a soil conditioner for agriculture and landscaping.[273] To fulfill Amman's solid waste management goals, IFC estimates a potential investment opportunity of $385 million to 2030.

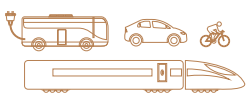
WATER **$550M**



Amman faces both frequent droughts and heavy rains that often lead to flooding in the low-lying areas of the city. To address these issues, Amman has partnered with the City Water Resilience Framework project, which seeks to establish qualitative and quantitative indicators to measure city water resilience, and accurately diagnose water challenges to plan investment and policy decisions.[274]

The city recycles much of its groundwater for use in agriculture and is gradually improving water infrastructure by replacing old pipes. However, there is a significant opportunity for private sector involvement in the improvement of Amman's water supply and distribution network to help increase water access for many neighborhoods that receive running water for only 12 to 24 hours each week.[275] IFC estimates a total investment opportunity of almost $550 million to 2030 to improve Amman's urban water infrastructure.

TRANSPORT $7B



Amman is seeking investment in urban transport networks both within the city and along its key urban corridors, to relieve traffic stress and meet transport demand.[276] The city has shortlisted 24 projects, including a freight rail route between Amman and Aqaba and bus rapid transit lines between Amman and Zarqa.

The city also aims to catalyze a modal shift to public and non-motorized transport, institutionalize urban planning, and update its Transportation and Mobility Master Plan as part of the resilience strategy. The city seeks to increase journeys made using public transport from 14 percent to 20 percent of total journeys by 2020.[277] To encourage partnership between the public and private sectors, the city intends to implement regulatory reforms and measures such as e-payments and tracking systems for taxis to create a competitive environment and secure the rights of all parties.

To generate the shift towards greener transportation, the Greater Amman Municipality has commissioned an assessment of areas with high parking pressures. This information will be used to create a demand management strategy through controlled parking zones.[278] In addition, tenders for the construction of bus rapid transit in Amman are open for competitive private sector bidding as of 2018.[279] IFC estimates an investment opportunity of over $4 billion in the city's public transport sector to 2030.

In 2015, Amman launched a pilot project in partnership with the private sector to promote the transition to solar-charged electric vehicles, including 150 cars and 10 free-to-use charging stations. This pilot is expected to be scaled up, with the next phase involving the rollout of 10,000 electric vehicles and 3,000 charging stations supplied with electricity from a solar farm.[280] Achieving this goal will require investments amounting to $3 billion in electric vehicles in Amman to 2030.

Financing and Policy Instruments

The city has had significant experience over the last two decades with PPPs in various sectors, supported by a national PPP policy. Amman has seen particular success in PPPs for water and wastewater management, including the high-profile Disi-Mudawwara to Amman Water Conveyance System. More recently, it has also seen success through the $120 million South Amman wastewater treatment plant and trunk line PPP, which has a treatment capacity of 52,000m³ per day and serves 600,000 people in south Amman.[281] The project to expand the As Samra wastewater treatment plant, which uses hydropower and is 80 percent energy self-sufficient, was completed through a PPP that included $100 million in private investment. The plant serves 3.5 million people in the metropolitan area.[282] The Greater Amman Municipality has also worked with the EBRD to develop a PPP program for energy-efficient street lighting.[283]

The Mayor of Amman has stated the city's intention to increase its creditworthiness and bankability to attract private sector investment in green projects.[284] To do so, the city is encouraging greater transparency and accountability by opening its books to potential investors. This will provide financial institutions with a clearer understanding of the risks for their capital, as well as reassure them of the opportunities, in an effort to attract their investment for new low-carbon projects.[285]

With support from the C40, Amman hosted the first City Creditworthiness Academy for the region—an intensive one-week capacity-building workshop that brought together chief financial officers, treasurers, revenue directors, and planners to understand the underlying principles of creditworthiness and enhance the city's financial management performance.[286]

Tackling Climate Change through Green Public Procurement

Public procurement is an essential tool to support climate commitments, including the goal to have climate-neutral government operations and infrastructure. From electric buses to zero energy kindergartens, and recycled construction materials to local organic catering services, city administrations worldwide are increasingly procuring innovative, low-carbon solutions to help them deliver public services in the most sustainable way possible.

Globally, public procurement accounts for between 10 percent and 15 percent of global GDP. This represents a huge degree of purchasing power. Procurement decisions can have a significant impact on the market and help encourage the provision of more sustainable goods and services.

Almost everything we buy has an effect on climate change, whether this relates to the energy products we consume or the carbon embedded in global supply chains. The most significant procurement sectors for cities include building and infrastructure construction and renovation, transport (covering public fleets, public transport services, as well as the delivery of goods and services), food, energy, and energy-consuming products. In all these sectors, cities are driving new technologies and solutions by providing an invaluable launch market and helping suppliers achieve economies of scale.

Many cities—from Auckland to Tshwane, Oslo to Seoul, and Buenos Aires to Montréal—are putting sustainable procurement strategies and policies in place. The Global Lead City Network on Sustainable Procurement provides an international platform for cities to highlight their achievements and share their experiences.

CITIES IN ACTION

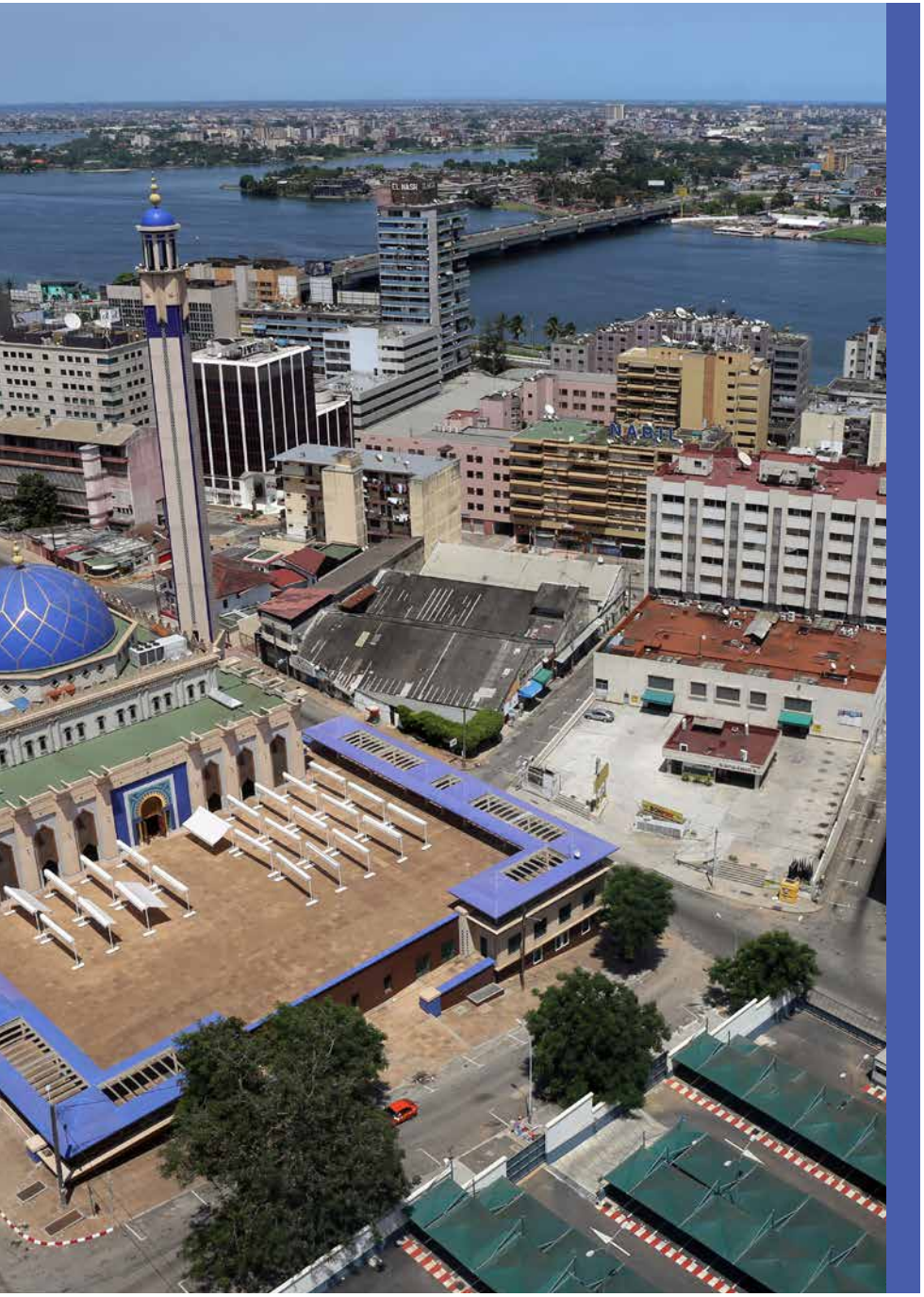
With an annual spend of nearly €3 billion on goods, works, and services, Oslo in Norway has been working with sustainable procurement for many years. In 2017, its commitment to sustainability was embedded directly within its new procurement strategy, which includes specific objectives on using procurement to promote environmentally sound and socially responsible outcomes. The strategy is accompanied by detailed instructions on how procurement should be carried out by those responsible within the city administration.

Photo: © Iwan Bagus / IFC

This includes instructions on the use of zero-emission vehicles for the delivery of goods and services to the city, promoting the use of recycled materials, and increasing the share of organic food in municipal catering contracts. A major area of work for the city is ensuring that all public construction works are carried out emission-free, meaning the use of zero emission construction equipment and construction material transport.

In South Africa, the public sector has considerable experience in using procurement to meet societal goals, notably through the Preferential Procurement Policy Framework Act, which gives preference to black-owned businesses in public contracts. The City of Tshwane (whose Executive Mayor, Solly Msimanga, is Chair of the Global Lead City Network on Sustainable Procurement) has moved beyond this, recognizing the potential of procurement in tackling the city's wide-ranging social and environmental objectives. The city has introduced electric vehicles into the municipal fleet and is building new headquarters (Tshwane House) to the five-star Green Star South African standard. The city is developing a Sustainable Procurement Strategy, to be published in 2018, and has committed to ensuring 10 percent of all purchases are sustainable by 2021. It has also signed the Clean Bus Declaration, committing the city to greening 40 percent of the bus fleet by 2020.

In 2007, Seoul Metropolitan Government introduced a governmental ordinance requiring procurers to buy green products where possible. This program uses a national database of green products certified by the Korea Environmental Industry and Technology Institute under the Ministry of Environment, which procurers can use directly in their procurement processes. When purchasing products, procurers are obliged to check whether a green alternative is included in the database. By 2017, 41.7 percent of all procurement expenditure was spent on green products. Seoul Metropolitan Government also has specific procurement targets, including using electric vehicles in the city-owned fleet, introducing eco-friendly food in schools, installing photovoltaic power in public facilities, and ensuring all new municipal buildings are zero energy.



Sub-Saharan Africa

Sub-Saharan Africa's cities are home to more than 470 million people, a number that is expected to double over the next 25 years.[287] The region's global share of urban residents is expected to grow from about 11 percent in 2010 to over 20 percent by 2050.[288]

Climate change is one of the leading factors contributing to urbanization in Sub-Saharan Africa. Extreme temperatures and unpredictable rainfall have already affected income from agriculture in the region, which has caused people to migrate from rural to urban areas. Agricultural yields are expected to face losses of up to 15 percent by 2050, signaling further rural-to-urban migration in the coming decades, and the associated pressures on urban infrastructure and services.[289]

Recognizing the role of climate change in shaping their development, and the need to help mitigate it, cities in Sub-Saharan Africa are setting urban planning goals that emphasize climate-related targets. For example, eight cities in the region, including Accra, Addis Ababa, Dar es Salaam, and Lagos, have pledged to achieve zero-carbon economies by 2050 by eliminating emissions from transport, buildings, energy production, and waste management.[290] In South Africa, Cape Town's Climate Action Plan seeks to source 10 percent of its electricity needs from renewable sources by 2020, up from 2 percent in 2016,

excluding nuclear energy. Johannesburg and Cape Town have both issued municipal bonds over several years to meet their development needs. Johannesburg was also the first city in the region to issue a green bond in 2014, which raised more than $125 million for investments in renewable energy, solid waste management, and hybrid-fuel buses.[291] Greater Accra is developing a Climate Resilient and Integrated Development Project that seeks to implement climate-sensitive urban planning and improve enforcement, particularly on flood and solid waste management.[292]

A substantial portion of the urban population in the region lives in small and intermediate cities rather than large metropolises. These cities typically have less access to financing for the provision of low-carbon, resilient infrastructure and services.[293] There is a significant opportunity to fill this gap, and IFC estimates a climate-smart investment potential of $1.5 trillion in small, medium, and large cities in Sub-Saharan Africa to 2030.

Estimated Climate Investment Opportunity in Sub-Saharan (2018–2030)

	$1.5T	GREEN TARGET PENETRATION
Waste	$13B	48%
Renewable energy	$89B	34%
Climate-smart water	$101B	65%
Public transport	$159B	N/A
Electric vehicles	$344B	30%
Green buildings	$768B	22%

ADVISORY SERVICES ON WATER IN DURBAN (IFC)

In Durban, South Africa, eThekwini Water Services is the public municipal utility that provides water, sanitation, and wastewater treatment and disposal. Most of the sewage only receives primary treatment before being discharged into the ocean. IFC has an active advisory services engagement with eThekwini Water Services. It intends to develop two greenfield wastewater treatment works and refurbish another (estimated capital cost of $148 million) using a PPP model. The projects aim to reduce environmental and ocean pollution by providing adequate treatment of wastewater, and are likely to include an indirect water reuse component. It will also increase the water resources available to the city in this water-scarce and drought-affected region.

Photo: © Hendri Lombard / World Bank

BUS RAPID TRANSIT IN DAR ES SALAAM (AFRICAN DEVELOPMENT BANK)

Dar es Salaam is the most populous city in eastern Africa. In 2015, the African Development Bank committed a $97 million loan and brought in $44 million from the Africa Growing Together Fund to construct 20km of exclusive bus lanes. Over 1 million people will benefit from the project when it is completed in 2018. The project will also improve air quality for travelers and residents living close to the roadway. Property values are expected to rise as a result of the reduced congestion. Women will be allocated a 25 percent share of construction jobs and 30 percent of the jobs created during operations.

INVESTING IN TRANSPORT IN ACCRA (AFRICAN DEVELOPMENT BANK)

In 2016, the African Development Bank committed an $84 million loan to Accra, Ghana, to reduce traffic congestion and accidents. The project will finance a modern three-tier highway exchange in a rapidly developing industrial zone. The infrastructure is designed with a special focus on public transport and non-motorized traffic, providing for mass rapid transit and rail expansion. Traffic accidents in the covered area are projected to decrease by 40 percent by 2020.

Photo: © IFC

SUPPORTING MEDIUM-SIZED CITIES IN SENEGAL (AFRICAN DEVELOPMENT BANK)

In March 2017, the African Development Bank committed $128 million in loans to Senegal to modernize transport infrastructure in 13 medium-sized municipalities. The first phase of the program, Promovilles-1, will rehabilitate and construct 78km of roads with sanitation facilities and lighting, and improve the technical and financial capabilities of municipal authorities. The project also finances five community homes for women, 10 schools, and training in road maintenance and building for 1,500 young people.

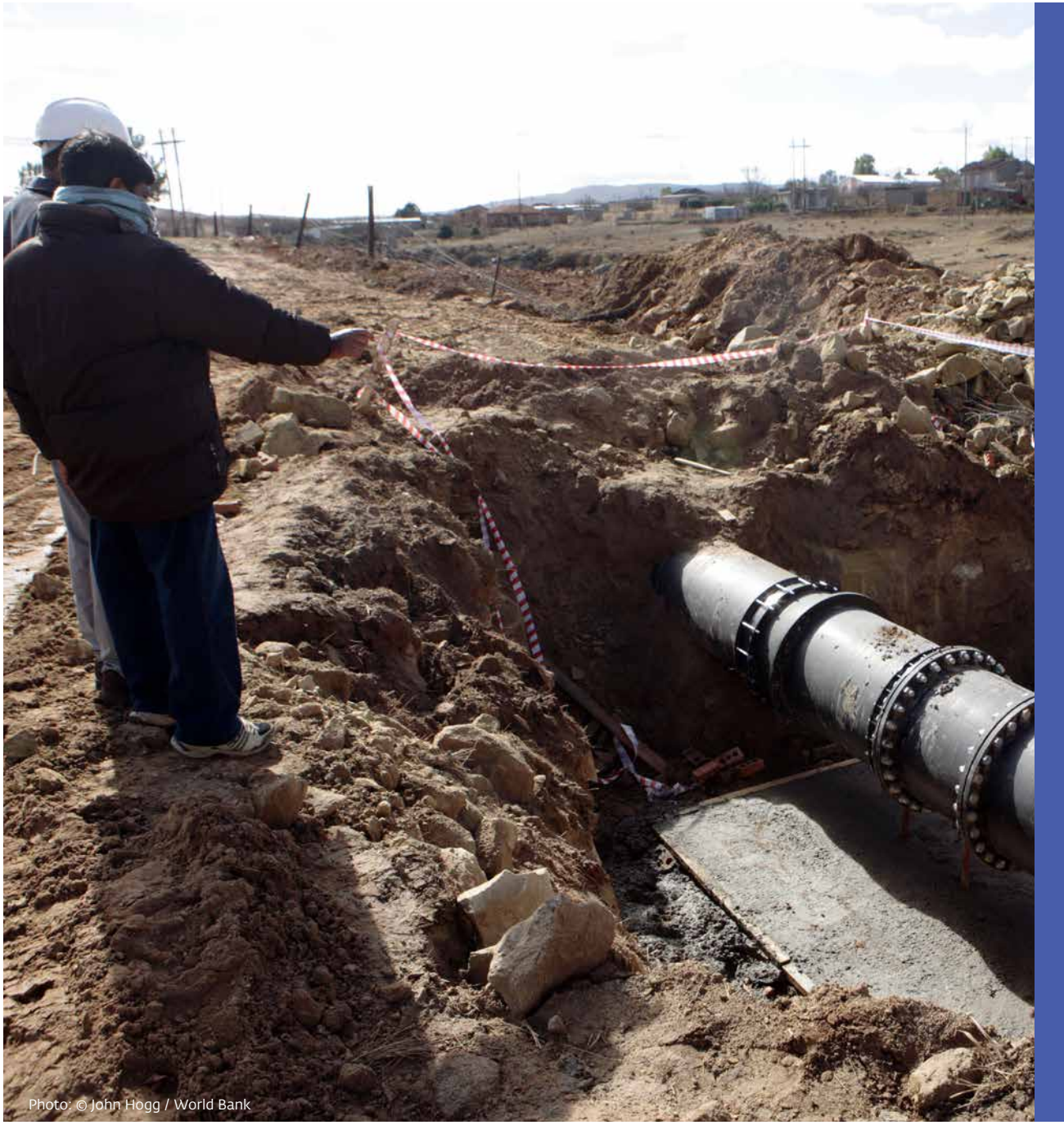
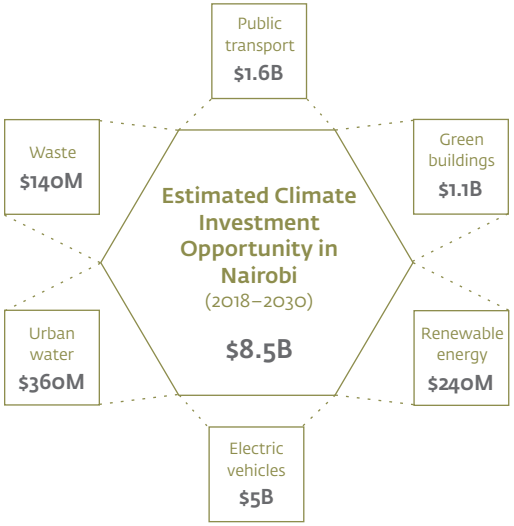


Photo: © John Hogg / World Bank

NAIROBI, KENYA



City	Nairobi
Population	4 million
GDP (GDP per capita)	$6,000
Current GHG emissions	Unknown
GHG reduction target	N/A
Municipal credit rating	N/A

"The green economy presents a tremendous opportunity for not only Kenya but also all of Africa in so far as innovation and shared value. As we seek to address the effects of climate change, a collaborative approach is necessary to shift the global and pan-African financial system to become a primary enabler of sustainable development. We are thankful that IFC has demonstrated this leadership."

— **Nuru Mugambi,** Kenya Bankers Association, Lead on Sustainable Finance

Nairobi is a rapidly urbanizing city with a population that has doubled since 1986.[294] It currently grows at a rate of 4.7 percent,[295] among the highest growth rates in Africa.[296] The city is a key driver of Kenya's economic growth, contributing almost 13 percent of the nation's GDP,[297] and home to the fourth largest stock exchange on the continent.[298] The city has a burgeoning technology sector, establishing itself as a regional powerhouse in mobile technology, and has been termed Africa's Silicon Savannah.[299] Nairobi is working to meet the demands of rapid urbanization and economic growth in a sustainable way, including sourcing over 70 percent of its energy from renewable sources.[300]

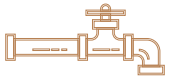
Mitigation and Adaptation Plans

With support from the Japan International Cooperation Agency, the city has developed the Nairobi Integrated Urban Development Master Plan to provide a guiding framework for the city to 2030.[301] The plan focuses on the intersection of urban planning and environment, with an emphasis on sectors such as sustainable transport, water and wastewater, power, municipal solid waste, and telecommunications. The city is working with C40 to formalize a long-term climate plan to align with the goals of the Paris Agreement.[302]

As a member of the 100 Resilient Cities network, Nairobi is in the early stages of appointing a Chief Resilience Officer, who will work with the city to develop a strategy to build its resilience to shocks and stresses, including water shortages.[303] The country's Nationally Appropriate Mitigation Action on Circular Economy Solid Waste Management Approach for Urban Areas in Kenya is to be piloted in Nairobi.[304] The program involves the development of infrastructure to collect and recycle 600 metric tons of waste per day through 15 recycling centers, 16 composting facilities, and a viable compost market, as well as new or improved technologies to enhance the recycling process. The city seeks to partner with the private sector, which will be contracted by the city government to collect and recycle waste, and invest in the recycling and compost facilities.

Priority Sectors for Investment

WATER	$360M



Nairobi's water demand is expected to more than double by 2035 from 2010 levels,[305] **making it a key sector for development.** As per its urban development plan, Nairobi seeks to reduce water losses from theft and leakage from 40 percent to 20 percent by 2030, as well as harness water resources and develop a robust water supply system.

A priority for the city is to expand its distribution network and water supply system, and it has engaged extensively with the World Bank over the years to achieve this goal. Most recently, the city has worked with the World Bank to structure and help finance the Nairobi Bulk Water Supply Project as a $24 million PPP.[306] The contract to construct raw and treated water gravity mains and the associated pipe network[307] was awarded to the China State Construction Engineering Corporation and the Nanchang Foreign Engineering Corporation in 2016.[308]

Nairobi is also prioritizing storm water and wastewater management. The existing sewerage network collects wastewater from 40 percent of the total area covered by the water supply service, and the city plans to extend this coverage to attain a sewage collection rate of 75 percent by 2030.[309] The city has also begun work to construct an 8km-long storm water drainage system to build its resilience to frequent flash floods, improve its ability to manage its water resources, and mitigate the damage to people and property as a result of storm water.[310]

IFC estimates an investment potential of $360 million to help Nairobi meet its urban water and wastewater management goals to 2030.

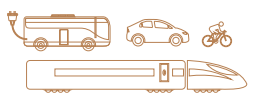
GREEN BUILDINGS $1.1B

In 2018, Nairobi has seen an almost 12 percent growth in non-residential building construction, as well as the announcement of a large-scale affordable housing program.[311] About 60 percent of Nairobi's population lives in informal settlements[312] and the city needs 1.85 million additional housing units.[313] To meet this deficit, as part of the Kenyan President's Big Four agenda for prioritizing development, Nairobi is expected to construct 30,000 new affordable housing units in the short term, and private companies are expected to be assigned 7,000 acres of public land for development in the long term.[314]

The expected sharp rise in building construction presents a significant opportunity to ensure that these buildings are green and sustainable. Some of the largest construction projects in the city are already being designed to emphasize sustainability, energy-efficiency, and reduced energy and water use. One such example was the installation of the largest solar carport in Africa on top of a mall in the city in 2015.[315] The carport is composed of 3,366 solar panels that generate enough energy to power the equivalent of 550 urban homes each year, funded in part by IFC.[316] The mall includes water recycling and rainwater harvesting design elements, for which it has received Leadership in Energy and Environmental Design certification.

Given the impetus for affordable housing construction, as well as the centrality of Nairobi as a commercial hub in the region, IFC estimates an investment opportunity of over $1.1 billion to 2030 to green the expected construction of buildings in the city.

TRANSPORT $6.6B



As walking is the preferred mode of daily transport for 47 percent of Nairobi's population, non-motorized transport is a major consideration in the city's transport plans. The city government formulated and launched its non-motorized transport policy in 2015, which commits 20 percent of the city's road construction budget to non-motorized transport investment.[317] In addition, the city aims to develop its motorized public transport infrastructure and services. Created in February 2017, the Nairobi Metropolitan Area Transport Authority aims to develop a sustainable integrated public transport strategy that focuses on bus rapid transit and commuter rail routes.[318] The city is working with the Japan International Cooperation Agency to develop a plan for an integrated transport system as per the city's urban development plan.[319]

Nairobi is attempting to develop these initiatives partially through PPPs. For example, the Mombasa-Nairobi Standard Gauge Railway, launched in 2017, is the largest infrastructure project since the country's independence in 1963.[320] The project's primary contractor was the China Road and Bridge Corporation, which worked with Kenyan institutions to establish training centers for railway technology and operations.[321] As another PPP, Nairobi seeks to emulate the example of Bogotá's bud rapid transit model, and plans to introduce five lines with a total length of about 54km, to be serviced by 950 high-capacity buses.[322] The Nairobi bus rapid transit project is currently seeking private investors as it moves into a pilot stage.[323]

IFC estimates an investment opportunity of $1.6 billion for Nairobi to meet its public transportation targets and goals to 2030.

The city is also welcoming the expected large-scale adoption of electric vehicles, given impetus by the national government's development of environmental, health, and safety standards for importing electric cars and motorcycles.[324] Nairobi is home to one of two inspection centers

that are undergoing automation in anticipation of the influx of electric vehicles into the city.[325] First-movers from the private sector are already recognizing this opportunity. Finnish company EkoRent has launched Nopia Ride, a full electric taxi service, in Nairobi. It aims to increase its fleet size to a few hundred vehicles by the end of 2018.[326] Nigerian company Nigus Enfinity plans to introduce electric cars into the city in 2018 and establish a local assembly plant by 2020.[327]

IFC estimates an investment opportunity of almost $5 billion to 2030 for investments in electric vehicles in Nairobi, including for building the necessary charging infrastructure.

Financing and Policy Instruments

Nairobi has a strong private sector presence and is the eighth most attractive city in Africa for foreign direct investment.[328] Nairobi is also taking advantage of the national priority to attract private sector participation in infrastructure and using the World Bank's help to develop the laws and frameworks for a national PPP policy.[329] The city is looking to leverage private investment through PPPs for several planned climate-smart projects, including the bus rapid transit network, commuter rail network, and water supply system discussed above. The city is also planning PPPs in other sectors, including a $2.5 million recycling and waste-to-energy facility at Dandora, one of Nairobi's largest waste dumping sites,[330] and the construction of a student hostel with the capacity to accommodate 35,000 students.[331]

Nairobi is also trying to attract financing from other sources, including international investors, insurance companies, multinational corporations, and various funds. For example, the Nairobi City Water and Sewerage Company has launched the Upper Tana-Nairobi Water Fund in partnership with East African Breweries Ltd, Coca-Cola, and electricity provider KenGen, to raise $15 million for soil and water

conservation activities in the Upper Tana watershed, which supplies 95 percent of the capital's water.[332]

Recently, Nairobi opened itself to investment through financial products as well. The Kenya Bankers Association partnered with the Nairobi Securities Exchange to develop a green bond market for the private sector.[333] In September 2018, the Nairobi Securities Exchange launched a legal framework to support the issuing of green bonds.[334] Once issued, these bonds are expected to focus on priority sectors including water, waste, and transport. The city has also considered issuing a $1.24 million municipal bond to fund infrastructure projects that align the city with the National Economic Development Strategy.[335]

Data-Driven Solutions for Climate-Smart Cities

Global trends such as climate change, rapid urbanization, and technology disruptions are transforming the future of cities. With booming populations and stretched infrastructure systems, cities are increasingly using advanced data sources and digital technology to make more informed decisions for city planning, and for the service delivery models that underpin their development. Today, more than half of the world's population live in urban areas, a proportion that is expected to increase to about 70 percent by 2050. Projections show that urbanization, coupled with the overall growth of the world's population, could add another 2.5 billion people to urban areas by 2050, with close to 90 percent of this increase taking place in Asia and Africa.[336]

Digital technologies are equipping cities with smart tools, including mobile applications, intelligent transport systems, and open data portals, to improve service delivery and bolster social and economic inclusion. These technologies are critical in helping cities to reorganize operations, improve services, and become more efficient—from encouraging people to travel during off-peak hours and altering routes in real-time to avoid traffic congestion, to using less energy and water at different times of the day.

Smart street lights, grids and metering, leak detection systems, and the internet of things are transforming the way utilities such as electricity and water are being delivered, used, and paid for. And new integrated mobility solutions that are efficient, cost effective, and sustainable are displacing conventional transport services of the past. These new models include smart traffic control systems, commuter planning tools, and smart parking systems, as well as digital payment systems and flat-rate mobility subscriptions that cover multiple modes of transport.

Smart technologies can make daily commutes faster and less frustrating. It is estimated that, by 2025, cities using smart mobility applications could cut commuting times by between 15 percent and 20 percent on average. However, the potential associated with each application is highly variable, depending on each city's density, existing transit infrastructure, and commuting patterns. In a developed city such as New York, smart technologies save the average commuter almost 15 minutes a day.

In a developing city with more taxing commutes, workers may gain up to 30 minutes every day.

Water consumption tracking, which pairs advanced metering with digital feedback messages, can nudge people towards conservation. It could reduce consumption by 15 percent in a higher-income city where residential water usage is high. In many parts of the developing world, the biggest source of water waste is leakage from pipes. Deploying sensors and analytics can cut those losses by up to 25 percent.[337]

As low-tech recycling programs reach the limits of what they can do, technology can further reduce the volume of unrecycled solid waste. For example, digital tracking and payment for waste disposal charges users for exactly the amount and type of trash they throw away. However, this type of application should be considered alongside other policy initiatives, particularly in emerging markets where household budgets are invariably small and informal recycling already takes place.[338]

The Massachusetts Institute of Technology's SENSEable City Lab has teamed up with Cisco to create a lightweight sensing platform, called City Scanner, which attaches to urban vehicles such as garbage trucks and taxis. They are piloting this on trash trucks in Cambridge, Massachusetts, which cover large areas of the city on a weekly basis, allowing the sensing platform, which includes thermal cameras, air quality, temperature, humidity, WiFi scanner, accelerometer, and GPS sensors, to capture over 1.6 million data points. City Scanner radically reduces sensor and deployment costs, and the overarching goal is to create a new source of information for decisions regarding public health, security, and boosting new urban services. There are plans to make the captured information available to all via Cambridge's open data portal so that citizens can better understand the environment they live in, and to allow for on-demand configuration based on citizen input.

Because smart applications primarily succeed when they are widely adopted and visibly shift behaviors, the technology needs to be accessible to large segments of the population. Smart applications are also more effective when paired with complementary policy shifts at national or municipal level, along with low-tech measures. While most infrastructure services are owned and operated by the public sector, there is an immense opportunity for the private sector to provide the initial investment in smart applications, and to implement and service the technology. In addition to the roles the public and private sectors must play in data-driven service delivery models, community engagement with citizens is also a critical element. This allows a constant feedback loop to help evaluate the effectiveness of existing delivery models and to help develop the next generation of technology-driven solutions.

Latin America and Caribbean

As the second most urbanized region in the world, an estimated 81 percent of Latin America's population lives in urban areas today,[339] with almost a third of the region living in emerging, intermediate cities.[340] With 198 of the largest Latin American cities expected to contribute 65 percent of the region's GDP over the next 15 years, these urban areas need to fulfill their economic potential in a sustainable way, while grappling with congestion, housing shortages, bad air quality, and the need to provide basic infrastructure and municipal services such as solid waste management.[341]

Cities in the region are facing a multitude of climate challenges, including groundwater depletion in Mexico City, rising sea levels in Buenos Aires, and flooding in Barranquilla. To manage these challenges and explore the potential opportunities that climate change presents, cities in Latin America and the Caribbean are trying to become "smart cities" and plan their urban development in a sustainable manner. About 40 percent of the cities analyzed in a 2017 Inter-American Development Bank study have carried out a smart city assessment.[342] Forward-thinking cities are developing digital solutions, exploring new approaches to city planning such as transit-oriented development, and finding innovative methods of green climate finance across sectors.

Given the region's large-scale, rapid urbanization, cities are facing housing pressures. With roughly a quarter of the region's urban population living in informal settlements,[343] there is a huge imperative for cities in Latin America to invest in affordable housing. This presents a significant opportunity for green housing construction. Cities in the region are already acting on this—Bogotá has implemented a Sustainable Urban Planning and Buildings Policy; a Green Building Code; incentives for greening new and existing residential and commercial buildings; and policies for green schools, green municipal buildings, energy benchmarking, and data transparency.[344] The private sector is also recognizing the need for green buildings and is using certification programs such as LEED to guide the way, including the Nike store and HSBC headquarters in Buenos Aires, both of which have LEED Gold certification.[345] These developments and policies underpin IFC's estimate of the $4.1 trillion investment opportunity in green buildings in the region's cities.

IFC estimates an investment opportunity of almost $395 billion in the transport sector in the region's cities till 2030, including for the rollout of electric vehicles and the modal shift towards public and non-motorized transport. More than 42 major cities in Latin America have developed mass transit systems, including Bogotá, Santiago, and Medellín, and more than 320 others have integrated bike lanes into their transport systems.[346] A significant proportion of these projects had some private financing through PPP models.

There are significant opportunities in these sectors, as well as in renewable energy, urban water and wastewater, and municipal solid waste management. IFC estimates that the climate-smart investment potential in cities in Latin America and the Caribbean totals $5 trillion to 2030.

Estimated Climate Investment Opportunity in Latin America and Caribbean (2018–2030)

	$5T	GREEN TARGET PENETRATION
Waste	$37B	67%
Public transport	$109B	N/A
Renewable energy	$226B	28%
Climate-smart water	$228B	71%
Electric vehicles	$285B	40%
Green buildings	$4.1T	19%


Photo: © Dominic Chavez / World Bank

GREEN BUILDINGS AND GREEN TRANSIT IN BUENOS AIRES (IFC)

In June 2017, IFC and the city of Buenos Aires signed a $50 million loan to support the development of a low-emission, resilient urban transportation system. This was part of the Sustainable Mobility Plan, which took a holistic approach to sustainable transport in three interconnected areas: the execution of public transport projects, the creation of bicycle pathways and a bike-sharing system, and a public awareness campaign to promote the use of the systems.

The IFC project supports building efficient bus lines and infrastructure to support urban bicycle transport. IFC is also advising the city on transport, waste management, green buildings, and energy-efficiency. Through the Latin America and Caribbean Cities Platform, IFC is helping the city structure innovative engagements in these areas.

In close collaboration with the International Bank for Reconstruction and Development, IFC is supporting Buenos Aires in introducing green building standards in an iconic urban block in the heart of the city that is home to about 43,000 of the city's poor. The new standards have been adopted in the design of low-income housing projects financed by the International Bank for Reconstruction and Development, demonstrating that sustainable buildings can be implemented in the poorest and most vulnerable neighborhoods.

ENERGY-EFFICIENT STREET LIGHTING IN CHILE (IDB INVEST)

IDB Invest (formerly the Inter-American Investment Corporation) financed the installation of efficient LED technology for five Chilean municipalities (Cartagena, Coyhaique, Melipilla, San Javier, and Villa Alemana) under a third-party financing model. The client, Itelecom, will use a $7 million loan from IDB Invest to install, finance, and in most cases operate and maintain 37,000 efficient LED lighting fixtures. In addition, the corporation secured $14 million in concessional funds from the Canadian Climate Fund and the Clean Technology Fund. Energy savings are expected to range between 54 percent and 67 percent, amounting to as much as $40 million in cost savings for the cities. The project uses an energy service company model, in which the cost savings will enable the municipalities to cover the payment obligations for the loan to Itelecom.


Photo: © Stephen Riley

IMPROVING ACCESS TO AFFORDABLE HOUSING IN MEXICO (WORLD BANK)

In June 2017, the World Bank committed $100 million to support the Mexico National Housing Commission's efforts to increase access to affordable housing for low-income beneficiaries. The project is promoting compact, dense urban development by providing direct support for people buying houses. The project uses a set of qualifying criteria, such as densification and access to public and non-motorized transport, and promotes the use of water- and energy-efficient appliances; lighting; and heating, ventilation and air conditioning systems, per Mexico's Nationally Appropriate Mitigation Actions. The project is expected to reduce overall greenhouse-gas emissions, while addressing bottlenecks in affordable housing provision and creating sustainable urban growth environment for over 27,800 beneficiaries and five local governments.

ENERGY-EFFICIENT STREET LIGHTING AND GENDER EQUALITY IN MEXICO (IDB INVEST)

In the port city of Ensenada, on the Pacific Coast of northwestern Mexico, the municipal government hired Optima Energía to update the city's street lighting system, substituting 25,000 sodium vapor lamps for energy-efficient LED lighting. The project will reduce the lighting system's greenhouse-gas emissions by 150,000 tons of CO_2e and save 260 million kilowatt-hours of electricity over the life of the project. While this would usually be a daunting investment for a city of close to half a million people, under Optima Energía's business model the city is paying for the project over time, covering the costs entirely out of the savings being generated. The bulk of the loan came from the Canadian Climate Fund for the Private Sector in the Americas, a fund established by Canada and managed by IDB Invest.

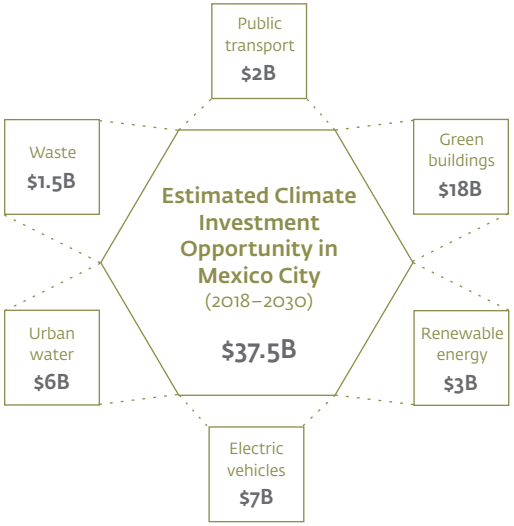
The loan was structured to provide incentives to improve gender equality and diversity—IDB Invest is helping Optima Energía enhance its workforce through a gender certification and internship program and lay the foundations for a more diverse work environment.

FINANCIAL INSTRUMENTS FOR ENERGY-EFFICIENT CITIES IN BRAZIL (WORLD BANK)

The Financial Instruments for Brazil Energy-efficient Cities Project is unlocking private financing for energy-efficiency projects in cities by enhancing their technical quality and reducing credit risk. The project specifically targets public street lighting and industrial energy-efficiency, recognizing their substantial potential to save energy. By improving public street lighting, which represents up to 4 percent of total electricity consumption in Brazil, cities can achieve electricity savings ranging from 50 percent to 80 percent.

Over 150 projects with high returns and short payback periods have already been identified among large industrial energy users. The project establishes an energy-efficiency facility to leverage public funds, such as the Green Climate Fund and Clean Technology Fund, to attract private sector investment and roll out a new incentive framework to finance energy-efficiency. The project also provides technical assistance to the financial intermediary and implementing body, Caixa Econômica Federal, a national development bank.

MEXICO CITY, MEXICO



City	Mexico City
Population	8.9 million
GDP (GDP per capita)	$16,372
Current GHG emissions	30.8 million tCO_2e
GHG reduction target	10 million tCO_2e reduction by 2020
Municipal credit rating	A3 (Moody's)

"In 2018, Mexico City was the first local government in Latin America to issue forest bonds. These instruments are transparent and will directly benefit communities that belong to a conservation land, where 339 land owners have committed to preserve the forest for 30 years, with all obtained resources to directly fund projects in their communities.

Funding climate action in Mexico City is a great challenge, considering billions are required to accomplish the strategic vision of the Climate Action Program 2014–2020."

— **Tanya Müller García,** Secretary of Environment of Mexico City

The capital of Mexico is one of the most populous metropolitan areas in the world; home to over 21 million people as of 2015.[347] Projected to be the tenth largest city in the world by 2030,[348] Mexico City will require significant public and private investment to meet its development needs. In 2017, the city contributed to 17 percent of the national economy, driven by key industries including trade, real estate, and financial services.[349]

As of 2015, the city released 31 million metric tons of CO_2 annually. This is equivalent to the emissions created by 6.6 million passenger vehicles driven for one year,[350] contributing to the city's ranking of 37th among the top 500 global cities for carbon footprint. Located in the Valley of Mexico, in the high plateaus in the middle of the country,

Mexico City faces significant climate change impacts. But it is not unfamiliar with resolving environmental problems with innovative solutions, having made significant advancements since it was labeled by the UN as the most polluted city in the world in the 1990s.[351]

Mitigation and Adaptation Plans

The city has laid out a roadmap to coordinate and execute 102 actions derived from seven strategic priorities contained in the Local Climate Action Strategy 2014–2020 and the Mexico City Climate Action Program 2014–2020, which seek to reduce Mexico City's exposure to the effects of climate change.[352] These priorities include energy transition, containing urban sprawl, building resilience, sustainably improving natural resources, and enhancing the environment. The current Action Program aims to improve the quality of life and facilitate sustainable, low-carbon development in the city, targeting mitigation of 10 million metric tons of CO_2e by 2020. This would represent a 30 percent decrease in emissions in comparison to the baseline scenario.[353]

The Action Program also aims to build the city's resilience and adaptation capability, paying particular attention to the 5.6 million residents most vulnerable to extreme weather events such as flooding.[354] Mexico City is already implementing measures to address its expected exposure to vector-borne diseases and forest fires as a result of extreme temperatures and flooding by 2025, including vaccination programs, development of crisis management systems for early warning and evacuation, and hazard-resistant infrastructure design and construction.[355] The local government is also engaging in flood management measures such as municipal water efficiency retrofits and investment in water supply infrastructure.[356]

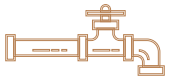
Achieving these targets and strategic priorities could present opportunities for private investment. Some key actions outlined in the program include modernizing solar-powered public lighting in the city's 16 boroughs, creating a fleet of electric taxis, rehabilitating green spaces to contain urban sprawl, constructing bike parking lots, and

treating and using waste as an alternative fuel.[357] The city has already demonstrated success through its 2008–2012 plan, which resulted in the mitigation of 7.7 million metric tons of CO_2e (10 percent above the target[358] and equal to the emissions generated by the annual energy consumption of over 831,000 American homes). It has also mainstreamed climate change as a priority for municipal agencies.[359]

To ensure accountability, Mexico City has designed a measurable, reportable, and verifiable virtual platform for the city's government agencies to report their progress on relevant actions, known as the Monitoring System of the Mexico City Climate Action Program 2014–2020.[360] According to the 2016 progress report, the city achieved 46 percent of its 2018 goals by October 2016, and had mitigated 3.1 million metric tons of CO_2e.[361] Institutionally, both the mitigation and adaptation agendas are being driven from the highest levels, with the city appointing both a Minister of Environment and a Chief Resilience Officer.

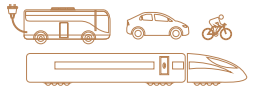
Priority Sectors for Investment

WATER	$6B



Investment in water management and infrastructure is both a priority and an urgent need for Mexico City. The city's water shortage has resulted in problems such as the over extraction of groundwater and the subsequent ground subsidence.[362] The city is encouraging the private sector to help provide water access to the 21 million inhabitants without reliable tap services[363] through projects such as La Quebradora Water Park. This water treatment complex combines infrastructure with public space to recycle water and alleviate shortages. It features water treatment facilities and basins for catchment and flood prevention, public buildings, plazas, and recreational areas.[364] A PPP project seeks to increase the water treatment efficiency of the Cutzamala System through a $134 million investment in constructing, operating, and maintaining a new pivot module, and improving the three existing modules by rehabilitating the filtration process and improving the sludge system.[365] Ensuring adequate water supply without further draining its aquifer, as well as repairing and upgrading its water infrastructure to reduce the leakage rate from the current 35 percent,[366] will require significant investment in Mexico City, signaling an opportunity amounting to almost $6 billion by 2030.

TRANSPORT	$9B



Since the 1990s, Mexico City has overhauled its transport sector, the largest source of its emissions (45 percent of total emissions),[367] to create a better connected, coordinated, and accessible urban landscape.[368] The Climate Action Program seeks to continue its transformation of the city's transport sector by modernizing the subway system, developing inter-modal transport schemes, and launching new bus rapid transit lines. Together, these initiatives aim to reduce air pollution, congestion, and energy use,[369] and are expected to reduce current total emissions by 10 percent by 2020, saving 2.7 million kilowatt-hours of energy.[370] As a member of C40 Cities, Mexico City has also signed the Declaration on Clean Buses, pledging to incorporate low-emission bus fleets.[371] According to Mexico City's Minister for Environment, the city is succeeding in catalyzing a modal shift towards clean and public transportation through its bus and bike lanes, with the latter witnessing 30,000 trips a day with more than 200,000 users.[372] The city seeks to expand on this success with a green corridor created through the deployment of 100 new electric buses and 22km of new bicycle lanes throughout the city.[373]

The city's Ministry of Environment opened a Non-Motorized Mobility Strategy Office in 2008 to encourage a modal shift to biking. The office was mandated to build better biking infrastructure, integrate biking into the transit network, and build a cycling culture in the city.[374] The city's public bike-share system, Ecobici, has become the fourth largest initiative of its kind in the world, expanding from 85 stations in 2010 to 444 in 2018. With a coverage area of 32km, Ecobici services have been used 36 million times since 2010.[375] The city is also developing a non-motorized transit policy with support from the UN Environment country office and World Resources Institute Mexico. This will address institutional arrangements, the policy framework, and implementation, and is expected to be completed by the end of 2018.[376]

Given Mexico City's focus on reducing emissions from transport, IFC estimates an investment opportunity of $2 billion in public transport and $7 billion in rolling out electric vehicles in the city, creating a total investment opportunity of $9 billion in the transport sector to 2030.

GREEN BUILDINGS $18B

Mexico City's population is expected to grow by 35 percent between 2016 and 2030,[377] and will require an estimated 50,000 new homes each year to meet housing needs.[378] The city's Environment Ministry published new regulations for green construction in 2016, with measures for energy-efficiency in retrofits and new buildings.[379] New energy-efficiency standards and project funding for green design and implementation, financed by the Municipal Energy-efficiency Project with the World Bank, are expected to be applicable in Mexico City once complete.[380] The city has also launched the voluntary Sustainable Buildings Certification Program, which encourages owners and tenants to reduce property emissions related to waste, water, energy consumption, and transport through tax reductions, reduced bills, and increased rental yields from green premiums.[381] To meet these green building policies and targets, IFC estimates an investment opportunity of almost $18 billion in Mexico City to 2030.

Financing and Policy Instruments

To help finance the mitigation and adaptation targets outlined in the Climate Action Program and meet the identified $7.2 billion funding need, the city government established a Climate Change Fund as part of the Public Environmental Fund. This fund is the main instrument to finance climate action in the city, as mandated by the 2011 Climate Change Law. It works as a trust that receives an annual budget from Mexico City's government and is able to receive national and international donations. It funds both mitigation and adaptation projects, and integrates revenues from other funding instruments that target strategic areas such as sustainable transport, water administration, and energy-efficiency. The fund has allocated about $7.3 million to climate action since 2016.[382]

Mexico City launched Latin America's first green municipal bond in 2016.[383] The $50 million issuance was oversubscribed 2.5 times over, and will fund sustainable investments in energy-efficient lighting, transport, and water infrastructure projects for the city. A second green bond was issued in November 2017, and a third is being prepared in the Mexican Stock Exchange as of August 2018.[384]

Each sector and level of government in the country is responsible for planning, implementing, and supervising its projects without an overarching PPP agency.[385] The national government is supporting such projects through a national Public Private Partnership Law that seeks to provide legal clarity to all parties, and is complemented by regulations and guidelines for project evaluation.[386] In addition, the Federal Ministry of Finance has also launched a Promotion Strategy for Public Private Partnerships in Mexico, which seeks to encourage participation in PPPs in a transparent manner.[387] Mexico City itself has had some success with green PPPs. One of these is its metrobus project, which reduced carbon emissions by 300,000 tons in its first six years of operation, and by 110,000 tons annually since then. It has resulted in a 15 percent shift from private cars to public transport.[388]

The Mexico City government is providing public servants with information and tools to encourage green procurement for public sector activities through its Environmental Management System. Twenty-five percent of all public procurement by the city's government has been sustainable and green since October 2016.[389] As the city moves towards achieving its green procurement target outlined in the Climate Action Program, there is significant opportunity for the private sector to provide these green products.

In addition, Mexico City is working with the C40 Cities Finance Facility to improve its project financing capacity, particularly the financial structure of the electric bus corridor it seeks to create in the green corridor for mobility.[390]

Financing Climate-Smart Investments in Cities

Financing Climate-Smart Investments in Cities

Photo: © Dominic Chavez / IFC

A city's ability to make climate-smart investments, particularly in emerging economies, often relies on the reallocation of existing budgets and the ability to increase its sources of revenue. Cities do not always have the capability to finance the investments identified in urban development plans from their budgets alone, as they rely on tax and tariff revenues, and transfers from national governments for their funding. In addition, cities often face several competing priorities and resource constraints that make it challenging to develop investible project plans and accurately quantify project costs, particularly in nascent sectors.

The investment barriers faced by cities limit what they can do on their own. Weak long-term capital planning and poorly articulated business cases can delay prioritization processes. Regulatory barriers, city budgets, and the ability to access external financing are often controlled by the national government, and local revenues are too small to service local access to finance. A survey of 100 cities worldwide found that 55 percent of municipalities identified lack of public funding as a major barrier to sustainable urban growth, while 50 percent cited insufficient national support.[391] Where capital is available, there is often a lack of investment-ready, bankable projects.[392] Some cities lack the capacity or knowledge to develop and report climate-smart projects that are competitive with non-climate projects in attracting finance. Most projects also require close cooperation across sectors, and smaller projects, which are more typical at city level, often need

to be aggregated by public and private actors.[393] Aligning the interests and goals of different parties is therefore often a limiting factor for increased investment in urban mitigation projects. A lack of track record or creditworthiness exacerbates some of these challenges in much of the developing world.[394]

The proportion of entirely city-funded projects decreases as project costs increase. Cities are using alternative mechanisms such as initial grants, subsidies, and loans for more costly projects. However, increasing up-front capital investments, operations, and maintenance costs, coupled with most municipal governments' inability to establish creditworthiness and access capital markets, is making it challenging for cities to meet these financing needs. There is a growing mismatch between capital requirements and available resources. As cities grow, municipal governments need to broaden and deepen sources of financing, moving beyond traditional public funding to access much larger private pools of savings, particularly through domestic capital markets and commercial partnerships.

To date, cities have struggled to mobilize private sector finance at the scale necessary to address the fundamental infrastructure needs in most developing countries.[395] While tapping into the private sector for investment is crucial in financing climate action, requirements and preconditions for private sector investment such as creditworthiness and project bankability are often not considered.

Creditworthiness

Countries at different levels of development and financial maturity face different financing challenges. To attract private investment in infrastructure, cities first need to be creditworthy; they need to manage finances, plan development, and engage citizens using methods that emphasize sustainability and transparency. Credit ratings serve as proxies for financial maturity, as they consider debt levels and sound public financial management by municipalities. Generally, a city can only access the international capital markets if it has an investment grade credit rating, typically BBB- or Baa up to an AAA maximum rating, indicating that it has a low risk of default on its debt obligation.

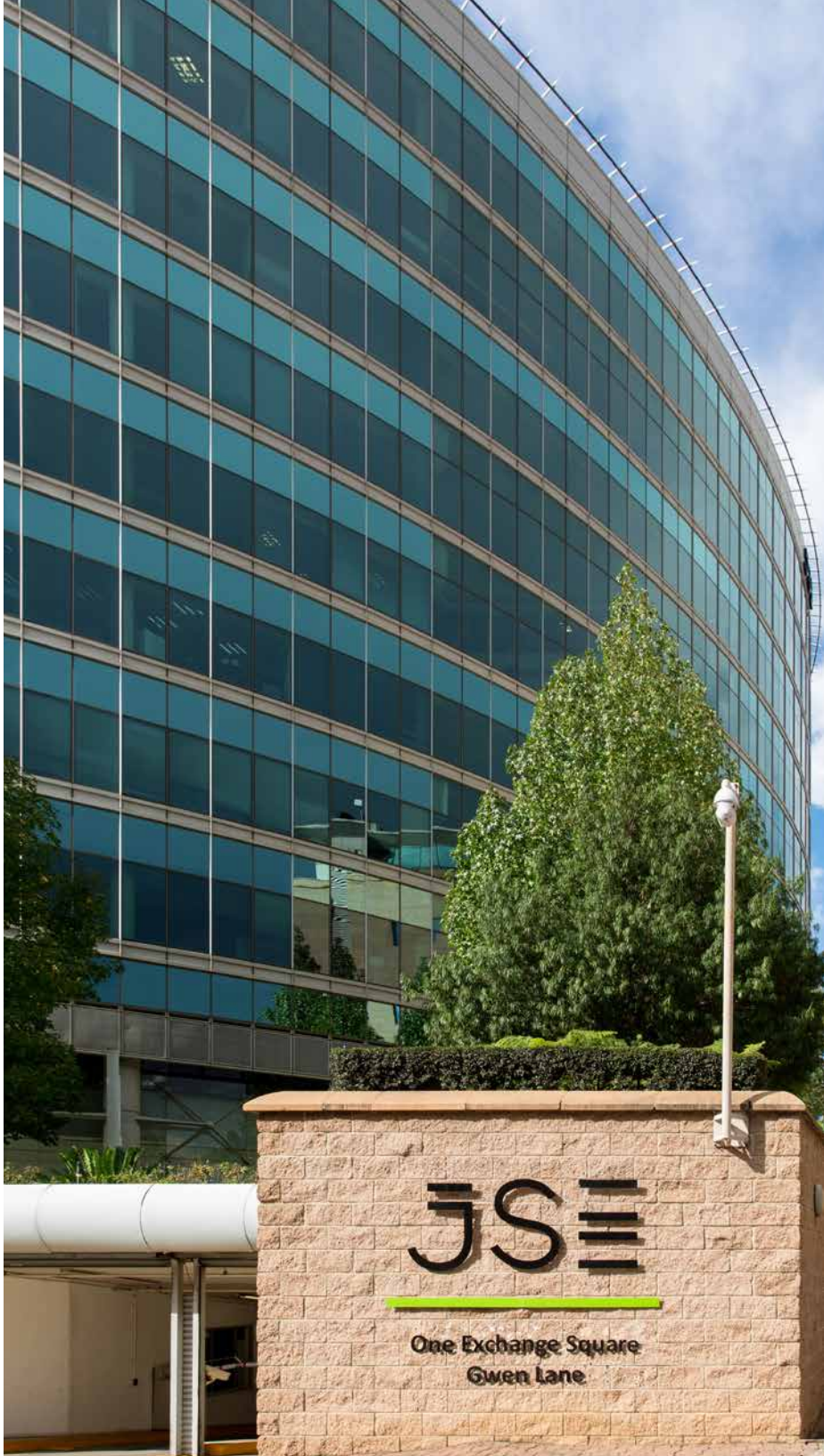


Photo: © Iwan Bagus / IFC

In high-income countries, cities often have debt financing options and PPP projects can also potentially offer equity opportunities to investors. Many of these cities have investment-grade credit ratings, enabling urban projects to raise debt finance in financial markets. Given high per capita income levels, essential urban infrastructure developments can generate consumer revenue streams, incentivizing private investors to invest in equity as a long-term investment.

By comparison, analysis shows that 93 percent of low-income and lower-middle-income countries have sovereign credit ratings that are below the international investment grade in terms of debt financing, thus severely constraining their access to finance. As such, the perceived risk of infrastructure projects is often too high for commercial and institutional investors in terms of equity financing, while the returns from user fees and revenue-generating assets are too low to provide a sufficient profit margin.[396]

Cities can receive investment grade credit ratings in local debt markets even in countries that are speculative grade on the international markets, which opens up possible access to debt financing for well-managed cities in lower and middle-income countries.[397] The World Bank's City Creditworthiness Initiative supports cities in emerging markets to achieve this through hands-on learning programs. The initiative helps cities develop customized, preliminary action plans for specific institutional reforms and capacity building to improve their status, as well as tailored multi-year implementation assistance plans to help them close market-based financing transactions for climate-smart infrastructure projects, using local currency markets whenever possible. Every dollar invested in the creditworthiness of a developing country's city through the initiative has the potential to leverage more than $100 in private sector financing for low-carbon and climate resilient infrastructure.[398]

National governments are also supporting their cities to improve their creditworthiness. Recognizing the potential of cities to raise financing on domestic capital markets, India has issued a guidance note on the use of municipal bond financing for infrastructure investments. The note provides actionable, step-wise inputs on preparatory actions to enhance creditworthiness, the regulatory framework, and the process of bond issuance.[399]

Project Bankability

Investment-readiness and bankability are essential criteria for lenders to provide project financing or investors to take an equity exposure in projects. A project's bankability is determined by its legal and regulatory framework, its inherent risks, including the project sponsors and their track-record, the technology, the long-term nature of projects, initial costs, revenue sources, and the allocation of these risks across the different phases of the project through the financing structure. As the bankability of an infrastructure investment is determined at the project development stage, failure by cities to develop project pipelines tied to long-term urban development plans and objectives can limit project pre-feasibility analysis and thereby undermine the quality of design. Critical challenges in the project preparation stages can have repercussions for the development of pipelines of investment-ready climate infrastructure projects that are up to scale and quality, as well as answering risk assessment requirements to allow for private investment. These challenges include lack of financial autonomy of cities; political interference and electoral cycles; local governments' financial management capacities; missing technical capacity for designing, negotiating, and implementing urban projects; and access to financing, all of which affect the ability to implement infrastructure investments and the future commercial viability of urban services.[400]

The quality and readiness of projects is therefore considered to be one of the biggest constraints to private sector investment due to perceived risks, including unpredictable revenues, land acquisition issues, environmental clearance delays, construction period delays, cost increases, and unavailability of long tenure financing.[401]

Project development information needs to improve in order to accelerate climate action. By supporting municipal governments to reduce information asymmetries and the perception of risk, substantial sources of private and institutional finance, nearly $120 trillion of assets currently under management by a range of private and institutional investors, could be directed into financing sustainable infrastructure in urban areas.[402] The first step in improving the relationship between cities and financial institutions is for cities to enhance their project development information. This information needs to be disseminated and communicated clearly to the finance industry through, for example, the CDP's annual disclosure platform. This is particularly important as cities often do not use the climate or resilience label for projects that in fact do have mitigation or adaptation properties. Cities can reduce transaction costs and provide the predictability needed to facilitate private sector participation by enhancing strategic planning and prioritization of urban projects, improving project pre-feasibility analysis, and ensuring standardized processes, documents, and data for project procurement. Using credit enhancement or alternative funding structures can also help cities improve risk allocation and project bankability. To ensure sufficient finance flows to these vital sustainable infrastructure projects and enable the market shift needed, capacity building within cities and investors is urgently required. Project preparation facilities and initiatives hosted by multilateral development banks, domestic financial institutions, and others such as the Global Infrastructure Hub are supporting cities to build a pipeline of bankable infrastructure projects.

Photo: © Nyani Quarmyne, Panos / IFC

Photo: © Nyani Quarmyne (Panos) / IFC

Financing Instruments

The financing gap can be narrowed by tapping into a wide range of potential sources of funding and financing (including own revenues through taxes, tariffs and fees, debt and equity financing, land-based financing, and transfers by the national governments), and by deploying new and innovative models of finance and investment based on stakeholder collaboration and partnerships. A primary mechanism used to finance capital-intensive, sustainable infrastructure is PPPs. Targeted taxes and incentives can also be used to incentivize investment in sustainable infrastructure by favoring density over urban sprawl, or low-carbon energy over fossil-fuel sources. Other public instruments include land value capture mechanisms to encourage sustainable infrastructure development while leveraging funding for finance. Grants and subsidies are of particular importance for cities with limited public resources, and can be used to support projects with significant potential for leveraging additional sources of finance while delivering sustainable outcomes.[403]

Debt financing instruments, such as bonds and loans, can be used to supplement public finance to encourage investment in sustainable infrastructure. Loans and guarantees from government or development finance institutions can support debt finance provision in developing countries for urban infrastructure financing, where domestic financial markets are underdeveloped or access to capital markets is restricted. Equity instruments can also support investment in sustainable infrastructure.[404] The exact range of instruments at a city's disposal will vary depending on the local context.[405]

Municipal governments can use the most suitable financial instruments when considering their funding and financing options, applying best practice from developed countries if relevant. There are several potential urban finance mechanisms that can have a profound effect on the ability of local and national governments to meet their investment requirements and close their financing deficits. The details of these mechanisms and cities' experiences with them are described below. In each case, the deployment of these mechanisms required national ownership and tailoring to local circumstances, political viability, and development needs.

Green and Municipal Bonds

Green bonds have great potential to drive climate-smart investment by allowing cities to acquire long-term debt at stable prices. They are well suited to larger projects or project portfolios with large upfront costs, where such access to capital is essential. Governments, both national and subnational, can raise private debt capital to finance infrastructure by issuing bonds (in addition to traditional bank lending for project and operational finance). Labeling and standards, such as the Green Bond Principles, can ensure that the debt finance is used for green investments. To access debt financing, governments need to have budgetary, accounting, and financial management capabilities in place, as well as sufficient sources of funding to make repayments. Although the cost of finance will depend on the structure of the bond and the creditworthiness of the project and the issuer, this is generally a competitively priced source of long-term finance.[406] In all cases, national governments play a critical role in supporting cities to deliver on their strategies through national-level regulatory frameworks, coordinated funding, and governance.

The supply of green bonds is growing rapidly, and issuance is expected to reach between $185 billion to $210 billion in 2018.[407] A growing proportion of these bonds are issued to fund climate change mitigation and adaptation in urban areas. For the green bond market to be successful, their risk-return must be as attractive to investors as non-green bonds. City and regional green bonds fund energy-efficiency, public transit, and social housing, while private real estate green bonds fund green buildings. Bonds issued by cities, municipal regions, and private real estate firms made up 13 percent of all green, social, and sustainability bonds in the first half of 2018.[408]

Over the last 15 years, pooled municipal bond issuances have mobilized close to $3 billion in developing countries to finance a range of essential public services, including water and sanitation, energy, and transport. A total of 650 small projects have been financed through this method in India, South Africa, Colombia, Kenya, and Mexico, showing the scalability of this financing method.

Municipal debt financing has not, however, been a panacea to infrastructure investment needs, even in high-income countries. Many municipalities have acquired substantial levels of debt through bond issuances and private loans, but capacity to collect revenues from taxation remains low, resulting in city bankruptcy. Notable examples include Detroit and San Bernardino in the United States. As a result, political support to implement municipal decentralization reforms is often scarce. According to the Inter-American Development Bank governance database, less than half of countries (42 percent) are recorded as devolving fiscal or legislative powers to subnational governments, and of these the depth of revenue-raising powers is highly variable. In a global study, only 16 percent of countries sampled were found to grant significant taxation autonomy to their local governments. Similarly, 56 percent of countries forbid any kind of borrowing by local governments, while only 22 countries (14 percent) allow borrowing without any restrictions.[409] As of 2013, only 4 percent of the 500 largest cities in developing countries had access to international debt markets, and only 20 percent are creditworthy in local markets. Only one in five C40 cities are able to borrow from their national government, and only one in four can issue municipal bonds.[410]

This lack of autonomy increases the difficulty of securing financing for cities' infrastructure projects and constrains cities' ability to establish partnerships to make development plans sustainable and resilient. Cities with constrained access to capital markets can often access financing through international financial institutions or development banks instead.[411]

In countries where subsovereigns can issue bonds, like Australia, Canada, France, South Africa, and Sweden, many cities and regions are issuing green bonds.

CITY GREEN BOND IN JOHANNESBURG, SOUTH AFRICA

The city pioneered the use of green municipal bonds in emerging markets to raise funds for sustainable urban development projects. The 10-year bond, aligned with the Green Bond Principles, was launched in 2014 and is worth $143 million. This was Johannesburg's first bond issuance to be specifically labelled green and to be aligned with the city's Energy and Climate Change Strategy and Action Plan. The strategy and action plan were used to identify key low-carbon projects across a range of sectors, such as energy, water, waste, and transport,[412] to be supported by the bond's proceeds.[413] This information was essential to investors, as it gave them assurance of both an attractive risk-return profile, and of the environmental and social benefits of the project. To date, projects include investment into 150 new dual fuel and 30 biogas buses, the establishment of waste-to-energy generation sites, energy-efficiency measures in buildings (including the implementation of 42,000 smart meters), sewage effluent treatment, and water management initiatives such as water meter installations, reservoir upgrades, and water pressure management.[414]

The bond's popularity among private investors has been instrumental in its success. In 2014, an auction held for potential investors was oversubscribed by 150 percent.[415] The bond has an AA-rating, reducing the risk to investors and making the investment more attractive.[416] The Mayor of Johannesburg has been an active proponent of low-carbon investment and the city has been internationally recognized as a leader in climate action. This international and domestic publicity was critical in raising awareness of the importance of green bonds and boosting investor confidence. The bond has allowed the city to act on its commitment to respond to climate change while receiving a market-related financial return.

CEPAC BONDS IN RIO DE JANEIRO, BRAZIL

Certificates of Potential Additional Construction (CEPAC) have been used as an innovative method of leveraging private funds for public investments in Brazil since 2001, and in Rio de Janeiro specifically since 2009. Urban legislation defines the construction potential for real estate in every neighborhood, setting standard dimensions such as the type, size, and height allowed. Investors wanting to build beyond these dimensions must purchase CEPAC bonds. Since different types of buildings require a different CEPAC bond value, the government can incentivize the construction of particular buildings and techniques, such as green buildings, by requiring fewer CEPACs for their construction. These bonds are auctioned on the market and purchased by private investors or developers. In the Porto Maravilha district, for example, the Caixa Econômica Federal (a federal government bank) acquired all of the CEPAC bonds on auction, amounting to $960 million, through a guarantee fund the bank manages (the Fundo de Garantia do Tempo de Serviço).[417]

The revenue gained from the auction of these bonds provides the cities with a new source of capital and is used to invest in low-carbon infrastructure. The revenue is typically captured in a separate fund, which can be used in the specified zone for upfront construction costs, such as public transport, waste management and water piping, and long-term maintenance.[418] In the Porto Maravilha district, revenue gained has been used to construct new public infrastructure, including 66km of drainage systems, 85km of sewer systems, and 120km of water systems.[419]

The CEPAC bond circumvents traditional bank financing. The municipal governments in São Paulo, Rio de Janeiro, and Curitiba have obtained about $3.8 billion for investing in urban redevelopment projects by issuing more than 10 million CEPAC bonds. CEPACs provide an alternative mechanism that compensates private investors through the likely increase in real estate value for their investments. It is also beneficial from a fiscal perspective. CEPACs do not increase public debt


Photo: © Porto Maravilha

because they serve simply as a mechanism to transfer building rights, with developers retaining the risk of developing their private projects.

This financing model has the potential to be applied in cities with buoyant housing markets. The mechanism relies on the purchase of permits to construct buildings, which means the model should only be applied to cities with a healthy and stable housing market anticipating rising land and property values. The success of these bonds also relies on considerable financial expertise in order to administer the system.[420]

POOLED MUNICIPAL BOND ISSUANCE IN TAMIL NADU, INDIA

The Water and Sanitation Pooled Fund in Tamil Nadu is a pooled bond, issued by the state government to raise financing for water and sanitation services in 13 small urban local bodies. These bodies were not able to access finance due to bond issuance fees, legal costs, and an inability to get a credit rating.[421] The pooled fund mobilized capital market finance through a $4.4 million unsecured unstructured debt obligation,[422] supported by the implementation of a multi-layered credit enhancement package, which gave private investors' confidence to invest.

Tamil Nadu capitalized a debt service reserve fund worth about $1.42 million, which gave investors assurance that the fund could pay creditors if the municipal borrowers were unable to meet scheduled repayments. Revenues from tax collections, including property tax, and project revenues provided extra funds. There was also a local service reserve fund, which comprised about 5 percent of the principal amount borrowed by each urban local body. USAID guaranteed they would help re-supply 50 percent of the principal amount of a default paid for by the debt service reserve fund.

Following the issuance of the bond, a number of projects were implemented, including water supply augmentation schemes for all 13 municipalities and an underground drainage project for Madurai Corporation.[423] By pooling the finance, the bond provided the access to capital necessary for smaller municipalities to fund large-scale infrastructure projects, which they had not previously been able to do.

The multilayered credit enhancement package is an essential element for successful replication in other cities as it creates a supportive environment for potential investors. Without this guarantee, cities would likely struggle to gain sufficient investment. To ensure the longevity of a pooled financing initiative, bonds should be reissued immediately after they mature to avoid depleting expertise and momentum and creating a lack of liquidity.

Photo: © Lennart Johansson, Stockholm City Planning Administration / World Bank

NORDIC GREEN BOND MODEL

Nordic actors have been part of the green bond market from the start and their participation has been driven by key public sector actors such as the four Nordic local government funding agencies. These are special purpose agencies owned by local authorities that issue bonds in the capital markets, domestically and internationally, and on-lend the proceeds to smaller local authorities and cities that are members/shareholders of the agency. The local government funding agency aggregation model allows smaller cities to tap into the deep pools of capital held by institutional investors in the $90 trillion bond market. This has been harnessed for green financing purposes since 2011, with all four Nordic agencies issuing at least $8.5 billion in green bonds as of 2018, and representing a quarter of the total Nordic green bond market.

The Nordic green bond market, which in 2018 stands at about $33 billion of cumulative issuance,[424] was kindled by Norwegian agency Kommunalbanken. In 2013 the agency offered a three-year $500 million green bond—the first of its kind in the Nordic countries. The city of Gothenburg, supported by the Swedish investment bank SEB, expanded the Nordic green bond market later in 2013, followed quickly by Orebro, the Stockholm County Council, and Oslo in 2015, with a dozen other cities following across Sweden and Norway. Cities and regions on their own account for $3 billion, or 9 percent, of the Nordic green bond market.

Land Value Capture

Land value capture can be used at scale and is an economically efficient system to meet the costs of climate-smart infrastructure investments, representing an effective alternative to mainstream financing methods.[425] It is a financial policy tool allowing municipal governments to recover a portion of the increase in land and property values that result from public investments, to improve nearby urban infrastructure. This in turn enhances the quality of housing, jobs access, transport, and social benefits. The boost in value can be used as a source of revenue to secure or reimburse upfront infrastructure funding, and can also be used to drive more compact urban development. By levying the direct beneficiaries of public improvements, who would otherwise benefit from such improvements as windfall gains, a city is able to unlock additional funding particularly when faced with limited access to traditional sources of public financing. This approach promotes infrastructure cost-sharing, with win-win outcomes for public and private stakeholders by creating private economic value that also benefits the location.

There are a range of approaches that cities can take to capture these land value gains, including land value taxation, leveraging public land and property assets, tax increment financing, special assessments, transfer of development rights, betterment levies, land pooling, transport utility fees, impact fees, and air rights. These mechanisms can be promoted on both privately owned and public lands, depending on local context, but are most effective in burgeoning real estate markets.

National legislation and frameworks are critical to enabling this local revenue stream, as higher levels of government often retain the power to set the parameters and tax rates. The city benefits from improved municipal revenues, in addition to having an improved urban environment and self-financed infrastructure, increasing its overall attractiveness for private financing. However, regulatory constraints, inadequate land controls and insecure property rights, deficient technology and data systems, and lack of knowledge and management capacity can hinder the implementation of this approach.

Despite being largely associated with transport upgrades, land value capture opens financing opportunities for many more infrastructure investments, particularly when city governments integrate spatial planning policies and investment strategies with transport infrastructure.

Photo: © Geson Rathnow

SABARMATI RIVERFRONT UPGRADE, AHMEDABAD, INDIA

An ongoing project aims to provide the city of Ahmedabad with an improved and accessible waterfront along the Sabarmati River, reduce erosion and exposure to flood risk, upgrade sewers, and rehabilitate and resettle informal settlements. Through an initial investment of $17 million in heavy engineering works and land reclamation, a 22km-long lower river promenade has been completed, and the upper promenade is in development. The key financing sources for this project were loans from a local municipal corporation and a central government financial institution that were placed in a special purpose vehicle established to manage this initial investment in riverfront upgrades and subsequent land sales to the private sector.

The project is self-financed. Cash for recovery of capital expenditure and operating costs comes from sales of reclaimed and serviced land for commercial development. The completion of major infrastructural components has already led to increased land values, thus reducing the amount of land that needs to be transacted for servicing the loans. Overall the amount invested has been recovered from sales of less than 15 percent of improved land.

MASS TRANSIT RAILWAY, HONG KONG, CHINA

Land value capture was used as a financing solution to fund the mass transit railway in Hong Kong between 1998 and 2013. The Mass Transit Railway Corporation bought an area of land and invested in railway infrastructure, increasing the overall land value. The property was then sold to private investors at a profit.[426] The corporation harnessed the added value from the land to invest in further railway infrastructure. Using this approach, it generated $11 billion from the sale of property, which was twice as much as it invested in the railway infrastructure.

The project's success relied on close cooperation between the Mass Transit Railway Corporation, the government, and other private investors. The corporation worked with the government to assess the cost of construction and purchase the right to develop properties above railway stations and depots for 20 years. Through public tender, the corporation allocated these property rights to private developers, who paid in full for the development costs, including the cost of construction of the residential and commercial properties. The corporation agreed to portion the profits generated by the sales if the private partners sold all units before the contractual deadline. This ongoing profit ensured the continued development of the railway line and was instrumental in the success of the land value capture approach.

Replicating this method in other cities will require careful macroeconomic management. The success of the mass transit railway land value capture depended on the transparent valuations of real estate, as well as the ongoing increase in land value. The continuous flow of capital leveraged from this project relied on the careful monitoring and evaluation of land value by technical and legal experts, as well as a buoyant real estate market. For the method to be successful, both a stable economy and technical expertise are essential.

This method is only suitable in cities that need infrastructure and are in a growth phase. The consistent revenue generated from the land value capture process depended on the demand for the development of the railway. This was closely linked to the ongoing development and growth in the city, both in terms of population and economy. For any cities replicating this model, infrastructure demand and urban growth are necessary conditions.

Public-Private Partnerships

These are defined as long-term contracts between public and private entities to develop or manage public assets or services where risks are allocated between the parties and remuneration is linked to performance and/or the demand or use of the asset or service.[427] PPPs have been effective when governments face technical, institutional, and financial constraints. They can bring private sector innovation, efficiency, and financing together in one package. There are many forms of PPPs, but their potential is typically limited to projects that involve commercial returns on revenue-generating assets. Energy and road infrastructure projects, which often extend beyond the municipal scale, have attracted the vast majority of global PPP finance, due to market regulations and policies that are primarily established at a national level, and thanks to clear income streams from these assets.[428] Ensuring fair and affordable pricing and adequate service coverage is essential in structuring PPP design and incentives.[429]

PPPs are complex structures. Their effectiveness depends heavily on appropriate project identification, structuring, contractual arrangements, and government capacity. They have been effective as an approach for the private sector to generate relevant returns on investment, develop local capabilities, and increase the level of international private sector participation. However, asymmetric information between levels of government and between the public and private partners can lead to rent-seeking behavior. Without tight monitoring and public expenditure management, PPPs can effectively create hidden liabilities for government agencies, and are therefore a particularly important instrument in middle and high-income countries with mature financial systems.[430]

In a PPP model, risks are appraised early on to determine project feasibility, allowing the private partner to check against unattainable government expectations.[431] PPPs require strong legal and regulatory frameworks to avoid expropriation and minimize risks to private investors. Without this assurance, only traditional, less risky, public infrastructure provision is feasible. Laws governing PPP activities across different departments need to be consistent with one another. A lack of transparency in the bidding and project supervision processes can deter private sector investors. Governments can enable the greater use of PPPs by establishing a pipeline of feasible projects, providing regulations and legislation that allow cities to enter into PPP transactions, and clarifying the way tariffs are set and the mandate of regulatory oversight processes and agencies. National or municipal-level PPP units that support project preparation and tendering can enhance the accountability, transparency, and competitiveness of the process, thereby attracting greater private sector interest.

PPP FINANCING OF THE BEIJING METRO LINE

A special purpose vehicle was set up to finance the fourth Beijing metro line, stretching almost 28km with 24 stations. The PPP model adopted was predominately public sector owned and operated, with inputs from the private sector to provide infrastructure. The Hong Kong China Mass Transit Railway Corporation and the Beijing Capital Group were awarded the project contract. The Beijing Capital Group is a large state-owned enterprise affiliated with the State-Owned Assets Supervision and Administration Commission of the Beijing municipal government, focusing on investment, financing, and capital operations of infrastructure projects in the city. The Beijing municipal government funded 70 percent of the project cost to cover the civil engineering and infrastructure of the project.

The second part of the project, which covered operational aspects, was undertaken at 30 percent of the total project cost. The project is financed by ticket sales revenue and the commercial operation of the subway stations. While the Mass Transit Railway Corporation and the Beijing Capital Group manage the operations of the subway line, the Beijing Infrastructure Investment Company monitors the management of assets, quality, and safety.

The innovative PPP model uses private companies' incentives to maximize profits as a means to balance investment risks and rewards. The Beijing Infrastructure Investment Company acts as a risk absorber, compensating the joint venture partners if the profits are substantially lower than expected and thus providing the partners with certainty of return on investment. In parallel, the Mass Transit Railway Corporation and the Beijing Capital Group are incentivized to maximize efficiency as they take on any excess profits made.

In the urban context, mobility is a public policy objective. As a result, public authorities often control fares and, to some extent, service levels, to ensure affordability and coverage. Ticket revenues are thus unlikely to be able to cover any new investment for system upgrades or expansion. Urban transport projects must therefore explore other areas of revenue generation, including land value capture, dedicated fiscal instruments, commercial revenues, and contingent liability coverage. They must also rely on some degree of public subsidy, either through revenue support or capital grants.

CLEAN RIVER GANGA PROJECT, INDIA

The Indian government approved a hybrid annuity PPP model for sewage treatment plants under the National Clean Ganga program in 2016. Over 75 percent of the sewage generated in the towns and cities along the Ganga flows untreated into the 2,525km-long river, which is a water source for 43 percent of India's population. IFC helped to structure and tender India's first-of-its-kind PPP to enable private companies to build sewage treatment plants in Haridwar, Varanasi, and Mathura—cities that discharge millions of liters of untreated sewage into the river. The three plants will process nearly 200 million liters of sewage per day.

The PPP model links the performance of new sewage treatment plants with payments to the private sector partner. Under the hybrid-annuity model, the government pays 40 percent of the project cost linked to construction milestones. The remaining 60 percent, supported by a World Bank loan, will be paid over 15 years as annuities to the private operator along with operation and maintenance expenses. This makes the project more viable for the concessionaire and gives the government leverage over the performance of the operator. The new sewage treatment plants and rehabilitated infrastructure assets in Varanasi and Haridwar have opened up a large market for the private sector in India, including national and international companies. The model is being replicated in 11 cities and will be the foundation for dozens of sewage treatment PPPs along the Ganga River, multiplying the environmental and social impact and improving water quality for millions of people.

Dedicated Funds

With support from multilateral development banks, government departments, commercial banks, and private investors, cities are developing dedicated vehicles to enable green investment by the private sector. The success of these approaches is contingent on the cities having a long-term vision and commitment to green investment, with a clear pipeline of projects. In all cases, establishing dedicated funding vehicles relies on close cooperation across a range of stakeholders. Recruiting credible fund managers with detailed technical knowledge is essential for boosting the confidence of the private sector and should be seen as a prerequisite for establishing green funds in other cities.

LONDON GREEN FUND

The London Green Fund provides funding for projects investing directly in waste, energy-efficiency, decentralized energy, and social housing to both public sector organizations and small businesses that are unable to access funds via mainstream finance. The $526 million fund[432] was set up in 2009 to help the city achieve its aim of reducing greenhouse-gas emissions by 60 percent below 1990 levels.[433] The fund is made up of three smaller funds, which target waste, energy, and social housing projects. The Foresight Environmental Fund provides equity finance for waste management, the London Energy-efficiency Fund provides debt finance to private and public sector energy projects, and the Greener Social Housing Fund provides investments for social housing, including the refurbishment of over 2,500 properties to make them more environmentally friendly. Since 2014, the fund has invested $135 million in 18 projects, which are estimated to have saved 288,805 metric tons of CO_2e per year, and diverted 440,980 metric tons of waste from landfills annually. The London Green Fund is managed by the EIB and is funded by the London European Regional Development Fund Program, the Greater London Authority, the London Waste and Recycling Board, and private investors.

Private sector investors played an important role in the London Green Fund. As the financial instruments were seen as attractive investment opportunities for growing the corresponding market, investors contributed a significant portion of the total fund. Investor confidence was also boosted by the credibility of the appointed fund managers, all of whom had a track record in environmental fund management. Funds like the London Green Fund are unusual in the commercial market due to their small geographic focus and niche investment theme of environmental infrastructure. By addressing uncertain market demand, risks around new technologies, and long lead times until returns are generated, the fund has been able to make projects less risky for the private sector.

CITIES DEVELOPMENT INITIATIVE FOR ASIA

The Cities Development Initiative for Asia has been supporting the financing of sustainable infrastructure projects since 2007. It is a regional initiative managed by the ADB, the German government, and Agence Française de Développement. It is funded by the governments of Austria, Sweden, Switzerland, the United States, and the United Kingdom, and established as a multi-partner trust fund under the Urban Financing Partnership Facility from October 2017. The initiative works closely with medium-sized cities in Asia and the Pacific to fund projects relating to urban transport, wastewater management, flood and drainage management, water supply, solid waste management, and social infrastructure.[434] As of June 2018, the initiative has assisted 94 cities across 19 countries, of which 71 have linked their project preparation studies to downstream financing amounting to about $7.7 billion.[435] For example, the Cities Development Initiative invested $451,000 in the project preparation study on flood and drainage management, solid waste management, and urban transport in Khulna, Bangladesh, which was subsequently linked to an ADB loan. In Palembang, Indonesia, the initiative invested $403,000 in urban transport, which was later financed from budget allocations by the local and national governments.

The initiative works closely with the private sector, bridging the gap between cities' development plans and the implementation of their infrastructure investments. It helps cities structure their projects to attract market-based international private investment and strengthens local institutional prerequisites to attract capital investment, including marketing local investment proposals to potential financiers. It also helps cities create strategic master plans, which are ready to be presented to these financiers and project developers.

Climate-Smart Investment Initiatives

The different financing approaches identified above will largely benefit creditworthy metropolises and megacities. The vast majority of intermediary cities will need support to establish solid and stable climate finance ecosystems and integrate climate into the development frameworks for all sectors and actors. Innovative financial and collaborative approaches will be key to promoting central and local ownership of climate issues, preparing bankable projects, developing domestic financial markets, and mobilizing private financing for local investment, while increasing local governments' revenues and improving creditworthiness for fiscal autonomy and access to capital markets when possible.

A range of initiatives are already attempting to fill these gaps. To synthesize the current status and landscape of support relating to investment in climate-smart solutions for cities, IFC has researched and mapped almost 30 supporting initiatives, actions, and platforms for climate-smart solutions that are being taken by cities, international or domestic institutions, companies, voluntary groups, donors, or special vehicles. This is not an exhaustive list and is intended to offer an indicative overview of the leadership being provided by national and municipal governments, private sector actors, and international organizations involved in these initiatives to varying degrees.

The mapped initiatives below include some with a direct focus on city and climate projects and others that indirectly support these priorities through alternative channels or the mandates of the institutions or countries that founded them. All provide replicable examples for cities to draw from. The detailed mapping, available in Annex B, captures information on applicable geographies and sectors, type of climate-smart investment solution, and the activities and funding amounts (if applicable) offered by the initiative.

Initiative	Organization	Objectives
100 Resilient Cities	100 Resilient Cities	100 Resilient Cities is a network that aims to help cities around the world become more resilient to the physical, social, and economic challenges inherent to the 21st century. This includes both large-scale natural disasters and local everyday stresses, such as unemployment and chronic food and water shortages.
Africa50	African Development Bank	Africa50 is an infrastructure investment fund that contributes to Africa's growth by developing and investing in bankable projects, catalyzing public sector capital, and mobilizing private sector funding. A significant proportion of the investment targeted by the Africa50 initiative is projects demanded by cities. Africa50's primary target sectors are transport and power, which represent almost 70 percent of the continent's projected infrastructure investment needs between now and 2025. Transport sector projects include roads, airports, ports, and logistics, many of which take place within an urban context. Climate objectives are secured via the mission of the fund. It was established under a governance structure convened by the African Development Bank.
Africa Climate Resilient Investment Facility (AFRI-RES)	World Bank	AFRI-RES is a is a network of technical experts that aims to strengthen the capacity of African institutions (including national governments, river basin organizations, regional economic communities, and power pools), and the private sector (project developers and financiers) to plan, design, and implement infrastructure investments that are resilient to climate variability and change. A central function of AFRI-RES is to facilitate interaction between policymakers, financiers, project developers, and scientific and engineering experts in order to develop and mainstream relevant new practices. AFRIS-RES's scope spans different sectors and different stages of the planning and project development process. Much of its targeted investments are projects located in cities, with roads and power as the two priority sectors.
African Water Facility	African Development Bank	African Water Facility is a multilateral fund which aims to implement innovative water projects and raise investment for water projects throughout Africa.
C40 Cities Finance Facility	C40 Cities Climate Leadership Group	C40 Cities Finance Facility aims to deliver project preparation and capacity development, and to share knowledge and establish partnerships between cities and financiers.
Catalytic Finance Initiative	Bank of America Merrill Lynch	Catalytic Finance Initiative is a partnership among selected commercial banks, development finance institutions, institutional investors, and philanthropies that aims to structure and deploy at least $10 billion in green business, primarily in clean energy. Some of the investments targeted by the initiative involve projects located in cities, as it aims to promote the SDG objectives, including acting on climate change and advancing access to clean energy and water.
Cities and Climate Change in Africa	Agence Française de Développement, European Union, Swiss State Secretariat for Economic Affairs	Cities and Climate Change in Africa is a regional support program for local authorities that aims to help 20 to 25 African cities translate their climate strategies into action plans, budgets, and investment projects that can attract (climate) finance and have mitigation and adaptation co-benefits by 2020.

Initiative	Organization	Objectives
City Creditworthiness Initiative	World Bank	The City Creditworthiness Academy is a series of training initiatives that aims to help 300 cities in 60 low and middle-income countries to improve their financial performance and secure the private investment they need to fund climate-smart infrastructure and services. Building creditworthiness in cities is a key constraint in accessing further investment and finance for city and climate projects.
City Performance Tool (CyPT)	Siemens	CyPT aims to help cities evolve, and to offer them strategies and tools to ensure they become social, cultural, and economic hubs.
City Resilience Index	Arup	The City Resilience Index is a tool which aims to inform all cities about how they can best respond to the risks posed by climate change, both by identifying weaknesses and suggesting improvements.
City Resilience Program	World Bank	The City Resilience Program aims to catalyze large-scale, long-term and comprehensive investments in urban resilience projects in emerging markets by assisting cities to access non-traditional sources of financing through the design of high-return investment projects and a reduction of risk and transaction costs, which make investments more attractive to private and institutional investors.
Clean Technology Fund	Climate Investment Funds	The Clean Technology Fund aims to scale up low-carbon technologies with significant potential for long-term greenhouse-gas emissions savings. Over $4 billion (75 percent of the fund's resources) is approved for implementation in renewable energy, energy-efficiency, and clean transport.
District Energy in Cities Initiative	UN Environment; Global Environment Facility; Sustainable Energy for All	The District Energy in Cities Initiative is a partnership of 40 public and private partners that aims to accelerate the transition of cities in emerging economies and developing countries to low-carbon, climate resilient societies through modern district energy systems.
Energy-efficient Cities program	Energy Sector Management Assistant Program	The Energy-efficient Cities program consists of two complementary windows: efficient and sustainable buildings; and energy-efficient city services, which together support and seek to expand the World Bank Group's efforts to help countries and cities harness their energy-efficiency potential. It aims to create an enabling policy and regulatory environment for energy-efficiency; integrate energy-efficiency in projects across sectors (urban, water, transport); and develop delivery models and financing mechanisms to scale up energy-efficiency.
Financing Energy for Low-Carbon Investment—Cities Advisory Facility (FELICITY)	EIB, GIZ	FELICITY aims to support emerging economies, namely Brazil, China, and Mexico, with both technical assistance and the financing of sustainable infrastructure projects.

Initiative	Organization	Objectives
Financing Sustainable Cities Initiative	World Resources Institute Ross Center for Sustainable Cities; C40	The Financing Sustainable Cities Initiative aims to help cities accelerate and scale up investments in sustainable urban solutions through the development of innovative business models.
Fund for Technical Expertise and Experience Transfers	Agence Française de Développement	The Fund for Technical Expertise and Experience Transfers funds technical-cooperation programs and project-preparation studies in developing countries, to meet their requests and needs, while working towards the sustainable development of those countries. One project funded is the Smart Cities Mission. This is an urban renewal program by the government of India, with the aim of using French expertise to enhance the quality of life for urban dwellers through sustainable and innovative solutions in 100 Indian cities.
Global Innovation Lab for Climate Finance	Climate Policy Initiative	The Global Innovation Lab for Climate Finance aims to drive billions of dollars of private investment to the low-carbon economy by identifying, developing, and supporting transformative sustainable finance ideas. Examples of city-level projects supported by the lab include financing for low-carbon auto-rickshaws, which is a facility designed to deploy more electric auto-rickshaws in Indian cities, and a battery subscription facility mechanism to provide long-term debt financing to the electric transit sector in India.
Green Bonds for Cities	South Pole Group, Climate Bonds Initiative	Green Bonds for Cities aims to support cities in emerging, developing, and transition countries to access the green bond market. The objective is to commercialize the outputs of the 2016 project, which sought to enable more local authorities to use debt markets to finance low-carbon infrastructure.
Green Cities Framework	EBRD	Green Cities Framework aims to address the most pressing environmental and climate change challenges facing cities through targeted planning, capacity building, and project development and investment.
HSBC Sustainable Finance Fund	HSBC	The HSBC Sustainable Finance Fund aims to enable the transition to a low-carbon economy by investing in energy-efficiency, renewable energies, new technologies, and infrastructure, and by helping clients manage transition risk. Much of this investment is urban focused. The HSBC Sustainable Finance team has a dedicated unit responsible for financing of bus rapid transit systems.
InfraFund	Inter-American Development Bank	InfraFund aims to assist public, private, and mixed-capital entities in Latin America and the Caribbean to identify, develop, and prepare bankable and sustainable infrastructure projects that have the potential of reaching financial closure. By sector, InfraFund has approved nine technical cooperation operations for energy projects (five of which are for renewable energy and energy-efficiency), seven for transportation projects (including an airport, road, bus rapid transit system, and railway), five for water and sanitation, and two for multisector projects.

Initiative	Organization	Objectives
Local Climate Adaptive Living (LoCAL) Facility	UN Capital Development Fund	LoCAL aims to promote resilient communities and economies by increasing financing for and investment in climate change adaptation at the local level in least developed countries. It is designed to re-enforce existing national and subnational financial and fiscal delivery systems, and it uses the demonstration effect to trigger further flows for local adaptation, including national fiscal transfers and global climate finance for local authorities, through their central governments.
Matchmaker	CDP	Matchmaker is a specialized project dashboard that aims to bridge the divide between cities and potential investors to highlight projects in flood control, waste management, sustainable transportation, renewable energy, water management, and energy-efficiency through project data disclosure and stakeholder consultation. Many of the Matchmaker projects, although not explicitly marked as city projects, occur within an urban setting.
NEPAD Infrastructure Project Preparation Facility	African Development Bank	The NEPAD Infrastructure Project Preparation Facility is a multi-donor special fund, which aims to increase the number of economically, environmentally, socially, and gender-responsive regional infrastructure projects prepared and implemented, to increase funding, and to improve interaction among stakeholders. It supports regional infrastructure development projects in the following sectors: transport, energy, ICT, and water resources management. The activities eligible for financing under the fund are: pre-feasibility studies, feasibility studies, project structuring, capacity building for infrastructure development, and facilitation and creation of an enabling environment for regional infrastructure development.
Subnational Climate Fund Africa	R20, BlueOrchard	The Subnational Climate Fund Africa aims to fund intermediate-sized subnational infrastructure projects in Africa using a dedicated $350 million fund. Based on this approach, the Subnational Climate Fund for Islands and Coastal Regions (SnCF Islands) was launched in May 2018, which is supporting Fiji to foster the development of green infrastructure projects for the Pacific in renewable energy, waste management, and municipal lighting.
Subnational Technical Assistance Program Public-Private Infrastructure Advisory Facility	World Bank	The Subnational Technical Assistance Program funds activities that aim to both establish mechanisms and frameworks that can improve the flow of domestic and foreign capital into infrastructure in a sustainable manner, and create the conditions necessary for these entities to improve their creditworthiness. Building capacity at subnational level and in cities is critical in accessing further investment and finance for city projects.
Sustainable Energy Fund for Africa	African Development Bank	Sustainable Energy Fund for Africa is a multi-donor trust fund to support small and medium-scale renewable energy and energy-efficiency projects in Africa. In many African countries, smaller renewable energy projects are potentially viable from a commercial perspective, but the initial development costs often prevent these projects from accessing necessary financing.

Initiative	Organization	Objectives
The Low Carbon City Lab	Climate-KIC	The Low Carbon City Lab is a flagship program that aims to unlock finance for cities. Public and private organizations work together to identify, test, and scale innovative tools and solutions tailored for cities and investors.
Transformative Actions Program (TAP)	ICLEI	TAP is a project pipeline and a project preparation facility developed by ICLEI and partners. It acts as an incubator that supports local and regional governments by catalyzing capital flows for low-to-no emission and resilient development. Through TAP, local and regional governments receive support to develop transformative local infrastructure projects. The program is designed to connect local climate actors, technical experts, and financial institutions.
Urban Climate Change Resilience Trust Fund	Asian Development Bank	The Urban Climate Change Resilience Trust Fund is a $150 million multi-donor trust fund established by the ADB under the Urban Financing Partnership Facility with contributions from the Rockefeller Foundation and the governments of Switzerland and the United Kingdom. The trust fund aims to support fast-growing cities in Asia to reduce the risks poor people face from floods, storms, or droughts by helping to better plan and design infrastructure that mitigates the effects of these events. It also aims to scale up investment in urban climate change resilience for the urban poor across 25 secondary cities in Bangladesh, India, Indonesia, Myanmar, Nepal, Pakistan, Philippines, and Vietnam.
Urban Financing Partnership Facility	Asian Development Bank	The Urban Financing Partnership Facility aims to raise and use development partner funds for investment co-financing in urban environmental infrastructure projects and support a wide range of technical assistance to help lay the groundwork for such projects.

Most of the platforms featured here are hosted by international organizations or are financing initiatives by coalitions that support project preparation and pilots. Very few private sector led initiatives were found. While private initiatives do invest in sustainable urban infrastructure through both debt and equity investments, they do so on a project or instrument-specific basis where most of the deal-level data is confidential, rather than through platforms and initiatives. Many other city-level activity initiatives, especially in emerging markets, occur through international or collaborative platforms captured by broader initiatives, which often rely on support from donors, multilateral development banks, or international financial institutions.

To effectively deliver on the promise of climate-smart cities, it is critical to move from planning to pilots, from pilots to projects, and from projects to partnerships. Investments in climate-smart projects require coordination and leveraged private sector finance to support efforts being made by the public sector. For most cities, achieving this access at scale and at reasonable cost will require sustained and disciplined attention to policies and practices underpinning their creditworthiness. Integrated planning, innovative financing, and collaborative partnerships are some of the approaches cities can adopt to deliver on their desired climate outcomes and community needs. Creating the green, resilient, and technology-based cities of the future offers the opportunity to showcase the role of good public policies and enabling conditions in shaping incentives, attracting private investment, and greening profits. IFC stands ready to support cities on this journey.

Annexes

Methodology for Estimating Climate Investment Opportunities

The analysis in this report is based on a range of sources, including information from city-level climate-related emissions databases and future pledges or commitments. IFC also used national data from the following sources to assess how best to leverage existing information for this analysis:

- *Carbonn Climate Registry:* City-level climate targets, committed greenhouse-gas emission reductions, and mitigation and adaptation actions.
- *C40:* Global Aggregation of City Climate Commitments report; Deadline 2020 report; City Greenhouse Gas Emissions Interactive Dashboard.
- *Global Covenant of Mayor:* Baseline review and action plans.
- *CDP:* City-wide greenhouse-gas emissions data and C40 city targets data.
- *City Climate Finance Leadership Alliance:* State of City Climate Finance report; Barriers to Private Sector Investments into Urban Climate Mitigation Projects report.
- *World Resources Institute:* CAIT—Country greenhouse-gas emissions data.
- *European Commission Emissions Database for Global Atmospheric Research (EDGAR):* National emissions.
- *Climate Watch:* Climate actions pathway data.
- *World Bank:* Intended Nationally Determined Contributions Database.

Step 1: Developing city typologies and sectors

Given that existing datasets are incomplete and overlap in coverage, IFC used a sampling approach, creating typologies of cities as units of analysis. It developed 18 city typologies using the six IFC regions and three city scales for each region, applying the Organisation for Economic Co-operation and Development-European Community definition of urban center sizes.

Cities in some regions have poor data availability, both in the sources listed above and in general. CDP estimates that of 533 cities disclosing climate-related data, 64 percent do not have targets to reduce emissions, particularly those in developing countries. In addition, data availability is significantly poorer for smaller cities. Therefore, the following three city scales from the European Community definitions were analyzed for each region:

- Small city: population between 500,000 and 1,000,000
- Medium city: population between 1,000,000 and 5,000,000
- Large city: population above 5,000,000.

The analysis focused on the following sectors:

- Renewable energy
- Green buildings
- Solid waste management
- Climate-smart water
- Public transport
- Electric vehicles.

Step 2: Estimating emissions reductions required to meet city climate action plans globally from 2018 to 2030

ESTIMATING A BASELINE 2017 AND 2030 GREENHOUSE-GAS EMISSIONS SCENARIO FOR EACH CITY TYPOLOGY

For each city typology, a typical 2017 greenhouse-gas emissions profile was created using between one and three benchmark cities in relevant IFC countries for which current emissions data was available in the sources listed above. For cities where the most recent emission data preceded 2017, the national emissions growth rate from 2010 to 2016 was applied to project 2017 emissions, using available data from the EDGAR database. Emission source splits as reported under the Greenhouse Gas Protocol for Cities were determined using available city data from Carbonn, C40, and other sources. Where data on the split of city emission sources were unavailable, the average split for the region was applied. This approach divided emissions into the three main sources: stationary energy, transport, and water.

For each city typology, a baseline 2030 greenhouse-gas emissions scenario was projected using the benchmark cities. It was assumed that emissions per capita remain constant for the city in the baseline 2030 scenario. Projections of the increase in the national population to 2030 were based on the UN Population Division (2017) World Population Prospects report and applied to the benchmark cities. The baseline 2030 greenhouse-gas emissions profile for each city was then calculated using the current per capita emissions and 2030 population projections for each city. Emissions were split into sectors assuming the same breakdown as for current emissions.

ESTIMATING A TARGET 2030 GREENHOUSE-GAS EMISSION SCENARIO USING CITY (OR NATIONAL) TARGETS

To find the overall target 2030 emission scenario for each typology, greenhouse-gas emission targets from city action plans for each region, sourced from the Carbonn database where available, were used to estimate an average overall emissions reduction target for each of the six regions. This regional reduction target was applied to the 2030 baseline emissions for each typology to find the target 2030 greenhouse-gas emissions for each city typology.

Where city-level targets had end dates preceding 2030, the reduction target was scaled using the annual compound growth rate to 2030. Where city targets were in absolute numbers, the average percentage reduction between the baseline year and target year were calculated. Calculations identified the required percentage reduction from the baseline to reach the 2030 target emissions.

ESTIMATING BASELINE AND TARGET 2018 TO 2030 EMISSION SCENARIOS

The total business-as-usual emissions between 2018 and 2030 were calculated by applying the compound annual growth rate from the 2017 current emissions to business-as-usual 2030 emissions. Similarly, target emissions from 2018 to 2030 were calculated by applying the compound annual growth rate required from 2017 current emissions to target emissions in 2030. The 2018 to 2030 target scenario was subtracted in each year from the 2018 to 2030 business-as-usual scenario to find the emissions reduction required in total from 2018 to 2030.

The emissions figures for each city typology were aggregated to regional figures. These were then scaled globally using the projected urban population in 2030. This was calculated from the 2018 UN World Urbanization Prospects data on the proportion of the population living in urban areas for each country in 2030. The ratio was applied to national population numbers to find the total urban population by country in 2030. Only cities within IFC client markets were included.

The global results were compared against other global studies and estimates of urban infrastructure emissions target figures to ensure the findings made sense.

Step 3: Calculating the climate-smart investment opportunity by sector

ESTIMATING THE FINANCING TARGET 2030 FOR EACH SECTOR SPLIT IN EACH REGION

IFC estimated the overall capital cost required for climate-smart interventions using a specific approach for each sector. These costs were estimated at a regional level before they were aggregated in global estimates for each measure. In addition to sector-specific assumptions, several cross-cutting assumptions across the five sectors were used:

- Rate of urbanization by country
- Rate of population growth by country
- GDP growth rate by country.

The following approach was used for each of the five sectors, drawing from methodology and data from a range of sources, including the previous IFC Climate Investment Opportunity reports. Where available, specific targets were used to illustrate how cities will reach the target 2030 scenario across each sector.

The sector-specific high-level adjustments used are set out below.

3.1 Renewable energy

- City-level target data for renewable energy share was found for between one and five cities in each IFC region (15 cities in total) using information from Carbonn and the CDP database on renewable energy targets. Where city-level targets had end dates preceding 2030, the reduction target was scaled using a linear growth rate to 2030.
- National targets for renewable energy as submitted under the intended NDCs were used for additional cities to ensure a minimum of four data points per region.
- Because city-level data was unavailable, the electricity generation capacity per city was calculated to find the total capacity of renewable energy installed. The national electricity generating capacity was taken from UN data and scaled by the ratio of city emissions to national emissions. The emissions ratio was applied because it considers differences in fuel mix between the city and the country.
- Based on 2017 and 2030 renewable energy capacity installed by city, the installed renewable capacity (in kW) for each year between 2018 and 2030 for the 15 benchmark cities was calculated assuming a constant growth rate.
- The split between renewable energy technologies (wind, solar, hydro, geothermal, and biomass) was applied from national data on the energy mix, using various sources including the International Energy Agency World Energy Outlook 2017, the International Renewable Energy Agency (IRENA), and country-specific reports. The capacity for each technology (in kW) was calculated for each city between 2018 and 2030 using this split.
- The additional capacity in each year was costed using total installed costs ($/kW) by technology and region from IRENA (2018) Renewable Power Generation Costs in 2017. The future costs were projected based on the cost curve estimates provided in the National Renewable Energy Laboratory's global technology review (only the change in costs has been used from the laboratory's data, not the actual cost figures).
- The total investment in renewable energy by city was scaled up to regional numbers using urban population estimates for that region in 2030.

3.2 Solid waste management

- Using the benchmark cities from step 2, the per capita waste generation data was sourced from the World Bank What a Waste 2.0 report (2018).
- The annual total generation figures for cities were found by applying per capita generation per year with population estimates for that year for 2017 to 2030.
- Country income levels for each city were updated using the latest 2018 World Bank classification.

- Using What a Waste 2.0 2018 numbers for the percentage of waste collected now and in 2025, and the type of waste disposal used by country income level, the amount of collected waste by disposal method was calculated in each year for each city (derived from published country figures in total metric ton).
- The 2030 cost and waste collection percentages were assumed to be the same as projections in the What a Waste report for 2025, due to lack of available data for 2030.
- The future waste management/treatment targets were based on a range of city and national policy targets, including the International Solid Waste Association and UNEP Global Waste Management Outlook.
- The cost of collection (in dollars) in 2012 and 2025 and the cost of disposal (in dollars) by country income level in 2012 and 2025 were used to calculate the required investment from 2017 to 2030.
- The incremental investment cost to meet the policy targets was summed for the period 2018 to 2030.
- The total investment in solid waste management by city was scaled up using urban population estimates for each region in 2030.

3.3 Climate-smart water

- Using the benchmark cities from step 2, the latest available country-specific wastewater generation numbers were sourced from the 2013 Global, Regional, and Country Level Need for Data on Wastewater report.
- Using these per capita wastewater generation numbers, the per capita figures for each city were projected to 2030 in tandem with GDP growth.
- The annual total generation numbers were calculated by multiplying per capita generation per year with the population estimate for that year for each city.
- The volume of wastewater to be treated was calculated using aspirations from the UN World Water Development Report 2017 by country income level as defined by the World Bank in 2018.
- The investment potential was estimated using wastewater treatment capital cost numbers from IFC's 2016 Water and Wastewater Investment: A Non-Technical Guide. An average total cost for South Asia was used ($0.5 per cubic meter), as per the IFC 2017 South Asia report. This number was scaled to other regions using regional cost factors from the World Bank CURB tool.
- The total investment opportunity was calculated by multiplying the capital cost with total wastewater volume to be treated in each year from 2018 to 2030.

3.4 Public transport

- World Bank CURB tool data on trips per resident per day, average trip length, and urban population by region was used to find total passenger kilometers travelled in cities in 2017 for each region. Total passenger kilometers per year to 2030 were projected using population growth estimates.
- The current model mix in cities was mapped using regional averages calculated from CURB tool data on modal mixes for cities and countries.
- The modal change by region was estimated to 2030 using expert judgement, city policy documents, and the World Business Council for Sustainable Development /International Energy Agency model data on annual passenger kilometers expected for private and public transport modes from 2010 to 2050.
- New passenger kilometers for public transport modes were estimated from 2017 to 2030 using shifts in modal shares for each vehicle type.
- Infrastructure capital expenditure costs (dollars per passenger kilometer) for each transport mode were based on IFC CURB tool data and costs were scaled for each region according to cost calibration factors in the CURB tool.
- The total investment opportunity between 2018 and 2030 was calculated by summing up the incremental cost per year.

3.5 Electric vehicles

- CURB tool data on trips per resident per day, average trip length, and urban population by region was used to find total passenger kilometers travelled in cities in 2017 for each region. Total passenger kilometers per year to 2030 were projected using population growth estimates.
- The current modal mix in cities was calculated using regional averages from CURB tool data.
- Passenger kilometers for vehicles that can be electrified from 2017 to 2030 were calculated using the modal share for each vehicle type that can be electrified (including passenger cars, microbuses, minibuses, standard buses, and bus rapid transit).
- National electric vehicle targets for proxy countries in each region were used, averaged by region, and extrapolated to the city level (assuming the majority of electric vehicles will be used for traveling short distances). At least three national targets per region were used. The regional average penetration was calculated and applied to each region.
- Where no data was available in countries, it was assumed that baseline electric vehicle penetration was 1 percent.
- The annual increase in electric vehicles was found using the current and 2030 share of electric vehicles, applied to each transport mode by year.
- Infrastructure capital expenditure costs (dollars per passenger kilometer) by fuel mix for electricity were used using IFC CURB tool data. Costs were scaled for each region according to cost calibration factors in the CURB tool.
- The total investment opportunity between 2018 and 2030 is calculated by summing up the incremental cost per year.

3.6 Green buildings

- Navigant data on total building stock by building type and country from 2010 to 2024 was used to map IFC countries.
- This information was then split into commercial and residential buildings, which was further divided into constituent building types (eight and two respectively).
- The total square meterage by building type and region was extrapolated to 2030 using the compound annual growth rate from Navigant data from 2014 to 2024.
- IFC EDGE Green Buildings Market Intelligence reports for all available countries and data from the 2016 Climate Investment Opportunity report were used to find the regional average for the predicted percentage share of green buildings in 2025. This share was assumed to be the same in 2030 due to lack of data.
- The annual growth rate of the percentage of green buildings was calculated from current and 2025 data using IFC EDGE reports.
- A 1.43 percent annual obsolescence factor was added to represent the turnover rate of building stock. This rate is equal to the IFC 2016 and 2017 Climate Investment Opportunities reports. New stock was assumed to be green, in addition to the growth rate of green buildings due to improved general building codes and standards, and the enforcement of standards.
- The square meterage of green buildings was projected for any given building type by any given year between 2018 and 2030 in the regions.
- This square meterage was multiplied by a cost in $/square meter to find the total cost of green buildings by region and year, broken into building character and type.
- Regional cost estimates by building type were taken from the Turner and Townsend 2016 International Construction Market Survey.
- The differences between the year-on-year values of green buildings from 2018 to 2030 were summed to arrive at the value of the investment opportunity for green buildings by both region and building character.

City Investment Support Initiatives

100 RESILIENT CITIES

Summary information

Initiative: 100 Resilient Cities

Organization: 100 Resilient Cities

Organization type: Foundation

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, street lighting, green industrial development

Key objectives of the initiative:

100 Resilient Cities is a network that aims to help cities around the world become more resilient to physical, social, and economic challenges. This includes both large-scale natural disasters and local, everyday stresses, such as unemployment and chronic food and water shortages.

Financing details

Type of investment solution: Capacity building

Total fund size: 100RC was launched with a $165 million investment from the Rockefeller Foundation. It has additionally secured pledges of over $212 million worth of pro-bono tools and services for its cities from a wide array of partners. To date, over $3 billion worth of funding from city, national, philanthropic, and private sources have been secured by its member cities to implement resilience-building initiatives.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2013 – ongoing

Partners: Rockefeller Foundation and 100+ public, private, and NGO partners donating services

Details on the type of climate-smart investment solution provided:

Cities in the network are provided with the resources necessary to develop a roadmap to resilience along four main pathways:

- Financial and logistical guidance for establishing an innovative new position in city government, a Chief Resilience Officer, who will lead the city's resilience efforts.
- Expert support for development of a robust resilience strategy.
- Access to solutions, service providers, and partners from the private, public, and NGO sectors who can help them develop and implement their resilience strategies.
- Membership of a global network of member cities who can learn from and help each other.

AFRICA50

Summary information

Initiative: Africa50

Organization: African Development Bank

Organization type: Multilateral and development bank

Geography: Sub-Saharan Africa, Middle East, and North Africa

Sectors: Green buildings, renewable energy, public transport/ mobility, water supply and treatment, street lighting, green industrial development

Key objectives of the initiative:

Africa50 is an infrastructure investment platform that contributes to Africa's growth by developing and investing in bankable projects, catalyzing public sector capital, and mobilizing private sector funding, with differentiated financial returns and impact.

Financing details

Type of investment solution: Investment/fund, project preparation facility, database/platform

Total fund size: Total capital is about $1 billion in 2018 and the medium-term target is $3 billion.

Total project size: Various projects ranging in size are under way. For example, Nigeria has a $150 million project for a 100 MW solar power plant, while Egypt has a $450 million for a 400 MW solar power plant.

Total finance leveraged: Unknown

Launch/end date: 2015 – ongoing

Partners: Africa50 is a collaboration between 23 governments, two central banks, and the African Development Bank

Details on the type of climate-smart investment solution provided:

Africa50 seeks to act as a bridge between the public and private sectors, by leveraging government and African Development Bank sponsorship to support projects.

It seeks to become a leading investor in African infrastructure by:

1. developing bankable projects and catalyzing investments into shareholder countries,
2. mobilizing funds not only from African states and international financial institutions, but also from long-term institutional investors such as pension and sovereign wealth funds, insurance companies and other private sector entities, and
3. operating as a commercial financial institution, seeking to provide an attractive return to investors.

AFRICA CLIMATE RESILIENT INVESTMENT FACILITY

Summary information

Initiative: Africa Climate Resilient Investment Facility (AFRI-RES)

Organization: World Bank

Organization type: Multilateral and development bank

Geography: Sub-Saharan Africa, Middle East, and North Africa

Sectors: Renewable energy, water supply and treatment

Key objectives of the initiative:

AFRI-RES is a network of technical experts that aims to strengthen the capacity of African institutions (including national governments, river

basin organizations, regional economic communities, and power pools, among others) as well as the private sector (project developers and financiers) to plan, design, and implement infrastructure investments that are resilient to climate variability and change.

Financing details

Type of investment solution: Capacity building

Total fund size: The total project cost estimate is €23.1 million. Nordic Development Fund is providing €5 million in grants while the World Bank provides in-kind co-financing of €8.1 million. Although not confirmed, the UN Economic Commission for Africa and other financiers are expected to provide an additional €10 million.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2017 – ongoing

Partners: UN Economic Commission for Africa, African Union Commission, African Development Bank, World Bank

Details on the type of climate-smart investment solution provided:

AFRI-RES provides:

- Project-level technical assistance.
- Outreach and training.
- Development and dissemination of guidelines, standards, and good practice notes for resilient infrastructure investment.
- A climate knowledge and data portal.

AFRICAN WATER FACILITY

Summary information

Initiative: African Water Facility

Organization: African Development Bank

Organization type: Multilateral and development bank

Geography: Sub-Saharan Africa, Middle East, and North Africa

Sectors: Waste management, water supply and treatment

Key objectives of the initiative:

The African Water Facility is a multilateral fund that aims to implement innovative water projects and raise investment for water projects throughout Africa.

Financing details

Type of investment solution: Grants, capacity building

Total fund size: Since 2006, the facility has mobilized €151.2 million from 15 bilateral and multilateral financial institutions, foundations, and African governments.

Total project size: Projects can last between two and five years

Total finance leveraged: Unknown

Launch/end date: 2006 – ongoing

Partners: African Ministers' Council on Water

Details on the type of climate-smart investment solution provided:

The African Water Facility provides grants and expert technical assistance in three key areas:

- Project preparation: Financial and technical assistance for the preparation of high-quality pre-feasibility and feasibility studies; investment plans; and structured public, private, and PPP operations.
- Water governance: Financial and technical assistance for the design and implementation of national, regional, and transboundary water policies and strategies.
- Water knowledge: Funding for the development and implementation of water information systems for better informed management of water resources and improved decision-making at national, regional, and transboundary levels.

C40 CITIES FINANCE FACILITY

Summary information

Initiative: C40 Cities Finance Facility

Organization: C40 Cities Climate Leadership Group, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Organization type: Coalition

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, street lighting, green industrial development

Key objectives of the initiative:

The Cities Finance Facility aims to deliver project preparation and capacity development, and to share knowledge and establish partnerships between financiers and C40's network of more than 90 of the world's largest cities.

Financing details

Type of investment solution: Project preparation, capacity development, knowledge sharing

Total fund size: Unknown

Total project size: $1 million

Total finance leveraged: C40 Cities works to leverage significant amounts of money from various other funders. For example, the facility is helping to secure $120 million in financing for a fleet of 100 electric buses in Mexico City, helping to decarbonize the public transport sector and provide a financing structure that other cities in Mexico can emulate.

Launch/end date: 2015 (first project in September 2016) – ongoing

Partners: Strategic funders: Bloomberg Philanthropies, Children's Investment Fund Foundation, Realdania

Additional funders and partners: Arup, CCAC, CDP, Citi, Cities Alliance, Clear Channel, Clinton Foundation, Eat, Ford Foundation, German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, IAA, ICLEI, Institute for Transportation and Development Policy,Johnson and Johnson, L'Oréal, Mastercard, Ministry of Foreign Affairs of Denmark, Novo Nordisk, Oak Foundation, OFO, Qlik, Ramboll Fonden, Rockwool, Suez, the World Bank, UK Government, World Resources Institute

Details on the type of climate-smart investment solution provided:

The C40 Cities Finance Facility provides technical assistance within four key areas:

- Project preparation of urban climate change investment projects for financing.
- Capacity development of city administrators to mobilize and access financing instruments.
- Knowledge sharing between partner cities.

- Creating partnerships between cities, investors, financiers, and representatives.

CATALYTIC FINANCE INITIATIVE

Summary information

Initiative: Catalytic Finance Initiative

Organization: Bank of America Merrill Lynch

Organization type: Private investor or insurance

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, waste management, water supply and treatment

Key objectives of the initiative:

The Catalytic Finance Initiative is a partnership among selected commercial banks, development finance institutions, institutional investors, and philanthropies to structure and deploy at least $10 billion in green business, primarily in clean energy.

Financing details

Type of investment solution: Capital investment, green bonds

Total fund size: The Bank of America initially pledged a $1 billion commitment when first launched in 2014, with a goal to stimulate at least $10 billion in new investment. The Catalytic Finance Initiative consortium has now committed to $8 billion, following the expansion of the group to include several other leading financial organizations. Each partner organization has its own additional capital commitment.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2014 – ongoing

Partners: AllianceBernstein, Babson Capital Management LLC, Barings, Crédit Agricole CIB, European Investment Bank, HSBC Group, IFC, Leonardo DiCaprio Foundation, Mirova, Rockefeller Foundation

Details on the type of climate-smart investment solution provided:

The initiative has pledged to provide both capital and expertise on innovative financing structures for investments in clean energy and other sustainability-focused projects.

Projects announced to date by Bank of America under the Catalytic Finance Initiative include:

- A new energy-efficiency financing in partnership with the New York State Green Bank, totaling $800 million.
- A green project bond for wind developer Energia Eolica S.A., in Peru, totaling $204 million.
- Helping to structure a new facility with the Global Alliance for Clean Cookstoves, totaling $100 million.

CITIES AND CLIMATE CHANGE IN AFRICA

Summary information

Initiative: Cities and Climate Change in Africa (CiCLIA)

Organization: Agence Française de Développement, European Union, SECO

Organization type: Coalition

Geography: Sub-Saharan Africa

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment

Key objectives of the initiative:

CiCLIA is a regional support program for local authorities that aims to help 20 to 25 African cities translate their climate strategies into action plans, budgets, and investment projects that can attract climate finance and have mitigation and adaptation co-benefits by 2020.

Financing details

Type of investment solution: Capacity building, financial assistance, technical assistance

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2017 – ongoing

Partners: European Union, SECO

Details on the type of climate-smart investment solution provided:

The main activities of CiCLIA include:

- Implementing territorial strategies integrating climate issues.
- Financing the adequate technical support for the realization of studies of pre-investment of projects with climate co-benefits (studies and/or technical assistance).
- Providing technical assistance for the implementation of these projects.

CITY CREDITWORTHINESS INITIATIVE

Summary information

Initiative: City Creditworthiness Initiative

Organization: World Bank

Organization type: Multilateral and development bank

Geography: Global

Sectors: Municipal finance, urban development

Key objectives of the initiative:

The City Creditworthiness Initiative is comprised of two primary components; The City Creditworthiness Academies and the City Creditworthiness Implementation Programs. Together, they provide a series of training initiatives to help 300 cities in 60 low- and middle-income countries to improve their financial performance and secure the private investment they need to fund climate-smart infrastructure and services.

Financing details

Type of investment solution: Program, research and knowledge, training

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2014 – ongoing

Funding partners: The Public-Private Infrastructure Advisory Facility, Korean Green Growth Partnership, the Rockefeller Foundation

Implementation partners: C40 network, UN-Habitat, Findeter, Municipal Institute of Learning, the Korean Development Institute

Details on the type of climate-smart investment solution provided:

The City Creditworthiness Initiative comprises two main activities:

- Hands-on learning programs that teach city leaders the fundamentals of creditworthiness and municipal finance.
- In-depth, multi-year, on-the-job, customized technical assistance programs to help them prepare for, structure, and close market-based

financing transactions for climate-smart infrastructure projects, using local currency markets whenever possible.

CITY PERFORMANCE TOOL

Summary information

Initiative: City Performance Tool

Organization: Siemens

Organization type: Commercial entity

Geography: Global

Sectors: Green buildings, energy-efficiency, public transport/mobility, green transport/electric vehicles

Key objectives of the initiative:

The Siemens City Performance Tool aims to help cities evolve, and to offer them strategies and tools to ensure that they will become social, cultural, and economic hubs.

Financing details

Type of investment solution: Tool to quantitatively assess city impact

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: unknown – ongoing

Partners: N/A

Details on the type of climate-smart investment solution provided:

The City Performance Tool:

- Evaluates buildings, transport, and energy technologies in a city by analyzing about 300 city-specific data points in three main sectors: electricity, heating, and cooling demand for buildings; passenger and freight transport demand; and the transport network.
- Measures the impacts of a city's strategic plans and compares traditional methods with state-of-the-art technologies.
- Determines the implementation rate needed for any city to meet its future environmental targets.
- Reports both environmental and economic key performance indicators across transport, building, and energy sectors.

CITY RESILIENCE INDEX

Summary information

Initiative: City Resilience Index

Organization: Arup

Organization type: Commercial entity

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, street lighting

Key objectives of the initiative:

The City Resilience Index is a tool that aims to inform cities how they can best respond to the risks posed by climate change, both by identifying weaknesses and suggesting improvements.

Financing details

Type of investment solution: Tool to assess current state of resilience of a city and suggestions for improvement

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2016 – ongoing

Partners: Rockefeller Foundation

Details on the type of climate-smart investment solution provided:

The City Resilience Index is a comprehensive tool that cities use to understand and assess their resilience, enhancing their ability to build sound strategies. The data is based on an analysis of 28 cities over a period of three years.

CITY RESILIENCE PROGRAM

Summary information

Initiative: City Resilience Program

Organization: Global Facility for Disaster Reduction and Recovery and World Bank Group

Organization type: Multilateral and development bank

Geography: Emerging markets

Sectors: Resilient infrastructure across sectors, emergency preparedness and response, urban planning and enforcement systems, geospatial solutions

Key objectives of the initiative:

The City Resilience Program seeks to promote a multi-sectoral approach toward enhancing resilience and strengthening urban planning. It aims to catalyze a transparent pipeline of well-prepared and bankable investments to enhance urban resilience, and to improve access for private and institutional investors to crowd into new markets.

Financing details

Type of investment solution: Program helps cities design investment projects and mobilize extra financial resources to achieve urban resilience

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2017 – ongoing

Partners: Swiss State Secretariat for Economic Affairs SECO, Austrian Federal Ministry of Finance

Details on the type of climate-smart investment solution provided:

The City Resilience Program engages cities in a long-term partnership to identify areas of need and opportunity and to define a robust response towards building resilience. This is done through a three-phased approach:

- Phase I – Identification: Preliminary assessments to define the set of activities needed to strengthen urban resilience, as well as a city's readiness to deploy various private capital mobilization instruments, including raising commercial debt, structuring PPPs, and leveraging private capital from land value capture transactions.
- Phase II – Preparation: Technical working group engagements with cities to carry out in-depth technical assessments, with parallel engagement with financial advisory firms to produce a capital

investment plan, which includes a menu of transaction options and capital budgeting to define the sources and use of funds.

- Phase III – Implementation: Implementation of the identified investment project through World Bank loans and co-financing from other multilateral institutions, or through private sources via PPPs or land value capture.

CLEAN TECHNOLOGY FUND

Summary information

Initiative: Clean Technology Fund

Organization: Climate Investment Funds

Organization type: Multilateral and development bank

Geography: East Asia Pacific, Latin America and Caribbean, South Asia, Europe and Central Asia, Middle East, Sub-Saharan and North Africa

Sectors: Energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, agroforestry

Key objectives of the initiative:

The Clean Technology Fund aims to scale up low-carbon technologies with significant potential for long-term greenhouse-gas emissions savings.

Financing details

Type of investment solution: Capacity building, financial assistance

Total fund size: The Clean Technology Fund is a $5.4 billion fund. Over $4 billion (75 percent of resources) is approved for implementation in renewable energy, energy-efficiency, and clean transport.

Total project size: N/A

Total finance leveraged: In total, this is expected to leverage another $47 billion in co-financing from other sources.

Launch/end date: 2008 – ongoing

Partners: World Bank

Details on the type of climate-smart investment solution provided:

The Clean Technology Fund provides large-scale financial resources to invest in clean technology projects in developing countries, which contributes to the demonstration, deployment, and transfer of low-carbon technologies with significant potential for long-term emissions savings.

DISTRICT ENERGY IN CITIES INITIATIVE

Summary information

Initiative: District Energy in Cities Initiative

Organization: United Nations Environment Programme, Global Environment Facility, Sustainable Energy for All

Organization type: Coalition

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, waste management, water supply and treatment

Key objectives of the initiative:

The Direct Energy in Cities Initiative is a partnership of 40 public and private partners that aims to accelerate the transition of cities in emerging economies and developing countries to low-carbon, climate resilient societies through modern district energy systems. It is coordinated by the UNEP, the Global Environment Facility,

and Sustainable Energy for All (a global initiative led by the former Secretary-General of the UN, Ban Ki-moon, to achieve universal energy access, improve energy-efficiency, and increase the use of renewable energy.)

Financing details

Type of investment solution: Capacity building, financial assistance, technical assistance

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2014 – ongoing

Partners: Global Environmental Facility; Danish International Development Agency; Italian Ministry of Environment, Land and Sea Protection; Copenhagen Center on Energy-efficiency; ICLEI—Local Government for Sustainability; IFC; Climate Technology Centre and Network; European Bank for Reconstruction and Development; Building Performance Institute Europe; China Energy Conservation and Environmental Protection Group; the Energy Resources Institute; Aalborg University; 4DH; Efficacity; Politecnico de Milano; Danfoss; Veolia; Empower; ENGIE; Sustainability Solutions Group; CCLO; Thermaflex; King & Spalding; Carbon Trust; Celsius; US Department of Energy; International Energy Agency; Energy-efficiency Services Limited; Goteborg Energi; Johnson Controls; PwC; Solar Turbines; Thermax; International District Energy Association; Euroheat and Power; Danish Board of District Heating; Chinese District Energy Association; The Cooper Alliance; UN-Habitat; ASHRAE

Details on the type of climate-smart investment solution provided:

The District Energy in Cities Initiative achieves these aims by:

- Raising awareness of the opportunities and multiple benefits of modern district energy systems.
- Technical assistance using a methodology based on inputs from over 45 cities and the expertise of the initiative's partners.
- Tailored policy advice on how to foster the development of district energy based on the results obtained from the technical assessments and consultations.
- Tools, guidance, training materials, and methodologies for all pilot cities.

ENERGY-EFFICIENT CITIES PROGRAM

Summary information

Initiative: Energy-efficient Cities Program

Organization: ESMAP (Administered by the World Bank)

Organization type: Multi-donor trust fund

Geography: Global

Sectors: Buildings, appliances, and city services, including public lighting, water supply and treatment, public transport and electric mobility, solid waste, district heating, power distribution, and industry in the framework of circular economy

Key objectives of the initiative:

ESMAP is a global technical assistance and knowledge program that seeks to assist low and middle-income countries reduce poverty and boost growth through environmentally sustainable solutions. Its Energy-efficient Cities Program consists of two complementary windows: efficient and sustainable buildings; and energy-efficient city services, which together support and seek to expand the World Bank Group's efforts to help countries and cities harness their energy-efficiency potential. It has three main objectives: create an enabling policy and regulatory environment for energy-efficiency; integrate energy-efficiency in projects across sectors (urban, water, transport); and develop delivery models and financing mechanisms to scale up energy-efficiency.

Financing details

Type of investment solution: Technical assistance and knowledge development and exchange

Total fund size: $22 million (over a four-year business plan: FY17–FY20)

Total project size: Variable

Total finance leveraged: Supporting activities in 30+ countries and informing over $1.2 billion of World Bank Group development financing

Launch/end date: Current business plan is from July 1, 2016 to June 30, 2020

Partners: Australia, Austria, Canada, Denmark, the European Commission, Finland, France, Germany, Iceland, Italy, Japan, Lithuania, Luxembourg, the Netherlands, Norway, the Rockefeller Foundation, Sweden, Switzerland, the United Kingdom, the World Bank

Details on the type of climate-smart investment solution provided:

ESMAP allocates grants to support a range of technical assistance activities, such as:

- Energy-efficiency diagnostics
- Market surveys
- Pre-feasibility studies and energy audits
- Analysis and design of policies, regulatory/institutional frameworks
- Assessment and design of implementation models and financing mechanisms
- Integration of energy and energy-efficiency considerations in urban development plans
- Development of funding proposals and support for mobilization of financing
- Capacity building
- Knowledge sharing.

ESMAP also produces knowledge products and supports and facilitates knowledge exchanges.

FINANCING ENERGY FOR LOW-CARBON INVESTMENT—CITIES ADVISORY FACILITY

Summary information

Initiative: Financing Energy for Low-Carbon Investment—Cities Advisory Facility (FELICITY)

Organization: European Investment Bank, GIZ

Organization type: Multilateral and development bank

Geography: Global

Sectors: Energy-efficiency, waste management, water supply and treatment, street lighting

Key objectives of the initiative:

FELICITY aims to support emerging economies—namely Brazil, China, and Mexico—with both technical assistance and the financing of sustainable infrastructure projects. The initiative is led by the European Investment Bank, the world's largest multilateral borrower and lender that provides finance and expertise for sustainable investment projects that contribute to European Union policy objectives, and the GIZ, a German development agency that provides services in the field of international development cooperation.

Financing details

Type of investment solution: Capacity building, financial assistance

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2017 – ongoing

Partners: N/A

Details on the type of climate-smart investment solution provided:

FELICITY offers:

- Guidance on the technical, financial, and economic feasibility of investments planned in cities, procurement procedures, and social and environmental soundness.
- Capacity development for municipalities to develop bankable projects and access international finance, especially for the purpose of addressing climate change.
- The facilitation of knowledge exchange across countries and regions on the preparation of low-carbon infrastructure projects and conducive regulatory environments.

FINANCING SUSTAINABLE CITIES INITIATIVE

Summary information

Initiative: Financing Sustainable Cities Initiative

Organization: World Resources Institute Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group

Organization type: Coalition

Geography: Global

Sectors: Green buildings, energy-efficiency, public transport/mobility, green transport/electric vehicles, waste management

Key objectives of the initiative:

The Financing Sustainable Cities Initiative aims to help cities accelerate and scale up investments in sustainable urban solutions through the development of innovative business models.

Financing details

Type of investment solution: Technical assistance, knowledge sharing, online engagement

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2015 (first forum in 2016) – ongoing

Partners: Funded by the Citi Foundation

Details on the type of climate-smart investment solution provided:

The Financing Sustainable Cities Initiative provides three key aspects:

- Knowledge sharing between cities and investors
- On-the-ground technical assistance to cities
- The delivery of an online engagement platform to scale investments in urban infrastructure and services.

Currently, the initiative focuses on eight solutions:

- Bike-sharing systems
- Bus rapid transit
- Low- and zero-emission buses
- Efficient new buildings

- Transit-oriented development
- Municipal building retrofits
- Affordable housing
- Waste-to-energy systems.

FUND FOR TECHNICAL EXPERTISE AND EXPERIENCE TRANSFERS

Summary information

Initiative: Fund for Technical Expertise and Experience Transfers

Organization: Agence Française de Développement

Organization type: Multilateral and development bank

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, green industrial development

Key objectives of the initiative:

The Fund for Technical Expertise and Experience Transfers funds technical cooperation programs and project-preparation studies in developing countries, while working towards the sustainable development of those countries.

One project it funds is the Smart Cities Mission, an urban renewal program by the government of India that aims to develop sustainable and innovative solutions in 100 Indian cities.

Financing details

Type of investment solution: Capacity building, technical assistance, financial assistance

Total fund size: In 2017, Agence Française de Développement granted €14.7 billion. In 2016, it granted €9.4 billion. Of this, 11 percent was for grants (€1.1 billion) and 84 percent for private loans (€7.9 billion). Of the grants, 70 percent of this amount is invested in Sub-Saharan Africa and 94 percent of grants went to priority countries. The total fund of the Smart Cities Mission is €700,000.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: N/A – ongoing

Partners: Various partners, dependent on regional focus

Details on the type of climate-smart investment solution provided:

The mechanism is used to fund several types of operations:

- Project-preparation studies: Planning, pre-feasibility, feasibility, preliminary, or detailed design.
- Technical cooperation: Resident technical assistance, short-term or repeat expertise, high-level training actions, and strategic partnerships between peer institutions.

The technical cooperation program must:

- Comply with the organization's geographical and sectoral missions and priorities.
- Develop existing French expertise or experience.
- Contribute to French influence, in economic, public policy, and/or ecological diplomacy terms.

GLOBAL INNOVATION LAB FOR CLIMATE FINANCE

Summary information

Initiative: Global Innovation Lab for Climate Finance

Organization: Climate Policy Initiative

Organization type: Public-private partnership

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, green industrial development

Key objectives of the initiative:

The Global Innovation Lab for Climate Finance aims to drive billions of dollars of private investment to the low-carbon economy by identifying, developing, and supporting transformative sustainable finance ideas. The lab is structured as a PPP, bringing together and catalyzing broader government and private sector efforts to scale up climate finance.

Financing details

Type of investment solution: Technical research, capability building

Total fund size: The lab has launched 26 finance instruments and businesses that have mobilized over $1 billion in sustainable investment. This is being used for the development of new early-stage investment vehicles, chosen from a pool of over 100 crowd-sourced, competitive ideas.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2014 – ongoing

Partners: Funded by: Australia's department of Foreign Affairs and trade; Bloomberg Philanthropies; Germany's Federal Ministry for the Environment, Nature Conservation and Nuclear Safety; Ministry of Foreign Affairs of the Netherlands; International Fund for Agricultural Development; the Rockefeller Foundation; SHAKTI Sustainable Energy Foundation; and the UK's Department for Business, Energy & Industrial Strategy

Details on the type of climate-smart investment solution provided:

The Global Innovation Lab for Climate Finance accelerates well-designed financial instruments that can unlock billions in financing, while reducing private investors' risks and improving their financial returns. This is achieved in five stages:

- Call for ideas: Open call for innovative sustainable investment solutions.
- Selection: Lab members select the most promising ideas.
- Development: Selected ideas for India, Brazil, and global labs benefit from analysis, stress-testing, and guidance from experts and investors.
- Endorsement and launch: Lab members vote to launch the ideas for piloting, based on their innovation, ability to be put into action, financial sustainability, and catalytic potential.
- Implementation: The ideas move into action, fundraising to launch pilots, with continued support from the lab network.

GREEN BONDS FOR CITIES

Summary information

Initiative: Green Bonds for Cities

Organization: South Pole Group, Climate Bonds Initiative, and Local Governments for Sustainability (ICLEI)

Organization type: Coalition

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, green industrial development

Key objectives of the initiative:

The Green Bonds for Cities project aims to support cities in emerging, developing, and transition countries to access the green bond market. The objective is to commercialize the outputs of the 2016 project, which sought to enable more local authorities to use debt markets to finance low-carbon infrastructure. The initiative is supported by South Pole Group, an international organization specializing in sustainability solutions, and the Climate Bonds Initiative, an international non-profit focusing on investors and mobilizing the bond market.

Financing details

Type of investment solution: Green bonds tools and training

Total fund size: N/A

Total project size: Variable

Total finance leveraged: N/A

Launch/end date: 2016 – ongoing

Partners: Climate-KIC

Details on the type of climate-smart investment solution provided:

The Green Bonds for Cities project provides support for local governments in developing countries to tap into the green bond market using the following tools:

- Identification of the prerequisites and processes to develop a successful green-bond strategy.
- Ready-to-use tools for local governments, including a feasibility assessment.
- Training sessions to support local green bond issuers.

EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT GREEN CITIES FRAMEWORK

Summary information

Initiative: Green Cities Framework

Organization: European Bank for Reconstruction and Development

Organization type: Multilateral and development bank

Geography: South Asia, Europe and Central Asia, Middle East, and North Africa

Sectors: Energy-efficiency, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, street lighting

Key objectives of the initiative:

The Green Cities Framework aims to address the most pressing environmental and climate change challenges facing cities through targeted planning, capacity building, and investment.

Financing details

Type of investment solution: Technical support, methodology, investment

Total fund size: The Green Cities Fund is a €250 million fund, operated through the bank's municipal and environmental

infrastructure division. This is used to fund the framework's Green Cities Action Plans and technical assistance components.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2016 – ongoing

Partners: Organisation for Economic Co-operation and Development and ICLEI

Details on the type of climate-smart investment solution provided:

The three key components are:

- Green City Action Plans: In collaboration with the Organisation for Economic Co-operation and Development and ICLEI, a methodology is developed to identify, prioritize, and evaluate green city actions.
- Green City Infrastructure Investments: Facilitates and stimulates sovereign and subsovereign finance for environmental, climate change mitigation, and resilience investments.
- Technical support and targeted capacity building: This includes appropriate project-level due diligence, capacity building for city management and relevant stakeholders including utilities, and project implementation and monitoring.

HSBC SUSTAINABLE FINANCE FUND

Summary information

Initiative: HSBC Sustainable Finance Fund

Organization: HSBC

Organization type: Private investor or insurance

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment

Key objectives of the initiative:

The HSBC Sustainable Finance Fund aims to enable the transition to a low-carbon economy by investing in energy-efficiency, renewable energies, new technologies, and infrastructure. It also helps clients manage transition risk.

Financing details

Type of investment solution: Credit lending, advisory

Total fund size: HSBC pledged to provide $100 billion to combat climate change by 2025

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2017 – ongoing

Partners: N/A

Details on the type of climate-smart investment solution provided:

HSBC sustainable financing includes both:

- Credit and lending facilities
- Advisory services or access to capital markets.

INFRAFUND

Summary information

Initiative: InfraFund

Organization: Inter-American Development Bank

Organization type: Multilateral and development bank

Geography: Latin America and Caribbean

Sectors: Green buildings, energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment

Key objectives of the initiative:

The InfraFund is a fund aiming to assist public, private, and mixed-capital entities in Latin America and the Caribbean in the identification, development, and preparation of bankable and sustainable infrastructure projects that have the potential of reaching financial closure.

Financing details

Type of investment solution: Capacity building, technical assistance

Total fund size: N/A

Total project size: Variable

Total finance leveraged: N/A

Launch/end date: 2009 – ongoing

Partners: N/A

Details on the type of climate-smart investment solution provided:

InfraFund resources are used for:

- Preparation of pre-feasibility and feasibility studies.
- Project design.
- Document preparation and revision to carry out financing requests and/or for bidding purposes.
- Studies related to project viability using new technologies or sources of energy.

LOCAL CLIMATE ADAPTIVE LIVING (LOCAL) FACILITY

Summary information

Initiative: Local Climate Adaptive Living (LoCAL) Facility

Organization: UN Capital Development Fund

Organization type: Intergovernmental organization

Geography: East Asia Pacific, South Asia, Sub-Saharan Africa

Sectors: Public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment, disaster risk reduction and agriculture

Key objectives of the initiative:

The Local Climate Adaptive Living (LoCAL) Facility aims to promote resilient communities and economies by increasing financing for and investment in climate change adaptation at the local level in developing countries. It is part of the UN Capital Development Fund, the UN's capital investment agency for the world's 48 least developed countries.

Financing details

Type of investment solution: Capacity building

Total fund size: N/A

Total project size: Variable

Total finance leveraged: N/A

Launch/end date: 2011 – ongoing

Partners: Global Climate Change Alliance, European Union, Swedish International Development Agency, Government of Liechtenstein, Belgian Development Cooperation

Co-financed by the Global Climate Change Alliance of the European Union and the Swedish International Development Agency

Details on the type of climate-smart investment solution provided:

The LoCAL facility provides performance-based climate resilience grants and technical support to help local governments in developing countries access and effectively spend vital funding for local adaptation measures. LoCAL serves as a mechanism to:

- Integrate climate change adaptation into local governments' planning and budgeting systems.
- Increase awareness of and response to climate change at the local level.
- Increase the amount of finance available to local governments for climate change adaptation.

CDP MATCHMAKER

Summary information

Initiative: Matchmaker

Organization: CDP

Organization type: NGO initiative/research

Geography: Global

Sectors: Green buildings, energy-efficiency, renewable energy, green industrial development

Key objectives of the initiative:

Matchmaker is a specialized project dashboard that aims to bridge the divide between cities and potential investors to highlight projects in flood control, waste management, sustainable transport, renewable energy, water management, and energy-efficiency through project data disclosure and stakeholder consultation. It is an initiative of CDP, formerly the Carbon Disclosure Project, which works with more than 6,300 companies, over 500 cities, and over 100 countries to measure and manage their environmental impacts.

Financing details

Type of investment solution: Database, technical platform, research, capability building

Total fund size: In 2017, 362 cities disclosed more than 1,000 projects to CDP, representing over $52 billion

Total project size: N/A

Total finance leveraged: Unknown

Launch/end date: 2017 – ongoing

Partners: Climate-KIC

Details on the type of climate-smart investment solution provided:

Matchmaker is a clearing house for cities to showcase planned projects to the finance sector and better position them to mitigate against and adapt to climate change by gaining access to:

- Dashboards detailing cities' climate and sustainability activities.
- Screening capabilities to identify urban climate projects based on desired criteria.
- Lead generation for projects in infrastructure, energy-efficiency, renewable energy, and so on.

NEPAD INFRASTRUCTURE PROJECT PREPARATION FACILITY

Summary information

Initiative: NEPAD Infrastructure Project Preparation Facility

Organization: African Development Bank

Organization type: Multilateral and development bank

Geography: Sub-Saharan Africa, Middle East, and North Africa

Sectors: Energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, water supply and treatment

Key objectives of the initiative:

The NEPAD Infrastructure Project Preparation Facility is a multi-donor special fund that aims to increase the number of economically, environmentally, socially, and gender-responsive regional infrastructure projects prepared and implemented; increase funding; and improve interaction among stakeholders.

Financing details

Type of investment solution: Grants, investments, technical assistance

Total fund size: Total donor contributions (since 2005): $102 million. Total investments mobilized (since 2005): $8 billion. Total approved grants (since 2005): 76. Total completed grants (since 2005): 48.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2005 – ongoing

Partners: Key donors: Canadian International Development Agency (Canadian government), The KfW Bankengruppe (German government), the Ministry of Economy and Competitiveness (Spanish government), Norfund (Norwegian government), UK AID (UK government), Danida (Danish government)

Details on the type of climate-smart investment solution provided:

The NEPAD Infrastructure Project Preparation Facility helps African countries prepare regional infrastructure projects in energy, transport, ICT, and transboundary water by:

- Increasing the number of projects prepared and implemented
- Increasing funding for the preparation of bankable projects
- Improving interaction among stakeholders.

Since 2005, the NEPAD Infrastructure Project Preparation Facility has prepared over 78 regional infrastructure projects, half of which have reached financial closure.

SUBNATIONAL CLIMATE FUND AFRICA

Summary information

Initiative: Subnational Climate Fund

Organization: R20, BlueOrchard, the Leonardo DiCaprio Foundation

Organization type: Coalition

Geography: Global

Sectors: Energy-efficiency, renewable energy, waste management

Key objectives of the initiative:

The Subnational Climate Fund Africa aims to fund intermediate-sized subnational infrastructure projects in Africa using a dedicated $350 million fund. It is supported by R20, a not-for-profit international organization supporting subnational governments around the world to develop and finance green infrastructure projects Blue Orchard, an impact investment fund manager and the Leonardo DiCaprio Foundation, a non-profit international organization.

Financing details

Type of investment solution: Financing; capability building

Total fund size: The total fund is $350 million. The Subnational Climate Fund Africa expects to invest in up to 30 projects and mobilize between $350 million and $1.05 billion of climate finance in the form of co-investments in projects.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: Unknown – ongoing

Partners: Project identification partners: Leonardo DiCaprio Foundation, ORU Fogar, AER, ICLEI, SALGA, FMDV
Project structuring partners: MINES Saint-Etienne, ENPO, Alexandria University, SIF
Project bankability partners: Egis, BG, ALPIZ, Philips Lightning
Project financing partners: Planet Pledge, Blue Orchard, R20
Project measure, report, and verify partners: Gold Standard, My Climate
Subnational network partners: Assembly of European Regions Association of Northeast Asian Regional Governments, C40, FMDV, ICLEI, Metropolis, World Association of the Major Metropolises, ORU-Fogar, SALGA, The Climate Group

Details on the type of climate-smart investment solution provided:

The Subnational Climate Fund provides six services:

- Project identification
- Project structuring
- Project bankability
- Project financing
- Project implementation
- Project measuring, reporting, and verification.

SUBNATIONAL TECHNICAL ASSISTANCE PROGRAM—PUBLIC-PRIVATE INFRASTRUCTURE ADVISORY FACILITY

Summary information

Initiative: Subnational Technical Assistance Program—Public-Private Infrastructure Advisory Facility (SNTA-PPIAF)

Organization: World Bank

Organization type: Multilateral and development bank

Geography: Global

Sectors: Energy-efficiency, renewable energy, waste management, water supply and treatment

Key objectives of the initiative:

The SNTA funds activities to establish mechanisms and frameworks that can improve the flow of both domestic and foreign capital into infrastructure in a sustainable manner, and creates the conditions necessary for these entities to improve their creditworthiness.

Financing details

Type of investment solution: Credit-worthiness enhancements; capacity building

Total fund size: N/A

Total project size: Variable

Total finance leveraged: N/A

Launch/end date: 2011 – ongoing

Partners: N/A

Details on the type of climate-smart investment solution provided:

The SNTA provides both:

- Technical grants: The PPIAF accepts grant proposals that are in line with its mandate to support governments in creating and strengthening a sound enabling environment for private participation in infrastructure.
- Knowledge grants: To support the creation of a sound enabling environment for the provision of infrastructure services by the private sector.

SUSTAINABLE ENERGY FOR AFRICA

Summary information

Initiative: Sustainable Energy for Africa

Organization: African Development Bank

Organization type: Multilateral and development bank

Geography: Sub-Saharan Africa, Middle East, and North Africa

Sectors: Energy-efficiency, renewable energy

Key objectives of the initiative:

The Sustainable Energy Fund for Africa is a multi-donor trust fund to support small and medium-scale renewable energy and energy-efficiency projects in Africa.

Financing details

Type of investment solution: Grants, equity investments, technical assistance, capacity building

Total fund size: Unknown

Total project size: Projects between $30 million and $200 million

Total finance leveraged: Unknown

Launch/end date: 2012 – ongoing

Partners: Governments of Denmark and the United States (funders)

Hosted by: The African Development Bank's Renewable Energy and Energy-efficiency Department

Details on the type of climate-smart investment solution provided:

The Sustainable Energy Fund for Africa has been designed to operate under three financing windows:

- Project preparation: Provides cost-sharing grants and technical assistance to private project developers/promoters to facilitate pre-investment activities for renewable energy and energy-efficiency projects.
- Equity investments: Provides equity capital combined with a dedicated technical assistance envelope, deployed by the co-sponsored Africa Renewable Energy Fund, a pan-African private equity fund solely focused on small/medium (5–50MW) independent power projects from solar, wind, biomass, and hydro, as well as some geothermal and stranded gas technologies.
- Enabling environment support: Provides grants to support mainly public sector activities that create and improve the enabling environment for private sector investments in the sustainable energy space in Africa. This includes advisory and implementation of legal, regulatory, and policy regimes.

THE LOW CARBON CITY LAB

Summary information

Initiative: The Low Carbon City Lab

Organization: Climate-KIC

Organization type: Public-private partnership

Geography: Latin America, East Asia Pacific, South Asia, Europe, Sub-Saharan Africa, and North Africa

Sectors: Climate finance, green buildings, energy-efficiency, public transport/mobility, green transport/electric vehicles, waste management, and green industrial development

Key objectives of the initiative:

The Low Carbon City Lab is a Climate-KIC flagship program that aims to unlock finance for cities. Within this initiative, public and private organizations work together to identify, test, and scale innovative tools and solutions tailored for cities and investors. Climate-KIC is Europe's largest public-private innovation partnership focused on climate innovation to mitigate and adapt to climate change.

Financing details

Type of investment solution: Capacity building, project preparation, scaling funding models

Total fund size: N/A

Total project size: N/A

Total finance leveraged: N/A

Launch/end date: 2015 – ongoing

Partners: Denmark Technical University, Copenhagen University, South Pole Group, Imperial College, Climate Policy Initiative, CDP, FMDV, Copenhagen Municipality, The Climate Group, Climate Bonds Initiative, Teralytics, Telefonica, Malmo Municipality, AESS Modena, Bologna Municipality, Carbone 4, Gold Standard Foundation, TNO, Suez, WWF

Details on the type of climate-smart investment solution provided:

- Training and capacity building: Offers training on access to finance, capacity building, and project preparation.
- Project acceleration: Aims to align and accelerate project generation at the city level by developing a pipeline of bankable green investments.
- Investment mechanisms: Aims to identify and scale innovative funding models for cities and support the implementation of climate finance mechanisms in cities.

TRANSFORMATIVE ACTIONS PROGRAM

Summary information

Initiative: Transformative Actions Program (TAP)

Organization: ICLEI

Organization type: Coalition

Geography: Global

Sectors: Energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment

Key objectives of the initiative:

TAP is an innovative program that aims to catalyze and improve capital flows to cities, towns, and regions and strengthen the capacity of local and subnational governments to access climate finance and attract investment.

Financing details

Type of investment solution: Capacity building

Total fund size: N/A

Total project size: Variable

Total finance leveraged: N/A

Launch/end date: 2015 – ongoing

Partners: The partnership renewal process is ongoing. Current partners are UN-Habitat, Global Infrastructure Basel Foundation, Global Fund for Cities Development, European Investment Bank, R20—Regions of Climate Action, Sustainable Infrastructure Foundation, Cities Climate Leadership Group (C40), and Cities Alliance

Details on the type of climate-smart investment solution provided:

TAP works in four key areas:

- The TAP project pipeline provides early-stage project feedback and verifies transformative impact.
- The online TAP platform optimizes visibility to potential investors and funders.
- TAP projects benefit from project development services offered by ICLEI and TAP partners.
- TAP promotes multi-level governance and effective financing for local projects.

URBAN CLIMATE CHANGE RESILIENCE TRUST FUND

Summary information

Initiative: Urban Climate Change Resilience Trust Fund

Organization: Asian Development Bank

Organization type: Multilateral and development bank

Geography: Central West Asia (Pakistan), South Asia (Bangladesh, India, Nepal), Southeast Asia (Indonesia, Philippines, Myanmar, Vietnam)

Sectors: Energy-efficiency, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment

Key objectives of the initiative:

The Urban Climate Change Resilience Trust Fund (UCCRTF) was established in December 2013 under the Urban Financing Partnership Facility. UCCRTF is a multi-donor trust fund that aims to reduce risks for urban poor and vulnerable from climate change and natural disasters in 25 cities in eight countries in Asia, and build resilience for 2 million people. The trust fund helps cities plan more effectively for shocks and stresses, and invest in resilience capacity building, city and community resilience planning, and climate resilient infrastructure.

Financing details

Type of investment solution: Integrated urban planning, participatory urban resilience assessment and planning (on regional, city, and community level), infrastructure investments, technical assistance, project preparation, spatial data analysis explorer—spade (database/platform), resilience academy/accelerator capacity building, peer-to-peer learning, and knowledge sharing

Total fund size: $150 million

Total project size: Direct charge $225,000; technical assistance $225,000 – $3 million; and investment grant $2 million – $8 million

Total finance leveraged: As of July 2018, about $49.4 million in UCCRTF grants is linked to a projected $2.5 billion in investments, which includes the ADB, government, partner co-financing, and private sector funds.

Launch/end date: 2014 – 2022

Partners: Government of UK, Department for International Development, and Switzerland, State Secretariat for Economic Affairs, and the Rockefeller Foundation

Details on the type of climate-smart investment solution provided:

The investments are improving processes that integrate climate resilience in city planning and in the resilience design/delivery of city infrastructure. This enables cities to effectively deal with and recover from future shocks and stresses. Working with ADB loans and country finances provides UCCRTF the opportunity to influence large-scale investments.

URBAN FINANCING PARTNERSHIP FACILITY

Summary information

Initiative: Urban Financing Partnership Facility

Organization: Asian Development Bank

Organization type: Multilateral and development bank

Geography: East Asia Pacific, South Asia, Europe, and Central Asia

Sectors: Green buildings, renewable energy, public transport/mobility, green transport/electric vehicles, waste management, water supply and treatment

Key objectives of the initiative:

The Urban Financing Partnership Facility aims to raise and use development partner funds for investment co-financing in urban environmental infrastructure projects, and supports a wide range of technical assistance to help lay the groundwork for such projects.

Financing details

Type of investment solution: Technical assistance, guarantees

Total fund size: In June 2017, the Urban Financing Partnership Facility total allocations amounted to $0.96 million for five projects. Cumulative assistance amounted to $80.8 million for 71 projects.

Total project size: Variable

Total finance leveraged: Unknown

Launch/end date: 2009 – ongoing

Partners: Government of Sweden, USAID, UK-AID, the Rockefeller Foundation

Details on the type of climate-smart investment solution provided:

The Urban Financing Partnership Facility includes the Urban Climate Change Resilience Trust Fund (multi-partner trust fund) and the Urban Environmental Infrastructure Fund (single-partner trust fund).

The main activities include:

- Providing technical assistance for building national government/local government/utility capacity (pre-feasibility assessments and project structuring, project implementation, and utilization).
- Providing early-stage investment or viability gap financing.
- Building a pipeline of pro-poor bankable urban environmental projects able to borrow cost effectively from domestic markets and stimulate long-term investment interest from mainstream investors.

Photo: © Dominic Chavez / IFC

Data Sources Informing Estimates of Climate-Smart Investment Potential

1. **Renewable energy**
    a. Renewable energy costs, National Energy Laboratory ATB 2018 data https://atb.nrel.gov/electricity/data.html
    b. Projected renewable energy costs, IRENA 2018 Renewable Power Generation Costs in 2017, International Renewable Energy Agency http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf
    c. Renewable energy targets for cities, CDP data https://data.cdp.net/Cities/Cities-Renewable-Energy-Targets/hztn-by6p
    d. Carbonn database for Surat, Independencia, San Carlos, Shah Alam and Da Nang https://carbonn.org/data/
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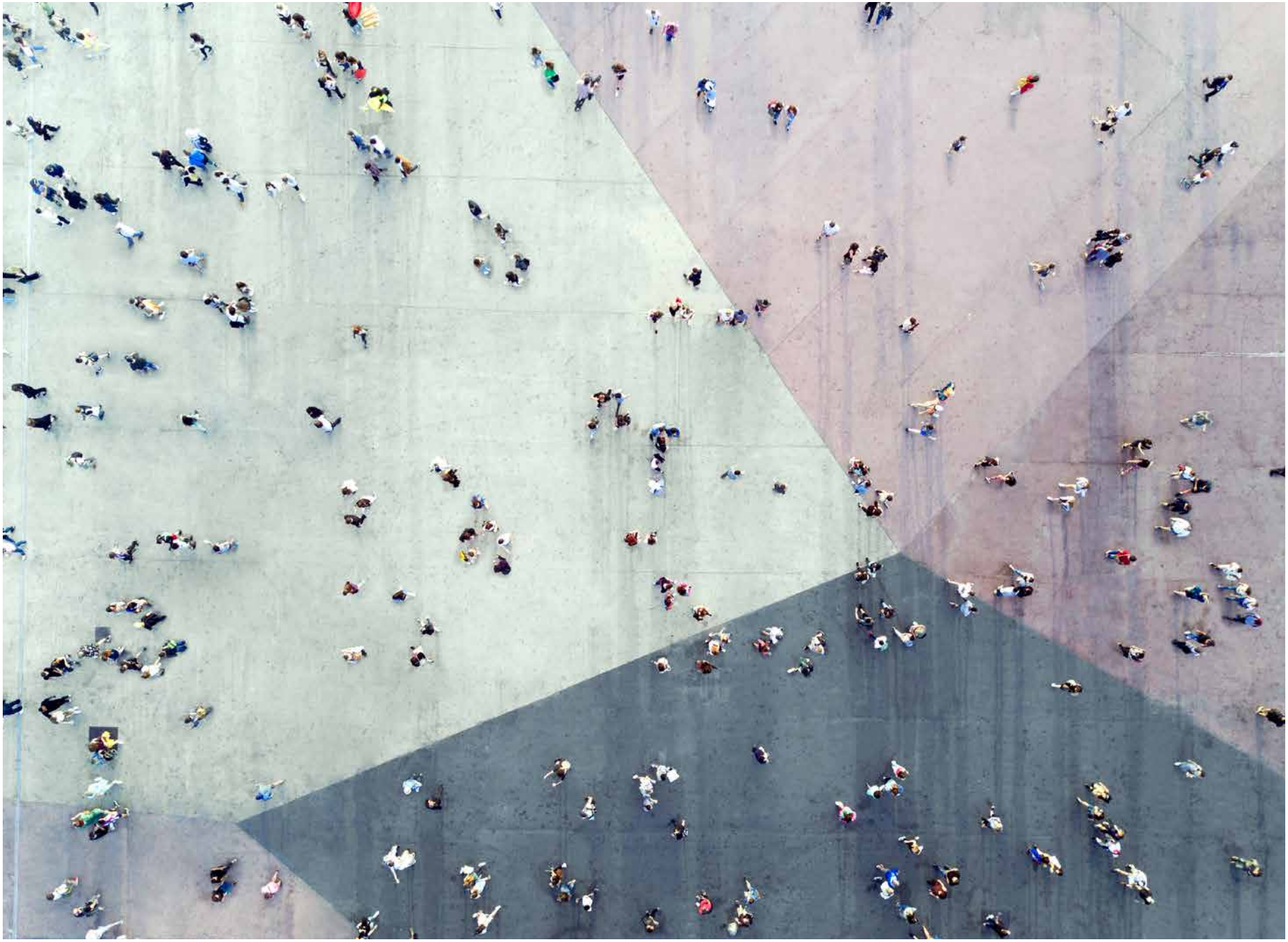

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