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CATALYZING PRIVATE SECTOR INVESTMENT IN

CLIMATE SMART CITIES

UNDP

WORLD BANK GROUP

Global Infrastructure Facility
A G20 INITIATIVE

A World Bank Group, United Nations Development Programme and Global Infrastructure Facility Report

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Abbreviations

BBB Breathe Better Bond

CCA Community Choice Aggregation

CRP City Resilience Program

FSC Financing and Service Company

GDP Gross Domestic Product

GHG Greenhouse Gas

IFC International Finance Corporation

IMIF International Municipal Investment Fund

IPCC Intergovernmental Panel on Climate Change

KfW *Kreditanstalt für Wiederaufbau* (German Development Bank)

NDC Nationally Determined Contribution

PACE Property-Assessed Clean Energy

PPP Public-Private Partnership

UNCDF United Nations Capital Development Fund

UNDP United Nations Development Programme

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

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01

OVERVIEW

01 | Overview

Cites are both a cause and a victim of climate change and have important reasons for addressing it. While achieving the goals of the Paris Climate Agreement rests on many factors, much depends on what happens in cities. Cities account for 55 percent of the world's population and 80 percent of global gross domestic product (GDP). Their rapid and often haphazard growth has been a driver of climate change. Today, cities account for 70 percent of the world's greenhouse gas (GHG) emissions. They face unmanageable air pollution, traffic congestion, and waste accumulation. Their energy demands are increasing along with their vulnerability to disasters and climate shocks such as heat stress, flooding, and health emergencies. These challenges put increasing pressure on critical urban infrastructure and services, city livability, and business continuity and can impact city competitiveness in the future if not addressed today.

By becoming climate-smart, cities can avoid locking-in to high-emissions and vulnerable pathways while enhancing future attractiveness and competitiveness. As the world's population becomes increasingly urban, it is critical that cities invest in physical infrastructure and natural capital solutions that will enable them to reduce their emissions and increase their resilience to climate change and other shocks and stresses. A climate-smart city minimizes environmental damage, reduces air pollution and GHG emissions, and maximizes opportunities to enhance urban resilience, thereby improving the natural environment and overall livability and appeal of the city. Efforts to address climate change in urban areas through investments to enhance air quality, the circular economy, green buildings, green spaces as well as compact, optimal densification and urban form, add to quality of life which in turn attracts talent and businesses and increases the competitive edge of a city. Green investments can also help lower the cost of living and help attract or retain talent in urban centers.

The private sector has an important role to play and its perception of climate investment is changing, particularly in cities. The investment potential of climate-smart urban infrastructure is substantial. Some $29.4 trillion in opportunities exist in developing countries alone across six urban sectors that reduce emissions: renewable energy, public transportation, climate-smart water, electric vehicles, and green buildings (IFC 2017). Climate resilience also presents significant private investment opportunities as climate change becomes an increasingly powerful macroeconomic trend impacting the real economy. As the climate change crisis gets bigger, better understood by markets, and better priced, so will the value, importance and return of companies and assets that are intrinsically resilient or provide resilience solutions. According to a recent survey of the world's biggest companies, climate adaptation products and solutions could result in $236 billion in increased revenue (GCA 2019).

Despite the investment potential, cities face unique challenges in accessing finance to fill the climate-smart investment gap. The global need for urban infrastructure investment is estimated at $4.5 trillion to $5.4 trillion per year, with current levels of financing only reaching $2.5 to $3 trillion annually (CCFLA 2015). Infrastructure needs are particularly acute in rapidly growing cities in Africa and South Asia. Many of the barriers cities face in attracting private investment are rooted in their limited control over broader enabling environmental conditions, such as national policies and regulations, as well as limited institutional capacity to plan and design climate-aligned investment opportunities for the private sector (C40 and ODI 2019). Globally, cities vary widely in their ability to borrow money. Only 5 percent of the 500 largest cities in developing countries have a credit rating on international capital markets and only 20 percent have a credit rating in local markets (World Bank 2018). In addition, 56 percent of countries forbid any kind of borrowing by local governments, excluding them from issuing bonds, and only 16 percent grant any taxation authority to local governments.

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Private investors face their own challenges investing in urban climate projects. The risks associated with emerging markets and developing countries are still present in cities. These include political risks, such as breach of contract, currency convertibility and expropriation of assets, and macroeconomic risks, such as currency fluctuation and inflation. At the urban level, investors are often less familiar with municipal governments and their financial conditions and finding a pipeline of sufficient size and quality can be difficult.

Significantly more must be done to support cities and subnational governments in their efforts to achieve low carbon, resilient development. There is no single solution to overcoming the complex, multifaceted barriers that cities face in financing climate change projects, particularly given the need for large, complex, cross-sectoral investments. Turning main sources of GHGs in urban areas into opportunities for green growth and creating livable cities requires integrated systems approaches and coordination with national government agencies. The scale and complexity of the investment needed will require enhanced technical capacity of people and systems in local municipal markets, national governments, and the private sector. This report outlines a number of innovative financing approaches and instruments that can increase critical climate investment in cities and help uphold the global commitment to keep global warming to less than 1.5°C.

The objective of this report is to explore innovative financing instruments and approaches for catalyzing private sector financing to fill the climate-smart investment gap in cities. The report reviews the existing literature, highlights key barriers in scaling-up private investment in climate-smart urban infrastructure, and showcases innovative financial de-risking instruments and other financial instruments for private sector financing for low carbon, resilient urban investments. The first chapter of the report introduces the topic and the second presents the challenges and the opportunities of urban climate investments. The third chapter discusses climate-smart cities and types of urban mitigation and resilience investments. The fourth chapter reviews and provides a framework to examine the interconnected layers of investment barriers specific to private investment, city financing, and climate-smart projects. Considering these risks allows investors and other stakeholders to better understand the complex web of challenges to expanding investment in urban climate projects and how they build on one another. Chapter five presents 10 case studies of innovative financing approaches to address some of these barriers and mobilize private sector finance for low carbon, resilient urban development. Finally, the conclusion in chapter six offers some key findings and considerations for the wider community of practice.

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02

CHALLENGE AND OPPORTUNITY

02 | Challenge and Opportunity

The ability to reach the Paris Climate Agreement goals rests on many factors, but much depends on what happens in cities and on mobilizing private resources. Cities currently account for 55 percent of the global population. Their share is projected to increase to 75 percent by 2050 as a result of rapid urbanization and demographic trends, with significant effects on climate change mitigation and adaptation efforts. The Inter-Governmental Panel on Climate Change (IPCC) reports that cities' ability to address climate change is critical to limiting global warming to 1.5° Celcius. The IPCC identifies urban and infrastructure systems as one of four key systems with the opportunity for transformational change toward a low-carbon, resilient global economy (IPCC 2018).

The magnitude of the investment needed to strategically plan for, build, and retrofit climate-smart infrastructure far exceeds public balance sheets. Leveraging private sector investment, innovation and know-how will be critical to delivering climate-smart infrastructure and services by 2030. Although numbers vary depending on the methodology used, the message is clear: The investment gap in sustainable urban infrastructure is estimated to be in the trillions annually and is particularly acute in emerging markets and developing economies.[1] According to the Cities Climate Finance Leadership Alliance, the global need for urban infrastructure investment is $4.5 trillion to $5.4 trillion per year with current levels of financing only reaching $2.5 to $3 trillion annually (CCFLA 2015). The need for infrastructure is particularly acute in rapidly growing cities within fast urbanizing developing countries in Africa and South Asia.

Cities are key drivers of climate change. They consume two thirds of global energy and account for more than 70 percent of global GHG emissions, with some of this being within their control and as a result of their policies and much of it not. Air pollution from traffic congestion or industry in cities such as black carbon, sulfates and nitrates have heavy implications for human health, increasing the risk of stroke, heart disease, lung cancer, and respiratory diseases. The World Health Organization recently reported that 7 million people die each year due to air pollution and some analysis shows life expectancy dropping by 4.3 years in some cities (Air Quality Life Index). This is particularly acute in developing countries.

Cities are very vulnerable to climate change shocks, especially in poorer countries. Cities increasingly concentrate people, assets and poverty. Rapid and unplanned growth is leading to urban sprawl, often onto low lying and vulnerable urban lands. Urban populations are already increasingly experiencing heat island effects,[2] rising sea levels, storm surges, and intensifying tropical storms (WBG 2019a) which could force hundreds of millions of people in coastal cities from their homes with a total cost to coastal urban areas of more than $1 trillion per year by 2050 (GCA 2019). Climate change related losses can significantly drain public investment especially in poorer countries and could push an additional 100 million urban residents back into poverty by 2030. Cities are places in which the risks associated with warming to 1.5°C, such as heat stress, terrestrial and coastal flooding, new disease vectors, air pollution and water scarcity, will coalesce (Dodman et al. 2017a; Satterthwaite and Bartlett 2017; IPCC Report 2019).

1 The 2015 CCFLA State of City Climate Finance report identifies $93 trillion of low-carbon, climate-resilient infrastructure needed by 2030, of which 70 percent will need to be built in urban areas.

2 The heat island effect is when built-up areas are hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people can be 1°C to 3°C warmer than its surroundings. In the evening, the difference can be as much as 12°C. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and GHG emissions, heat-related illness and mortality, and water pollution. See https://www.epa.gov/heat-islands

Climate change is also a leading factor in the rapid urbanization in emerging markets and developing countries which has placed significant strain on long-term strategic and spatial urban planning. In Sub-Saharan Africa, extreme temperatures and unpredictable rainfall have already affected income from agriculture and caused people to migrate from rural to urban areas. Agricultural yields are expected to face losses of up to 15 percent by 2050, signaling that further rural-to-urban migration in the coming decades is likely, along with the associated pressures on urban infrastructure and services (IFC 2017). More than 60 percent of the land projected to become urban by 2030 has yet to be developed (GCEC 2018) and smaller cities are growing faster than megacities, especially in South Asia and Africa. Lack of strategic and spatial urban planning could lock in inefficient, poorly designed and vulnerable urban infrastructure for decades to come.

> // Cities are places in which the risks associated with warming of 1.5°C, such as heat stress, terrestrial and coastal flooding, new disease vectors, air pollution and water scarcity, will coalesce

Climate change, along with other factors, may have future impacts on city competitiveness. Low carbon, resilient urban development pathways will be critical for creating attractive and livable cities that offer healthy and active lifestyles; clean air, green spaces, well managed waste and energy services, comfortable commutes and access to safe, resilient and green buildings. Investments in green infrastructure raise quality of life, which in turn, attracts talent and businesses. Green buildings3 can also lower the cost of living and help attract or retain talent in urban centers. Investing in resilience reduces costs to rebuild or repair; low carbon infrastructure planning and investments enhance energy efficiency and cost effectiveness, which can also help build resilience to financial shocks. On the other hand, not investing in climate smart urban infrastructure may have the opposite effect of future lost competitiveness and reverse urbanization, in some cases. Already today many large cities such as New York City, Chicago, Los Angeles, London and Paris, are beginning to see reverse urbanization due to the impacts of climate change or the problems that cause it such as pollution, congestion and inefficient housing.

The investment potential of climate-smart urban infrastructure is substantial. The anticipated growth in urban populations will require massive investment in climate-smart urban infrastructure, including energy efficiency, renewable energy sources for electricity, public transport and e-vehicle charging, water resources, and waste management. The Climate Investment Opportunities in Cities report identified $29.4 trillion of investment opportunities in developing countries across six urban sectors (renewable energy, public transportation, climate-smart water, electric vehicles, and green buildings) (IFC 2017). Realizing the investment potential of cities will require a focus on integrated urban planning and city spatial plans that promote low-carbon, compact urban development. The COVID 19 pandemic and crisis has exposed systemic vulnerabilities in urban areas and the importance of urban planning in achieving well-planned, optimized and well-managed urban density and form (Lall and Wahba 2020).

3 As defined by the World Green Building Council, a 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life. See https://www.worldgbc.org/what-green-building

Investment in urban resilience is important for the economy, for competitivity and for business at the local, national, and global level. Cities produce more than 80 percent of global gross domestic product (GDP) and are the economic powerhouses of most countries as they concentrate people, businesses, jobs and tax revenue, and provide goods and services (UNEP 2019; IFC 2017). However, climate- and disaster-related shocks can disrupt supply chains, essential services, and livelihoods. Climate change can also lead to health risks due to vector-borne diseases, extreme heat, pollution, as well as loss of productivity and an increase in unexpected expenses resulting from the need to repair or rebuild physical assets (IFC 2017). Upfront resilience and prevention have been found to have an economic return of $4 for each dollar invested (WBG 2019b). It is estimated across 279 cities that increasing urban resilience could protect as much as $73.4 billion a year of GDP from climate change risks (Lloyds 2018).

In spite of their investment potential, cities have unique challenges accessing finance and they need innovative approaches to leverage and attract private sector financing to fill the climate-smart investment gap. In general, cities rely primarily on reallocating existing municipal budgets or channeling tax revenue to fund investments and operating budgets for climate-smart infrastructure and services. However, the ability to mobilize private investment is shaped by the size, sophistication and institutional capacity of a city, which can vary widely even within the same country. Cities often face such barriers as limited or restricted bonding and taxation authority, low or no credit rating, limited capacity to structure bankable climate projects, and a lack of control over policies and enabling environment conditions that can encourage private investment. The combinations of these barriers in a given context will impact the financing modalities cities can use to attract private capital and at what cost (IFC 2017).

Private investors face their own challenges investing in urban climate projects. The risks associated with emerging markets and developing countries are still present in cities. These include political risks, such as breach of contract, currency convertibility and expropriation of assets, and macroeconomic risks, such as currency fluctuation and inflation. At the urban level, investors are often less familiar with municipal governments and their financial conditions and finding a pipeline of sufficient size and quality can be difficult.

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03

CLIMATE SMART CITIES

03 | Climate-Smart Cities

Although definitions vary, in general climate-smart cities[4] aim to minimize environmental damage, reduce air pollution and GHG emissions, and maximize opportunities to enhance urban resilience, improving the natural environment and overall livability of the city. On both the demand and supply sides, climate-smart cities are energy efficient; reduce reliance on nonrenewable energy sources; actively encourage waste reduction; and promote the circular economy, resilient low-carbon infrastructure, low-carbon transport, water management, green spaces, and nature-based solutions. Climate-smart cities must consider themselves as complex systems with interrelated dimensions (UNEP and UNISDR 2015; GFDRR 2015): functional (e.g., municipal revenue generation), organizational (e.g., governance and leadership), physical (e.g., infrastructure), and spatial (e.g., urban design). All these interventions require an integrated, systems-based urban and spatial planning framework to improve the quality of life of all residents (IPCC 2019; IEA 2017).

> // Cities are places of human convergence, where people live, work, and play. But beneath the bustle of any city are systems that make these hubs of humanity function. Cities are akin to living things that take in energy, metabolize material, and spit out waste. They consume and grow, using digestive, respiratory, and circulatory systems. And, like living things, cities can, with a nudge from citizens and their leaders, evolve in directions that increase their prospects for survival.
>
> *Garner G. 2016 The City: A System of Systems*

The level of municipal control and tools available for cities to influence and encourage resilient low-carbon public and private investment will vary according to sector, city, and national context, although, in general, a city has five roles to play in low-carbon investment.

1. On the demand side, the city is a consumer of goods and services, with the city and its citizens the end user. In certain instances, the city can act as a powerful demand side influencer, demand aggregator and green bulk procurer. Community Choice Aggregation (CCAs)[5] measures for example allow local governments to procure power on behalf of their residents, businesses, and municipal accounts from alternative renewable power sources.

2. The city can act as a regulator that offers incentives through local policies, regulations, standards, and subsidies. Cities can have substantial influence over local and regional policies and legislation that can influence and incentivize investments in carbon mitigation and climate resilience. Incentives could include instituting new tariffs and user fees for infrastructure, changing building codes, issuing business licenses, supporting electric vehicle charging infrastructure, energy efficiency financing for refurbishment (e.g.,

4 The term "city" may be defined very differently by region, geographic scope, population size and legal and governing authority and can include terms such as "city, town, district, municipality, local government or metropolitan area." For the purposes of this report – and its objective to shift investment in an urban environment towards low carbon, resilient infrastructure and catalyze private investment - the term "city" is all encompassing and refers to a heavily dense, non-rural area.

5 Further information available here https://www.epa.gov/greenpower/community-choice-aggregation

Property Assessed Clean Energy PACE[6]) and many other policy initiatives.

3. The city also acts as an investor and provider of goods and services when it has the independent mandate, purview, and financing to do so. Not all sectors fall within the finance purview of cities, especially utility scale energy, industry, and national or international transport.

4. The city mobilizes capital and raises funds from the private sector through financial mechanisms such as corporate taxes, municipal bonds, dedicated municipal trust funds, and public private partnerships (PPPs).

5. The city plays a role as a "system of systems" (Gardner G. 2016). Cities are akin to living things that consume and grow, using digestive, respiratory, and circulatory systems. As such it is important to also frame and consider financing and business models for urban infrastructure systems that deliver reliable, accessible, low carbon and resilient services to urban citizens – whether managed by the city, an operator or a utility. To enhance private capital for climate smart investments it is important to think of system creditworthiness as well as city creditworthiness (World Bank 2018).

Urban GHG Mitigation and Leveraging Private Investment

Reducing global GHG emissions requires transitioning our energy system away from fossil fuels to other forms of energy such as renewables. It entails focusing on energy efficiency, changing how we produce and consume goods, and removing carbon from the atmosphere. With rapid urbanization and other challenges such as technology disruptions, disease spread and global financial crises, cities are often in crisis mode, having to simultaneously address major challenges in crucial sectors such as traffic congestion, air pollution, urban sprawl, waste, and lack of reliable energy access. These challenges also constitute some of the main sources of GHG emissions in cities, with some of them within cities' control and as a result of their policies, and often much of them not.

GHG emissions will vary considerably from city to city, reflecting the structure of a city, its energy sources, and its residents' lifestyles (WB 2010), but in general come from five sectors: transport, buildings, energy, waste, and industry. To turn the main sources of GHGs in urban areas into opportunities for green growth, job creation, and livable neighborhoods, cities need integrated, systems-based approaches and spatial strategies that national government agencies support and that leverage finance. Similarly, the greatest opportunities for mobilizing private investment to support low-carbon cities include green buildings, urban renewable energy, urban green transport, circular waste, green industry, and urban farming.

> // With rapid urbanization, cities are in crisis mode in key sectors that are also the main sources of greenhouse gas emissions

Table 1 summarizes the main sources of GHGs in urban areas, potential solutions, and the level of municipal control. This is for illustrative purposes and will vary according to the specific municipal, regional, and national context and may not be an exhaustive list of measures available for cities.

6 One innovative financing mechanism used by local governments is to subsidize low-interest loans for homeowners to invest in renewable energy or energy efficiency, which they gradually pay back through slightly higher property taxes. This mechanism underpins the property-assessed clean energy (PACE) financing model used in the United States (PACE). Further information available here: https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs and https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_Renewable_Energy_in_Cities_2016.pdf

Table 1 Main Sources of Greenhouse Gases in Urban Areas, Solutions, and Level of Municipal Control

SOURCES	Transport	Buildings
SOLUTIONS	An Integrated Transport Plan that plans for compact cities and multimodal, networked, electrified, active and green transport systems: walkability, bikability; e-public transport (BRT, metro, light rail); e-vehicles (taxis, share-rides, private vehicles). Policy measures could consider: – Increasingly stringent emission standards for existing cars – Minimum fuel efficiency standards for new vehicles – Quotas for cars that can be registered – High-occupancy vehicle and bus lanes – Technology disruption, including self-driving and small flying vehicles.	An Integrated Systems Plan that promotes compact, green and efficient buildings and environment through urban form; centralized district approaches; building codes; zoning; appliance standards; Incentives (permitting, subsidies) and green infrastructure and nature based solutions such as trees, parks, green roofs, and water features to reduce urban heat island effect. Measures could include: – Energy efficiency financing for refurbishment (e.g., Property Assessed Clean Energy PACE) – Green mortgages for homes – Energy performance disclosures for buildings – Energy performance labels for buildings ('A' to 'F') – Cap-and-trade program for buildings
MUNICIPAL CONTROL	▷ **MEDIUM** Regional and national roads, highways, bridges, ports, trains under purview of national department of transport. Cities have purview over urban planning and form; in city road network, bus rapid transit, sidewalks, bicycle and pedestrian infrastructure, in city transit infrastructure such as metro, tram or light rail; Taxi and ride-share policy as well as parking fees and proportion of urban land dedicated to street parking and cars.	△ **HIGH** Heating, cooling, and cooking equipment standards and national building codes typically under a national department such as energy, housing or environment. Cities have purview over urban form, planning, zoning, building codes, district cooling and heating, permitting, inspection, and local financial incentives and financing approaches such as PACE.
	Integrated Urban Spatial Planning, Design and Form	

Energy	Waste	Industry
An Integrated Energy Plan fed by micro grids, urban grids and centralized utilities, supported by storage and renewable energy. Measures could include incentives for: – Rooftop solar on city-owned, residential and commercial assets. – Rooftop solar for slum upgrades and social housing. – Solar street lighting – Community Choice Aggregation (CCAs) measures that allow local governments to procure power on behalf of their residents, businesses, and municipal accounts from alternative power sources.	A plan to move towards a circular economy and zero waste concepts of "reduce, reuse, recycle (materials), recover (energy) and only then dispose" for solid waste and for water. This includes demand-reduction measures such as: – Reducing consumer packaging and extended producer responsibility; – Bans on single-use materials (e.g., plastic bags); – Encouragement for multiuse, recyclable, biodegradable materials – Pay-as-you-throw or landfill tax; – Investments in composting and landfill fugitive emissions capture; – Storm water diversion through urban design; incentives for permeable materials, green roofs, water gardens, and nature-based solutions for built environment	A plan to reduce final energy demand in industry by one-third through renewables, energy efficiency, and green infrastructure planning. Increase recycling of materials and the development of a circular economy in industry. Measures include: – Shifting to electrification of production processes where possible; – Increasing recycling and circular economy in industry; – Substituting towards renewable materials in high-carbon products (e.g., wood vs steel or cement in construction sector, natural textile fibers vs plastics); – Investments in green technologies such molten oxide electrolysis powered by renewables for greening steel; concrete for carbon sequestration; direct air capture technologies
▽ **LOW** Utilities and grid networks under purview of national department of energy. Although some cities may have municipal owned and managed utilities this is not the norm. Typically, cities can make independent decisions for rooftop solar on city-owned public buildings, social housing, and slum upgrades; incentives for solar roof top and upgrade street lighting Community Choice Aggregation (CCAs) measures are an attractive option for cities that want more local control over their electricity sources, more green power than is offered by the default utility, and/or lower electricity prices.	△ **HIGH** Cities have purview over solid waste management through urban planning, land zoning, waste collection, infrastructure investment for composting, landfill, waste to energy, incineration, and demand reduction measures (see above). Cities have medium purview over water supply, wastewater treatment and recycling, and storm water diversion, such as through urban design and incentives for permeable materials, green roofs, water gardens and nature-based solutions for built environment.	▽ **LOW** Industries located within cities must follow national environmental policies and safety standards. Trade-sensitive industrial sectors such as iron, petrochemicals, and fossil fuels make policy action by individual cities challenging because of competitiveness concerns. Cities have some limited levers of influence on industry through land zoning, permitting, and local taxation policies.
Integrated Urban Spatial Planning, Design and Form		

With rapid urbanization, cities are in crisis mode in key sectors that are also the main sources of greenhouse gas emissions

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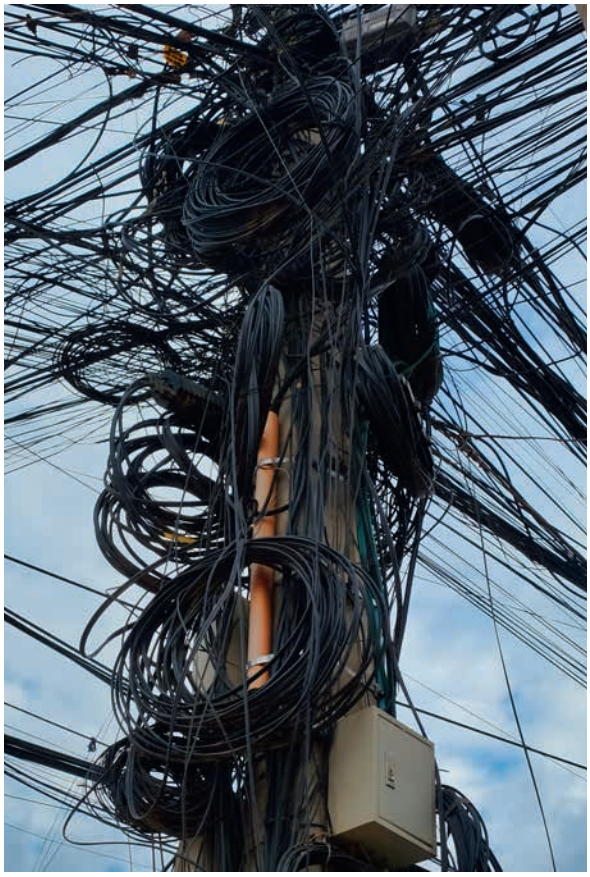

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Although cities have increasing needs for low-carbon investments, not all sectors fall within their financing purview, especially utility scale energy and industry. Nevertheless, in all sectors, cities can play a crucial role in pushing their urbanization and infrastructure systems toward sustainable low-carbon pathways. The city can influence private investment by purchasing, investing in and mobilizing capital for low-carbon goods and services as well as implementing policies and regulations that incentivize and prioritize emissions reductions and climate resilience. As highlighted in Table 1, cities can influence or direct private investment toward low carbon, resilient infrastructure through the implementation of standards, land zoning, permitting, taxation policies, or other incentives. One example of such measures includes the Mexico Improving Access to Affordable Housing Project highlighted in box 1.

The main drivers of urban energy consumption include the spatial form and design of the city; the coordination of resident and job densities; the accessibility of jobs, services, and amenities by walking, cycling, and public transportation; and the extent to which the built environment adapts to local climate conditions. The first three factors directly affect demand for motorized transportation, and the fourth affects operational energy demand of buildings (ESMAO 2014).

Compact city development and sustainable neighborhoods have been presented as models of development patterns that can address climate challenges and long-term resource, economic, and social sustainability. Cities need to steer present resource-intensive urban systems toward resource-efficient urbanization pathways for land, water, waste, transport, and energy demand. Density, land use mix, connectivity, and accessibility are critical determinants of urban form.

In turn, urban form and spatial planning (or lack thereof) are critical determinants of urban energy consumption and GHG emissions. Co-locating high residential densities with high employment densities, coupled with significant public transit improvements, high land-use mixes, and other supportive demand management measures can reduce emissions in the short term and generate even greater emissions savings over time. These mitigation strategies are interrelated and interdependent; pursuing any one of them in isolation is insufficient to lower emissions (IPCC 2014).

Box 1 Directing private finance toward housing that supports compact urban design: Improving Access to Affordable Housing Project

In the 2000s, federal housing subsidies in Mexico encouraged developers to build new units where land was cheapest – often areas that were furthest from jobs and services in central cities. While the subsidies provided many households access to quality housing, the poor location increased the time and commuting costs to reach urban areas. The Improving Access to Affordable Housing Project supports the government's demand side housing subsidy program which links the subsidy amount to the location of the housing unit. Beneficiaries who use the subsidy to purchase housing units that are closer to existing city centers and built-up areas are eligible for greater subsidies than are units located on the urban periphery, which discourages sprawl and congestion. To date, the project has supported more than 10,000 housing units in cities across the country. The project also supports complementary supply-side planning pilots for individual cities to unlock underutilized urban land for new housing. One of these has been completed in Mérida, Yucatan, and has provided a market analysis and financing plan to support new affordable housing in the city.

Thus, integrated spatial planning is an important city-level policy lever to shape urban development choices. It serves as a strategic point of engagement to analyze sources of urban emissions and urban vulnerabilities, identify local capacity to act and avoid carbon lock-in, model long-term implications of policy options and assess costs, benefits, and cost-effectiveness. The greatest opportunities for future urban GHG emission reduction are in rapidly urbanizing areas in developing countries where urban form and infrastructure are not yet locked in.

> // These mitigation strategies are interrelated and interdependent; pursuing any one of them in isolation is insufficient to lower emissions (IPCC 2014)

Urban Adaptation and Resilience

Urban resilience is about a city's ability to survive, adapt, and grow in the face of a wide range of shocks and stresses, including increasing frequency, intensity and complexity of hydrometeorological and other disaster events, exacerbated by the compounding effects of climate change. Urban resilience is becoming increasingly important as people (55 percent) and economic activity (80 percent of GDP), become more concentrated in cities and increasingly impacted by climate-related and natural hazards. In recent years the world has witnessed an increase in extreme heat, wildfires, air pollution, avalanches, wide-spread loss of wildlife; vector-borne diseases such as malaria and dengue moving into new regions (e.g. now in mountainous regions of Nepal and Bhutan) and droughts as a result of climate change.

At the city level, climate-related risks are expected to be very costly to cities and to reduce GDP. Without significant investment in resilience, cities worldwide may face $314 billion a year in damages by 2030 (GFDRR 2015), and this is a low estimate because it does not include the effect of events other than tropical cyclones, earthquakes, tsunamis, and floods, such as social and economic shocks and stresses. Similarly, it has been conservatively estimated that climate-related and natural hazards will cost cities an average of $226.4 billion annually in losses in economic output or GDP.

These threats can also compound one another. For example, unprecedented severe heat waves with temperatures exceeding 50 °C (123.4 °F), as seen in New Delhi, India; Cairo, Egypt; Tokyo, Japan; Paris, France – combined with a lack of preparedness – resulted in the loss of human life, reduced infrastructure performance such as train networks, and reduced economic productivity. Cities are even more vulnerable to heat events due to the urban heat island effect.[7]

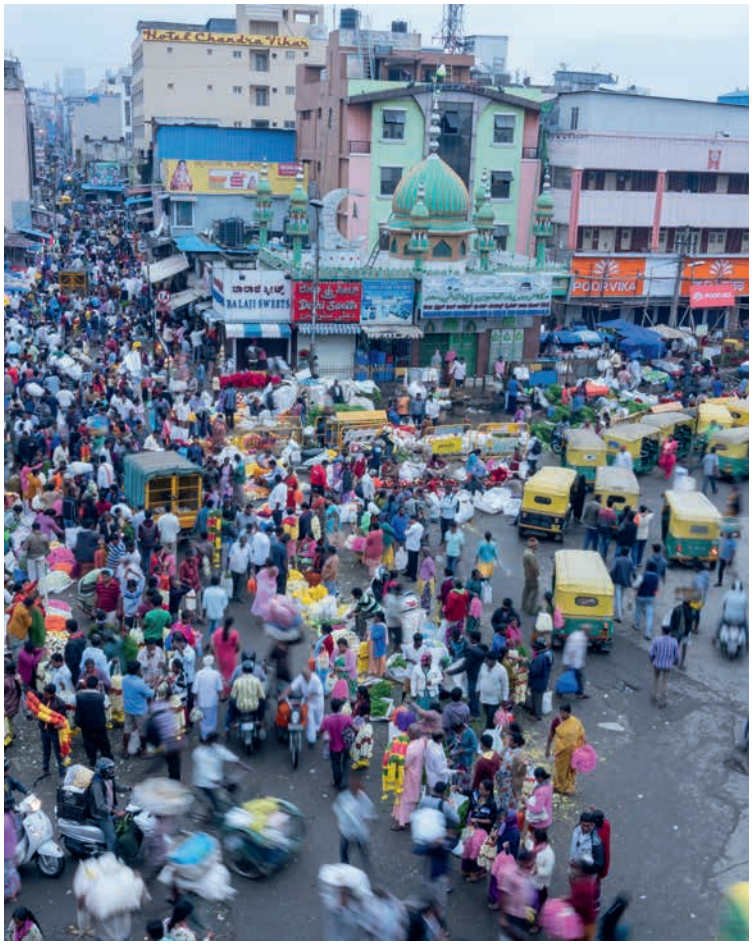
In urban areas, services, people, and systems such as transportation, energy, water, and communications are particularly interconnected, resulting in a co-dependent system that needs to be made resilient to technological, social, economic, political, health and cultural shocks at every link (IFC 2017; GFDRR 2015). Combining grey water infrastructure such as multipurpose reservoirs, flood control structures, and regional water supply networks with green infrastructure (also known as natural capital), such as floodplains, wetlands, mangrove forests, and coral reefs, can reduce disaster risks and protect other critical infrastructure, especially in urban areas. With built-up urban land cover forecasted to more than triple by 2030 (with projections of a seven-fold increase in Africa), it will be critical to continue investments to strengthen climate and disaster resilience.

7 Refer to footnote 2 for definition of Urban Heat Island Effect.

As urban populations grow, many cities are sprawling or building over floodplains, forests, and wetlands—putting more people and workers in harm's way, especially in rapidly growing, under-resourced cities in developing countries that have limited capacity to adapt to climate change (GCA 2019). With more people migrating to urban areas, rising land values often displace the most vulnerable and marginalized populations, forcing them to resettle in the areas most exposed to climate change-related hazards. These settlements are often informal and, in addition to being highly exposed to climate change, they are also not connected to critical services such as water and sanitation, electricity, and transportation. Enhancing cities' ability to respond to emergencies, support disaster preparedness, deepen financial protection, and finance long-term disaster resilience is critical to sustainable development.

In order to do this, municipal governments must be well-capacitated to coordinate risk-informed planning that identifies and prioritizes critical climate infrastructure and enables cities to reduce and prevent; prepare and respond; and restore and recover from disasters and shocks (GCA 2019). In cities, this goes beyond protecting individual infrastructure assets to ensuring that entire urban systems are resilient. Urban resilience investments include:

- enhancing climate-risk information and technical capacity;
- drawing on topographic and community-level data;
- promoting nature-based solutions for flooding and heat risks;
- upgrading living conditions, especially for people in informal settlements highly vulnerable to climate change;
- investing in resilient infrastructure and systems such as early-warning systems, multimodal transport, local and decentralized power, flexible flood management structures, stricter building standards, and telecommunications networks;
- and integrating urban design and spatial planning that consider extreme weather conditions, reduce displacement of people, and consider interdependencies and synergies across sectors, agencies, levels of government, and communities.



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As a foundation, integrated climate and disaster risk-informed urban and spatial planning will be crucial to establishing the best strategies and incentives across the three resilience elements. Ensuring that critical systems are resilient involves making the right choices about where and what to build and which assets to upgrade, prioritizing green infrastructure wherever possible, and guaranteeing that infrastructure continues to function even as damage occurs (GCA 2019). Table 2 provides examples of public investments to increase the resilience of cities in terms of prevention, preparedness, and recovery. Priority investments will differ according to location and local climate change related risks and hazards.

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Private Sector Investment in Urban Resilience

Unlike mitigation efforts, adaptation and resilience investments have historically struggled to mobilize private investment. Although overall global investment in adaptation had risen 35 percent to $30 billion annually in 2017/2018 from $22 billion in 2015/2016, nearly all of this is from public sources (CPI 2019). Global climate adaptation finance in cities has also been limited, with less than 5 percent of total adaptation finance spent on cities between 2010 and 2014 (GCA2019). Although some forward-thinking companies and investors are seizing opportunities to invest in urban resilience, this is still the exception, especially in developing countries, primarily because pure adaptation- and resilience-type projects are often considered (and structured) as public goods with little or no opportunity to generate near-market-return rates that attract private sector investment. The projects are often focused on averting losses from hazards (e.g., hurricanes) or chronic changes (e.g., drought) associated with climate change rather than generating revenue. They can be complex to value financially (e.g., ecosystem services provided by mangroves and habitat restoration) or to reach payback in the short term, for instance from a 50-year climate event (WBG 2019b). Nevertheless, although most adaptation and resilience financing comes from the public sector, there are opportunities to increase private sector investment.

Climate resilience presents a private investment opportunity and the private sector has an important role to play in terms of reducing, preparing, and responding to disasters and can provide investment, expertise, and innovation. Firms supplying food, products, or services to cities can make their own operations and supply chains more resilient and profitable by investing in adaptation. Data and finance companies can provide climate adaptation services to respond to market needs and can develop and expand insurance products that will provide contingent finance and create incentives for greater resilience.

Table 2 Examples of Urban Resilience Investments in Cities According to the Three Elements of Climate Change Adaptation

Reduce & Prevent	Prepare & Respond	Restore & Recover
Invest and maintain critical infrastructure that reduces risk, such as flood drainage, fire management, energy and transit systems.	Organize and coordinate across all units of municipal and national government. Establishin clear roles and responsibilities to reduce disaster risk.	Ensure that needs of affected populations are prioritized, with their support, to design and implement responses, including rebuilding homes and livelihoods.
Assess safety of schools, health facilities, retirement homes, public housing, and other public buildings and upgrade as necessary.	Assign budget for disaster risk reduction and encourage homeowners, low-income families, communities, businesses, and the public sector to invest in reducing risks they face.	Plan for and trigger emergency financing such as insurance and risk finance instruments; disaster reserve funds; private property catastrope risk pools; small business short-term disaster loans.
Apply and enforce building regulations and land use planning principles that factor in climate and natural hazard risk. Identify safe land for low-income citizens and upgrade informal settelements where feasible.	Maintain data on hazards and vulnerabilities. Prepare risk assessments to inform urban development plans and decisions. Ensure that information and city resilience plans are publicly available and discussed with public.	As part of disaster response, put in place social and economic saftey nets, unemployment and underemployment insurance, paid leave, health insurance, worker cash payments, fiscal risk strategies.
Embed nature-based solutions into planning and policy, most effective if deployed on landscape, ecosystem, or citywide scale. Protect ecosystems and natural buffers to mitigate floods, storm surges, and other hazards. Invest in tree cover, green spaces, green roofs, and permeable surfaces to increase water retention and lower heat island effect.	Install early-warning and emergency management systems and hold regular public preparedness drills. Provide education and training in disaster risk reduction in schools and communities.	Recovery services, including health and education.
Integrated Urban Planning, Design and Form		

Source: Adapted from GCA 2019, figure 1.3; IFC 2017, 35; GFDRR 2015, figure 4.3.

Structuring PPP projects to include green spaces that act as water sinks to prevent flooding, or urban parks that charge a fee are some innovative ways to channel private investments into urban resilience measures, which in turn improve the livability and competitiveness of the city. The creative economy[8] and sustainable tourism industry can also increase public awareness of and action on climate and resilience needs and support people-centered recovery strategies to restore the physical and social fabrics of cities after a disaster (UNESCO 2018).

The private sector can get ahead of regulatory trends and achieve a first mover advantage. Financial authorities, central banks, and large economic blocs are requiring companies and financial institutions with potentially high exposure to climate risks to conduct routine analysis and disclosure and are moving toward mandatory disclosure of climate risk. The private sector can gain a competitive advantage by anticipating these regulatory trends, mainstreaming climate risk into investment decisions, and embedding resilience in company priorities such as engineering design, research, technology, and innovation.

The private sector's climate resilience depends on the resilience of the community in which it operates. Business continuity depends on public infrastructure to stay resilient. Breakdowns in transport, communications, water, energy, and health systems can significantly reduce business continuity if workers cannot reach the workplace, suppliers cannot deliver, customers cannot make purchases, or workers are incapacitated because they lack access to health care. Natural hazards cause significant economic and business disruptions that cost households and firms at least $390 billion a year in low- and middle-income countries (WBG 2019b). Investing in and paying for resilience and prevention can help avoid much greater damage and costs in the future, with an overall net benefit of $4.2 trillion over the lifetime of new infrastructure in developing countries alone and a $4 return for each dollar invested (WBG 2019b). And this calculation is now likely to significantly increase as the global community learns from the experience of the COVID-19 pandemic and its ramifications. Greater incentives and new business models need to be created for the private sector to join the public sector in investing more broadly in resilient infrastructure and systems and nature-based solutions (GCA 2019).

From a pure investment perspective, climate change is an increasingly powerful macroeconomic trend with huge potential. As climate risks increase over time and impact all kinds of investments, the demand for companies that are either intrinsically resilient to natural hazards or that are involved in providing climate resilience solutions should grow. First, investing in existing companies whose technologies and solutions can help build climate resilience tools and scale their solutions as the problem gets bigger can generate extranormal growth for those companies and returns for investors, as well as measurable impact on the climate change problem itself. Second, climate resilience investments are a natural hedge against climate change risk impacting the real economy. The Wall Street Journal called PG&E, a California-based utility provider, the first climate change bankruptcy in January 2019, and BlackRock identified underpriced risk in many assets including coastal real estate (Blackrock 2019). Third, climate resilience investments will be more related to the increasing impact of climate change than, for example, the credit cycle or trade conflict (Kerschberg 2019). The Lightsmith Group, a private equity investor, has identified 20 sectors of the economy representing $130 billion of current market size, that are related to climate change resilience. Those market segments are already growing 20-30 percent per year and will likely grow faster (Kerschberg 2019). According to a recent survey of the world's biggest companies, climate adaptation products and solutions could result in $236 billion in increased revenue (GCA 2019).

8 The creative economy the refers to infrastructure, resources and processes for the production, distribution, and sale of creative cultural goods such as music, crafts, audio-visual products, theater, cinema, and books in both formal and informal economies.

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The private sector is increasingly engaging in resilience through innovative financing approaches and business models. Private capital is seeking ways to enable businesses, governments, and households to adapt to climate change. For example, there are opportunities to leverage commercial capabilities, a practice common in risk modeling, disruptive technologies, and insurance that needs to expand to focus on how disasters affect jobs, firms, competitiveness, and critical supply chains. In the hydrometeorology sector, there is growing interest in PPPs, because the private sector has an important role to play as both producer and consumer of customized and improved weather services. That said it is important that public roles in hydrometeorology services not be compromised, particularly in functions related to enforcing standardized approaches to weather observation and data sharing (WBG 2020). Table 3 provides examples of private sector mobilization for the three elements of resilience.

Table 3 Examples of Private Investment, Expertise and Innovation Categorized According to the Three Elements of Climate Change Adaptation

Reduce & Prevent	Prepare & Respond	Restore & Recover
Invest in resilient Infrastructure: buildings, built environment, trunk systems (transit, water, energy, information and communications technology).	Provide data intelligence and real-time analytics (cell phone, software, geospatial and drone companies).	Design and provide insurance and risk finance instruments.
Invest in nature-based solutions (tourism, agriculture, land value capture).	Contribute to early warning systems and social resilience platforms (e.g., communication companies; traditional, online, and social media companies; the creative economy).	Provide recovery services, including health (clinics) and remote work and education (online cloud services), temporary housing in private real estate (hotels, Airbnb, rentals).
Mainstream climate risk into investment decisions and resilience into workforce staff incentives and engineering design, research, technology, and innovation.	Increase first responder access to critical supply chains: key equipment, medication, trained staff, emergency buidlings.	Encourage investment in resilient and green infrastructure through private-public partnerships, green public procurement, building standards.
Integrated Urban Planning, Design and Form		

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04

BARRIERS TO EXPANDING CLIMATE-SMART URBAN INVESTMENT

Cities face unique challenges in accessing and attracting private capital. Urban climate projects can differ significantly from large-scale national projects; to be successful, all stakeholders must tailor their approach to the unique national context, local capacity, project characteristics, and implementation challenges that can limit the expansion of solutions and increase time and due diligence costs.

There are three things to consider when framing the challenges of mobilizing private investment in urban climate action.

The first is the role of cities as government authorities in mobilizing private investment in urban infrastructure. Many of the barriers cities face in attracting private investment are rooted in their limited control over broader enabling environmental conditions, such as national policies and regulations, and limited institutional capacity to plan and design climate-aligned investment opportunities for the private sector (C40 and ODI 2019).

The second is the role of cities as investors in urban infrastructure. Globally, cities vary widely in their ability to borrow money, with only 5 percent of the 500 largest cities in developing countries with a credit rating on international capital markets and only 20 percent with a credit rating in local markets (World Bank 2018). In addition, 56 percent of countries forbid any kind of borrowing by local governments, excluding them from issuing municipal bonds, and only 16 percent grant any taxation authority to local governments (Coalition for Urban Transitions 2019b, Ivanyna and Shah 2012). Both restrictions limit cities' ability to raise the capital needed to finance their climate plans.

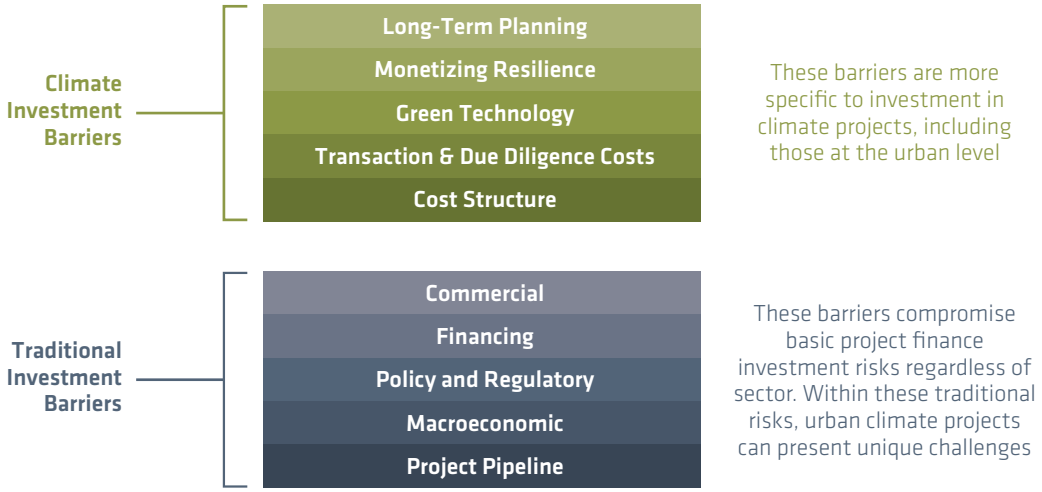
Cities also have limited direct access to catalytic development finance that could be used to unlock private investment. Multilateral and bilateral development finance institutions[9] are traditionally oriented to work at the national rather than the municipal level, although they are still an important source of urban climate investment, and climate funds such as the Green Climate Fund, Adaptation Fund, and Global Environment Facility are not directly accessible to cities, which must go through national ministries, where there can be tensions and competing priorities (C40 and ODI 2019).

The third is how cities mobilize capital from private investors. Historically, private and institutional investors have had limited familiarity with financing sustainable infrastructure projects at the municipal level (Blended Finance Taskforce 2018). Some investors may also be subject to financial regulations that prohibit or restrict them from investing in developing countries or in infrastructure anywhere (Blended Finance Taskforce 2018). Although projects may take place at the municipal level, investors are also wary of the risks at the country level, including currency and exchange rate fluctuation, inflation, and political risk (C40 and ODI 2019). Private investors can also find it challenging and time consuming to access blended finance, which could be used to reduce the risks of some of these challenges.

Although urban climate investment projects in developing countries face all these challenges, these challenges are not exclusive to these types of projects. Two interconnected sets of barriers must be overcome to expand private urban climate investment in developing countries. The first set of barriers are traditional project finance challenges, and the second set of barriers is more unique to climate projects. Considering these risks together allows investors and other stakeholders to better understand the complex web of challenges

9 National and international development finance institutions (DFIs) are specialized development banks or subsidiaries set up to support private sector development in developing countries. They are usually majority-owned by national governments and source their capital from national or international development funds or benefit from government guarantees. This ensures their creditworthiness, which enables them to raise large amounts of money on international capital markets and provide financing on very competitive terms. See https://www.oecd.org/development/development-finance-institutions-private-sector-development.htm

Figure 1 Private Sector Investment Barriers



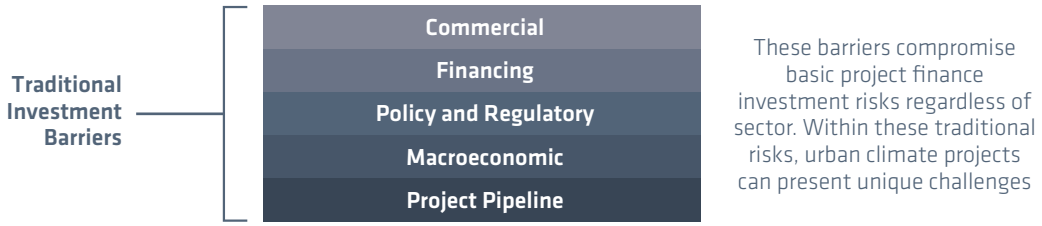
to expanding investment in urban climate projects and how they build on one another. Figure 1 provides a visual stacking of these two sets of investment barriers and their interlinkages.

This section will examine barriers to expanding urban climate investment. The first part of the section will examine traditional investment barriers and how they manifest in urban climate projects; the second part will examine a set of barriers specific to or strongly exacerbated in climate projects. Solutions to these barriers will then be explored in case studies.

Traditional Investment Barriers

This section reviews traditional barriers to private investment and how these barriers manifest in urban projects, summarized in figure 2. There is an additional focus on how these urban project finance barriers are exacerbated in climate-aligned investments as a result of the complexity of climate projects and intricacies of the climate finance architecture. Each barrier impacts the various stakeholders, including cities as both a government authority and as an investor, as well as private investors, involved in urban projects differently.

Figure 2 Traditional Investment Barriers



Project Pipeline Barriers

Cities

As government authority

- Limited capacity to develop bankable[6] climate-friendly projects and prepare projects of sufficient size and quality for commercial financing
- Limited capacity to manage diverse stakeholders
- Limited early-stage project preparation financing

Private Investors

- Unaccustomed to working with municipal governments; limited understanding of city projects
- Limited standardization of term sheets for portfolio aggregation to counter project ticket size

A major barrier to private investment in climate action is a limited supply of bankable projects of sufficient quality and size that offer fair risk allocation between public and private capital.

The lack of quality projects is frequently attributed to limited local government capacity for designing and structuring deals that are attractive to private investors, combined with weak project-related contractual frameworks, including international arbitration and currency convertibility provisions. This shortage of internal capacity is especially pronounced in developing country cities. To implement and fund their climate action plans, cities will need to significantly increase their capacity to identify, prioritize, and prepare bankable projects and ensure their successful implementation. In addition, climate-related projects often require technical, feasibility, and impact studies which cities struggle to afford because public budgets are tight and cities have limited direct access to external project preparation finance and support.

Even in cases in which urban projects have been well structured, they are often too small for institutional investors[11] and come with a high cost of capital as a result of limited concessional finance (C40 2018). Investors, especially larger ones, struggle to justify the transaction costs for small projects, which are often equal to those of larger projects, even if the internal rate of return meets or exceeds their expectations. "Assets such as energy-efficiency investments in buildings and micro power generation are often impractical for traditional large investors to finance. Admittedly, many of these projects receive some form of concessionary capital that should improve risk-adjusted returns, but the complicated processes involved in securing funding from development banks and other investors can create bureaucratic hurdles that slow project preparation and push up transaction costs" (CCFLA 2015).

To help address the critical need for project preparation support and pipeline size, the Global Infrastructure Facility was established in 2014 as a G20 initiative[12] to support governments at the national and subnational levels—including cities—and multilateral development banks with funding and hands-on technical expertise to design and structure infrastructure investment opportunities that are attractive to private capital.[13] It was designed to address pipeline size through

10 The term "bankable" means that a project has sufficient collateral, future cashflow and probability of success to be accepted for financing by a commercial bank or institutional financing.

11 C40 The Demand for Financing Climate Projects in Cities. Forty-five percent of projects surveyed for investment are less than $10 million.

12 G20 is an international forum for governments and central bank governors of 19 countries and the European Union.

13 See https://www.globalinfrafacility.org/sites/gif/files/GIFBrochure.pdf

standardization, aggregation, and concerted private sector engagement to generate interest in projects.

However, even in cases in which cities have the capacity to prepare bankable projects, private and institutional investors often have limited understanding of cities and their financial conditions and consequently may be reluctant to invest in urban infrastructure, green or otherwise (C40 and ODI 2019). Private investors are also often wary of investing in some of the rapidly evolving climate technologies that cities need to meet their climate action plans. The combination of inexperience with municipal governments and the potential technological risks of new climate technologies can deter private investors from urban climate projects in spite of the multi-trillion-dollar opportunity (IFC 2017).

Case study 1 in the next section of the report describes a dedicated fund that supports cities to build a quality pipeline of projects and then mobilize institutional investment. The International Municipal Investment Fund, which the United Nations Capital Development Fund developed and Meridiam SARL manages, sources projects directly from municipalities. It uses concessional capital to support municipal governments and developers with project development and preparation, including increasing the sustainability and resilience elements of projects and their financial bankability, and then mobilizing private investment from institutional investors.

Case Study 2 introduces The City Climate Finance Gap Fund, currently in development, that will provide financial and technical support upstream specifically to support pipeline identification and feasibility studies for low carbon resilient urban investments primarily in rapidly urbanizing cities in developing countries.

Macroeconomic Barriers

Cities

As government authority

- Lack of influence over monetary policy

Private Investors

- Foreign exchange risk
- Inflation
- Interest rates

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Many of the greatest barriers to long-term private infrastructure investment in developing countries are macroeconomic risks that apply to all investments, including currency fluctuations, inflation, and interest rates (GCEC 2018).

For foreign investors, currency volatility is one of the most pervasive challenges to investing in developing countries over the long term. Foreign investors typically denominate their balance sheets in hard currencies such as dollars, euros, or pounds, and investments in local currencies, especially for long-term infrastructure projects. This creates an asset-liability mismatch which can expose them to significant foreign exchange risk (Blended Finance Task Force 2018). Denominating projects in hard currencies can be better for foreign investors but exposes the local off-taker to more foreign exchange risk, which presents its own challenges.

Some solutions to circumventing currency challenges include hedging instruments, local-currency financing for the private sector, and issuing developing country bonds on foreign exchanges. For example, The Currency Exchange Fund (TCX) pools foreign exchange risk into a global fund with a first-loss tranche that allows foreign lenders to provide local-currency loans while Guarantco offers local currency guarantees. To mitigate the risk of currency fluctuations and asset-liability mismatch in the private sector, international financial institutions such as the IFC can provide local currency financing, including loans, swaps, guarantees, and risk-sharing facilities.[14] Another strategy for managing currency risk is to create pathways for developing countries and municipal governments to issue debt in their local currency on foreign exchanges, such as India's Masala bonds on the London Stock Exchange, where investors rather than borrowers bear the currency risk.

However, at present, none of these options are sufficient to mitigate currency risk at scale and more-sustainable solutions will need to come from more-developed local capital markets and an expansion of local currency financing through local and international commercial banks (IISD 2015). Some of these macroeconomic challenges can also be mitigated by bringing more developing country institutional investors, who have more than $5 trillion in assets under management, into deals (Blended Finance Taskforce 2018). Local institutional investors, whose balance sheets are usually denominated in local currency, are less exposed to currency risk and are often not bound by the same international financial regulations (see chart of institutional investor regulations in appendix 3) that international institutional investors must follow. These local investors also have a greater understanding of domestic markets and can be more comfortable pricing country and political risks.

Bringing local and international investors together in a deal can have powerful co-benefits. According to investors convened by the Climate Finance Leadership Initiative, "the willingness and ability of the host country and its population (pensions, entrepreneurs, sovereign wealth funds, development banks, etc.) to invest alongside international investors on pari passu or junior terms can also demonstrate local will and execution capacity, as well as local and non-local financial alignment (CFLI 2019)."[15]

Although these macroeconomic challenges influence the financial viability of municipal projects, as government authorities, cities have limited capacity to mitigate these risks for investors because

14 IFC has provided more than $13 billion in local currency financing. See https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/Solutions/Products+and+Services/Treasury-Client-Solutions).

15 Investopedia defines Pari-passu as a Latin phrase meaning "equal footing" that describes situations where two or more assets, securities, creditors, or obligations are equally managed without preference. An example of pari-passu occurs during bankruptcy proceedings: When the court reaches a verdict, the court regards all creditors equally, and the trustee will repay them the same fractional amount as other creditors at the same time.

they lack direct influence and control over foreign exchange, inflation, and interest rates, which are usually under the purview of central banks.

On the international stage, two networks have formed to share best practices and experiences on macroeconomic, fiscal, and public finance management policies for low-carbon, climate-resilient growth which should have a positive ripple effect on cities ability to attract private investment. The Network of Central Banks and Supervisors for Greening the Financial System, launched in 2017, is a group of central banks and supervisors willing to share best practices, contribute to the development of environmental and climate risk management in the financial sector, and to mobilize mainstream finance to support the transition to a sustainable economy. Similarly, the Coalition of Finance Ministers for Climate Action, which the World Bank and the International Monetary Fund co-convened for the first time in 2018, recognizes the unique role of finance ministers in addressing climate challenges and developed the Helsinki Principles and the Santiago Action Plan (World Bank 2019; Coalition of Finance Ministers for Climate Action 2019).

The coalition brings together 50 finance ministries and institutional partners, including the United Nations Development Programme, the Organization for Economic Cooperation and Development, the United Nations Framework Convention for Climate Change Secretariat, the United Nations Environment Programme Finance Initiative, the European Commission, and the NDC Partnership. While cities are not explicitly or directly included in these international processes and coalitions, addressing the macroeconomic barriers that impede private investment at the national level will likely have positive impacts for cities who must also operate within the national context. However, as cities are key levers in the transition to a resilient low-carbon world, more efforts should be made to engage cities in these international processes and coalitions and include them as important climate stakeholders from the beginning.

Policy and Regulatory Barriers

Cities

As government authority

- Lack of vertical alignment between national and subnational governments
- Limited control over policies and regulations to encourage private investment, including well-designed concessions, well-regulated tariffs, and consistent technical standards for hardware, electricity quality, and grid expansion
- Lack of strong, efficient, impartial domestic dispute resolution systems

Private Investors

- Repudiation or breach of contract
- Currency convertibility, transferability, and funds expropriation risk
- Restrictions related to international financial regulations (e.g., capital requirements, treatment of guarantees)

Long-term private investment in infrastructure, green or otherwise, requires an effective enabling environment, including strong rule of law with clear rights and obligations of private investors, and an efficient, transparent, and impartial dispute resolution system. Low-carbon projects can be particularly sensitive to policy and regulatory risks, such as tariff fluctuations for renewable energy. The risks of policy reversals and renegotiations, which can be only partially covered through political risk insurance, is a major concern for developing country investors (CFLI 2019).

Cities often lack control over policies and regulations that shape strong enabling environments for private investment and are subject to policy directives of national governments. The fiscal constraints

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that national governments place on cities increase investor risk sensitivity, which can make it especially difficult to attract private investment to cities in developing countries where there is often uncertainty over the policies that impact the financial viability of investing in low-carbon and climate resilient infrastructure, such as tax subsidies.

In addition to concerns about local regulations and policy conditions, international financial regulations prevent foreign institutional investors, including banks, pension funds, and insurers (see appendix 3 for chart on institutional financial regulations according to investor segment) from investing in emerging markets and alternative assets[16] such as infrastructure. Depending on where the investor is based, different regulations and requirements apply, including liquidity, leverage, and collateral requirements. As a result of these regulations, many foreign institutional investors avoid investing in emerging markets and infrastructure even when local enabling environment conditions are attractive (Blended Finance Taskforce 2018).

Case study 3 explores the combination of policy and financial risk-reduction tools that the municipality of Yerevan in Armenia, along with UNDP and local financial institutions, is deploying to create targeted financial incentives to address market barriers to private investment in urban energy efficiency.

Financing Barriers

Cities

As government authority

- Limited direct access to climate funds and development finance that could reduce risk of private investment

As investor

- Lack of creditworthiness of cities, who are often constrained by the creditworthiness of their host country, which can be misaligned with the city's creditworthiness
- Limited ability to raise debt or taxes to finance projects
- Limited access to affordable, concessional co-financing, especially in local currency

Private Investors

- Underdeveloped capital markets (notably corporate bond markets)
- Limited access to risk-capital, first-loss financing, or junior tranche equity to reduce risk of commercial investment
- Lack of standardized term sheets, limiting portfolio financing

Many developing countries, and consequently the cities within them, face extreme barriers to accessing finance. Ninety-three percent of low- and

16 Alternative investments are assets other than stocks, bonds and cash such as hedge funds, private equity funds, commodities, infrastructure, and real estate.

lower-middle-income countries are below investment grade or are unrated, which poses a significant challenge to raising debt financing (NCE 2018).

For debt investors, whether the counterparty is a government or private project developer, there are often serious concerns about whether off-takers have sufficient balance sheets, track records, and management and operations systems to meet their requirements. Even with credit enhancements and other tools such as guarantees and political risk insurance, credit rating agencies will rarely pierce the sovereign credit ceiling[17] for a bond. For equity investments, commercial and institutional investors often consider the risks of infrastructure financing to be too high (NCE 2018).

The creditworthiness of host countries, which does not always align with cities' creditworthiness and limits their ability to borrow money, often constrains cities.[18] Approximately 5 percent of the largest 500 cities in developing countries are deemed creditworthy in international capital markets, and only 20 percent can access local capital markets (World Bank 2018). Development finance institutions can enhance cities' creditworthiness through financial structuring, guarantee instruments, and anchor investments, and can support cities in issuing green bonds for climate projects. Johannesburg was the first city in a developing country to issue a green bond, in 2014 and other cities and subnational entities across Asia, Africa, and Latin America are considering issuing green bonds to finance their sustainable infrastructure needs (C40 and ODI 2019). Initiatives, such as World Bank City Credit Worthiness Initiative supports cities in budget management to attain A or B level international or local credit ratings through capacity building and technical assistance.[19]

Even cities in developing countries that are deemed creditworthy in international capital markets can be downgraded because of factors beyond their control, including climate risks. For example, in 2017, Moody's downgraded Cape Town, South Africa, when a major drought threatened its water security.[20] Downgrading a city's creditworthiness directly affects its ability to benefit from private investment and to borrow capital, and the cost of that capital, which creates a vicious cycle when cities are looking to implement projects that would reduce their emissions and increase their resilience to climate-related hazards.[21]

In addition to challenges of creditworthiness, national regulations may limit cities' ability to raise capital and fund projects, climate or otherwise, themselves. "Fiscal constraints on sub-sovereign finance—including limited capacity to impose taxes or fines that could provide a revenue base, as well as the inability to borrow from national governments, or issue municipal bonds, remain a primary barrier to investment. This means that the funds directly held by city governments will only be able to supply a small proportion of the additional resources required to build low carbon climate-resilient infrastructure. These constraints are closely tied to creditworthiness and the ability to access local and international capital markets" (C40 and ODI 2019).

A global World Bank study found that only 16 percent of countries sampled granted significant taxation autonomy to local governments, which limits their ability to raise capital to fund climate

17 Rating agencies such as S&P and Moody's will rarely allow corporate or municipal issuers to be rated above the sovereign home country credit rating. See https://www.cfainstitute.org/en/research/cfa-digest/2017/09/dig-v47-n9-3

18 Cities can receive investment-grade credit ratings in local debt markets even in countries that are speculative grade on the international markets. This opens a possible channel to debt financing for well-managed cities in lower-income countries. For example, capital cities Dakar (Senegal) and Kampala (Uganda) have achieved an investment-grade rating in their local markets despite international sovereign ratings of Senegal and Kampala being below investment grade (NCE 2018).

19 See https://www.worldbank.org/en/topic/urbandevelopment/brief/city-creditworthiness-initiative

20 See https://www.moodys.com/research/Moodys-revises-the-outlook-of-the-City-of-Cape-Towns--PR_395926

21 See https://insideclimatenews.org/news/04082019/climate-change-ratings-agencies-financial-risk-cities-companies

projects (Ivanyna and Shah 2012). National governments also limit local borrowing: 89 of 160 of countries forbade any kind of borrowing by local governments, and only 22 allowed local governments to borrow without restrictions (Ivanyna and Shah 2012). As a result of restricted access to local and international finance, cities in developing countries are forced to make investments on a pay-as-you-go basis, meaning that capital expenditures for infrastructure and other urban projects are restricted to funds available in a given fiscal year. This makes it particularly difficult for these cities to engage in coherent infrastructure portfolio planning or to choose options that might cost more upfront but have a lower total cost of ownership.

Beyond regulatory restrictions on raising debt through bonds and revenue through taxes, cities face unique obstacles to financing projects, including limited access to development finance from climate funds and development finance institutions. It is difficult for cities to access financing from international climate funds such as the Green Climate Fund, Adaptation Fund, and Global Environment Facility because applications must be channeled through the national government focal point. Although development finance institutions are an important source of financing for cities, these institutions must generally work with national rather than with subnational entities. Although careful application of concessional capital can mitigate risks and improve the bankability of select eligible projects, it is not a panacea for the financing challenges that cities face.

Private investors face their own financing challenges with urban investments, such as project size, underdeveloped local capital markets, and difficulty accessing concessional risk capital. "Private investors lack incentives to incur the transaction costs associated with urban financing models, including the aggregation and standardization that may be required for smaller projects, while perceptions of country, currency and exchange rate risk and uncertain development and transaction costs can deter investors whose asset allocation may limit their exposure to low-income countries" (ADB 2017).

Although concessional risk capital can increase risk-adjusted returns for municipal projects, investors can struggle to access this financing or find the process too lengthy and cumbersome (Blended Finance Taskforce 2018). In addition, underdeveloped or nonexistent capital markets in developing countries limit liquidity if an investor wants to exit, which reduces the attractiveness of investments in these markets.

Case studies 4 (Breathe Better Bond), 1 (International Municipal Investment Fund) and 5 (Shanghai Green Urban Financing) present examples of how municipal bonds, guarantees, technical assistance, and mezzanine risk-reduction facilities developed by the IFC, World Bank, and UNCDF can crowd-in urban climate investment.

Commercial Barriers

Cities

As investor

- Consumer demand, including stability and growth prospects for infrastructure services and competitive environment
- Local developer and contractor capabilities, particularly with regard to construction and operation
- Overall size of market (stability and growth prospects) limiting size of project or investment and ability to replicate or expand

Private Investors

As investor

- (Same as above)

Commercial risks—risks inherent to the project or the market in which it operates (commercial viability and revenue risk, construction risk, operating risk, input supply risk, and force majeure risk)—also present barriers to investment, particularly in developing countries. All these risks limit the ability to structure the project to provide a reasonable economic return to investors in any market and can be more pronounced in developing countries. Furthermore, commercial risks often result in high interest rates for cities. In a context where cities need to balance affordable service delivery with their own financial sustainability, this may impact whether a project is considered viable or not.

As per the discussion above, the bankability of climate investments will vary depending on whether the investment is in a mitigation-type project, in which there is more market experience in monetizing, creating revenue streams, and allocating risk efficiently, rather than an adaptation-type project, which the market typically perceives to be a public good with no or limited market-rate returns.

Designing projects well to reduce commercial risks and getting them to a bankable state is typically expensive and can be cost prohibitive for municipalities. The capacity of municipal governments to provide experts with the knowledge to navigate these challenges is also often limited. As such, initiatives to make standardized, project frameworks, such as the Open Source Solar Contracts[22] that the International Renewable Energy Agency (IRENA) recently released, the Terrawatt Initiative, and other programs such as the IFC Scaling Solar[23] program, readily accessible can help cities overcome these commercial barriers.

Case study 6 provides an example of innovative dedicated support from the City Resilience Program that is helping cities identify and build bankable transactions in resilience.

Climate Investment Barriers

This section highlights barriers specific to climate projects and how they compound and build upon traditional project finance risks, summarized in figure 3.

Cost Structure (Higher Upfront Costs, Lower Operating Costs)

Many climate-mitigation projects, including renewable energy and electric transport, have higher upfront capital expenditures than conventional fossil fuel alternatives but lower operating and overall costs. The higher upfront costs of making a project low carbon and climate resilient, usually 5 percent to 10 percent (Bouton et al. 2015), can be difficult for investors (government and private) to justify given the time it can take for these projects to pay off, despite reducing the overall

Figure 3 Climate Investment Barriers

22 See https://opensolarcontracts.org/
23 See https://www.scalingsolar.org/

cost of ownership. It is difficult to pass these upfront costs on to consumers, and it is likely that a decision by government officials to do so would be politically unpopular. Large upfront urban investments that have long implementation timelines are also challenged by political and mayoral election cycles, where political officials wish to demonstrate quick wins and results within their terms in office.

Green bulk procurement is one approach to aggregating demand, providing a market launch pad that helps suppliers achieve economies of scale and reduce costs. Globally, public procurement accounts for 10 percent to 15 percent of GDP—much of which is from cities. This represents a huge degree of purchasing power (IFC 2017). Green procurement models should consider the total cost of ownership over the lifetime of the investment, rather than just the upfront cost (e.g., rooftop solar, e-buses). Green procurement models also need to include a mechanism to manage the risks and uncertainties of new technologies, such as financial leasing and operational leasing mechanisms instead of upfront purchase (WRI 2019).

Case study 7 describes an innovative approach to green procurement of e-buses in Santiago, Chile.

Higher Transaction and Due Diligence Costs

Low-emission and climate resilient urban infrastructure can incur high transaction and due diligence costs which reduce returns and increase projects costs, deterring critical investment by cities themselves and outside investors. "Transaction costs are already higher for infrastructure than many other asset classes and are then magnified by the real and perceived challenges of new green technology, the small scale of some projects, and the complexity of cities' project development and financing systems" (CCFLA 2015). Other things that can increase transaction costs include a high-cost of capital, high due diligence costs and inefficient processes, all of which can create additional hurdles for financing small projects because transaction costs are often fixed.

One solution to financing smaller climate projects and reducing transaction and due diligence costs is to bundle projects together. Bundling smaller projects also has the advantages of improving liquidity, diversifying risks, enhancing underlying creditworthiness, and creating separate tranches of capital that appeal to different types of institutional investors. In addition to bundling projects, standardizing successful models once they have been proven could reduce transaction costs for funding climate projects in the $1 million to $5 million range that often struggle to access capital, although because blended finance transactions are often designed to meet the needs of specific investors and are often based on country and sector contexts, they can be difficult to replicate and expand.

Case study 1 outlines an innovative example of bundling climate projects into an urban climate fund structure to help lower transaction costs for pooled investment. Case study 7 features another approach where cities to act as aggregators of demand through green bulk procurement, enhancing economies of scale and reducing transaction costs of private sector developers and providers of resilient low-carbon solutions.

Green Technology Risk

A fundamental barrier to private investment in many climate projects is the underlying risk of newer technologies. Many of the green technologies that cities are looking to incorporate into their climate action plans, including battery storage, electric vehicles, and waste-to-energy projects, have not run through their projected lifespan, so there is insufficient data covering performance over the asset lifespan. This data gap introduces levels of risk and uncertainty that many investors, governments, and project developers may be unwilling to accept. "The lack of experience with and performance data for many sustainable technologies, such as anaerobic digestion for waste-to-energy projects, adds to the complexity and cost of investors' due diligence" (CCFLA 2015).

Many green technologies are also evolving at such a rapid rate (e.g., rapid improvement and corresponding cost decline of solar photovoltaic in parallel with battery storage) that it is difficult to keep track of the latest improvements, and technologies quickly become obsolete or more expensive than future iterations. Introducing new green technologies can also require restructuring legacy systems and development of new laws and regulatory frameworks, which can delay adoption. However, as more green technologies become mainstreamed and run through their lifecycles this barrier may become less of a challenge over time.

Case study 8 features the case of urban vertical farming – a disruptive farming approach that is attractive to investors and has significant potential to help fight climate change and increase resilience in cities.

Monetizing Resilience Investments

As discussed in the previous section, one of the barriers to greater private investment in climate adaptation and resilience is the challenge of monetizing benefits and identifying clear revenue streams that would allow investors to recover their full costs over the lifetime of an asset. Adaptation and resilience projects are often focused on reducing losses from event-driven or acute effects (e.g. severe weather events) and long-term or chronic changes (e.g. drought) associated with climate change rather than generating revenue. Large infrastructure adaptation projects can incur high upfront costs and may not prove their value for decades, such as infrastructure built to withstand 50- or 100-year flood events (CCFLA 2015).

These projects can also involve the complex challenge of quantifying the value of natural capital such as coral reefs and mangroves in mitigating the effects of hydrometeorological and other natural hazards exacerbated by the compounding effects of climate change. This challenge is complex for a combination of reasons, including the inherent difficulty of monetizing socioeconomic benefits; the often large and diverse stakeholder groups, including vulnerable populations without the ability to pay for benefits from the interventions; and uncertainties related to climate effects and timing of benefits that depend on when an extreme climate event might occur (WBG 2019b).

In order to monetize investment, governments, cities, and the private sector need approaches to properly price risk and incorporate costs of externalities into economic analysis and financial planning. However, although insurance and catastrophic risk-transfer markets offer proxy markets to price risk, this is complex, because there is no single metric, such as a price on carbon for climate mitigation, that applies to all sectors and countries. Many climate risks are local, and risks and prices will differ according to location (GCA 2019). Much more international collaboration is needed to produce global data on hazards and exposures, calculations of probabilities, and knowledge of local conditions and vulnerabilities, and to create new risk management products and pool risk across countries. To help coordinate efforts across the private sector, the World Economic Forum, Willis Towers Watson, the Global Commission on Adaptation, the Government of the United Kingdom, and the Government of Jamaica are developing the Coalition for Climate Resilient Investment, a private sector–led coalition with assets of $8 trillion that brings together companies all along the infrastructure investment value chain (IIGCC 2019).

In addition, establishing clear climate goals, including at the city level, is particularly important for many essential adaptation projects that may not be bankable in the traditional sense but could attract investment if prioritized. Resilience bonds are a tool that city governments can use to mobilize private investment. The dividend from a resilience bond can also theoretically be used to finance projects beyond infrastructure, such as awareness campaigns and community-building exercises. 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 (IFC 2018).

Case study 9 presents a very innovative and promising approach to monetizing resilience investment in natural capital assets, such as coral reefs in the tourism sector, through parametric climate insurance products financed by the private sector.

Long-Term Planning Barriers

Climate-smart urban investments and planning need to account for the effect, and growing uncertainty, of long-term climate trends and build in flexibility to harness new clean technology innovations and promote cross-sectoral, systems-based approaches. The effect of climate change on the spatial distribution and intensity of natural hazards makes planning challenging and all assessments uncertain. For instance, climate change models show a wide range of possible futures for global sea level rise and change in timing and intensity of climate patterns. The effects of technology shifts, as mentioned above, also need to be accounted for. Methodologies and approaches to long-term investment and planning within the context of uncertainty constitute a new field and include robust decision-making, decision trees, and adaptive pathways. This new field also considers methodologies that favor robust solutions that perform well across a wide range of futures, preferences, and worldviews, although it may not be optimal in any particular scenario. However, the complexity and lack of such robust long-term methodologies and policies present a barrier to private sector signaling and investment (WBG 2019b).

There are several initiatives focusing on long-term planning at the global, national, and municipal levels that need to be well coordinated, interlinked, and reinforcing at all levels, including the 2050 Pathways Platform,[24] which supports countries seeking to develop long-term net-zero-GHG emissions and climate-resilient sustainable-development pathways; Vision 2050 of the World Business Council for Sustainable Development, which convenes 200 forward-thinking global companies; and the C40 Climate Action Planning Program, which supports almost 100 cities in planning for net neutrality pathways by 2050.

Case study 10 features a software tool developed by the World Bank and IFC that helps cities improve their long-term strategies for climate investments, policies, and planning opportunities. The tool provides powerful data-driven scenario planning that helps cities make decisions about the future of their energy, transport and waste systems. Case study 2 features the City Climate Finance Gap Fund—a dedicated development climate finance fund designed to support cities on strategic spatial planning and design that support low carbon, resilient development pathways upstream, particularly in rapidly urbanizing cities in developing countries.

24 See https://www.2050pathways.org/resources/

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05

CASE STUDIES: CROWDING-IN PRIVATE URBAN INVESTMENT

05 | Case Studies: Crowding-In Private Urban Investment

This section of the report consists of 10 case studies of innovative financing solutions to circumvent the barriers discussed in the previous section and to mobilize private investment in cities in developing countries. It focuses on climate investment with the city as the borrower and presents modalities to address obstacles that cities have encountered in mobilizing private finance. The report deliberately excludes investments by state-owned enterprises. Table 4 provides a summary of the 10 case studies reviewed.

Table 4 Summary Table of Case Studies

#	Case Study	Activity Name	Climate Benefit	Instrument	Key Barrier Addressed	Country	Stage
1	Bundling Urban Climate Investment Opportunities in a Dedicated Fund to Crowd-in Institutional Investors	The International Municipal Investment Fund	Mitigation	Technical Assistance, Equity, Senior Loans, Mezzanine Loans	Project Pipeline, Financing, Policy	Global	In Development
2	Directing Private Investment for Mitigation in Cities through Comprehensive Urban Planning and Design	City Climate Finance Gap Fund	Mitigation, Adaptation, Resilience	Tehcnical Assistance (Grants)	Project Pipeline, Long-Term Planning, Policy & Regulatory	Global	In Development
3	Scaling Urban Investment through Policy	Energy Efficiency investments in Yerevan City, Armenia	Mitigation	Blended Finance	Policy and Regulatory, Financing	Armenia	Under Implementation
4	Combating Climate Change and Air Pollution through Municipal Bonds	Breathe Better Bond	Mitigation	Municipal Bonds	Financing	Global	Piloting

Blue highlight = mitigation focused case studies
Green highlight = adaptation/resilience focused case studies
Orange highlight = both mitigation and adaptation focused case studies

Table 4 Summary Table of Case Studies (continued)

#	Case Study	Activity Name	Climate Benefit	Instrument	Key Barrier Addressed	Country	Stage
5	Leveraging Private Investment through Blended Finance Mechanisms	Shanghai Green Infrastructure Fund	Mitigation, Adaptation, Resilience	Blended Finance, Green Bonds and Asset Pools, Credit Enhancement	Financing, Policy and Regulatory	China	Under Implementation
6	Unlocking Viable Investment Pipelines for Resilience	City Resilience Program (CRP)	Resilience	Technical Assistance (Grants)	Project Pipeline, Financing, Policy and Regulatory	Global	Under Implementation
7	Reducing Transaction Costs through Green Bulk Procurement	Electric-Buses in Santiago Chile	Mitigation	Leasing, PPP, Green Bulk Procurement	Financing, Cost Structure, Long-term Planning, Policy	Chile	Under Implementation
8	Trailblazing Investment in Urban Vertical Farming Technology.	Aerofarms	Mitigation, Adaptation, Resilience	Blended Finance	Green Technology, Financing	USA	Under Implementation
9	Developing Natural Capital Insurance Products for Urban Coastal Resilience	Reef2Resilience	Resilience	Trust Fund & Insurance	Monetizing Resilience	Mexico	Piloting
10	Building Software Planning Tools for Cities	EPIC Investment Tool	Mitigation	Planning Software	Long-Term Planning, Policy and Regulatory	Global	Piloting

Blue highlight = mitigation focused case-studies
Green highlight = adaptation/resilience focused case-studies
Orange highlight = both mitigation and adaptation focused case-studies

Case Study 1: Bundling Urban Climate Investment Opportunities in a Dedicated Fund to Crowd in Institutional Investors

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Structure	Technical assistance, early-stage project capital, and mezzanine risk-reduction facility
Size	€350 million
Region or country	Middle-income and least-developed countries
Stage	In development
Barriers addressed	Project pipeline, financing

The International Municipal Investment Fund (IMIF) is a unique, bespoke fund designed to focus exclusively on supporting cities and local governments, notably municipalities in developing countries, including least-developed countries. The United Nations Capital Development Fund (UNCDF) and United Cities and Local Governments developed the fund together with their technical partner, the Global Fund for Cities Development, to expand subnational finance and accelerate implementation of the Sustainable Development Goals and Paris Climate Agreement.

The IMIF was designed with three objectives to support urban climate investment:

1. Give local governments in developing countries a sustained channel to access capital markets

2. Develop municipal capital market access to cities in developing countries in line with the objectives of the Malaga Global Coalition on Municipal Finance, and ensure long-term success of projects sponsored by municipalities while meeting financial-return expectations[25]

3. Meet a standard related to resilience and sustainability to ensure benefits for local communities

The fund will start with capital of €350 million and be accessible to all cities in non-Organization for Economic Cooperation and Development (OECD) countries.

Meridiam SARL, the Paris-based infrastructure investment and global asset manager, with $7 billion of assets under management, was formally selected as the fund manager for IMIF and, together with UNCDF, will offer the following products:

- The IMIF Technical Assistance Facility, *managed by UNCDF*, will provide urban climate investment opportunities with early-stage capital to assist with project development and preparation and policy and regulatory reform. It will focus largely on providing direct support to municipalities in developing countries.

- Catalytic Capital and Resources, *managed by Meridiam*, will provide early-stage capital and project development and preparation expertise to cities and city-sponsored projects. Support will also be provided to developers who secured projects through due process procurement and who need to improve the sustainability and resilience of their project. Through Catalytic Capital and Resources, Meridiam will prepare large municipal and privately developed investments.

- A risk-reduction facility, *managed by Meridiam*, will reduce overall cost of funding, increase affordability, and attract private capital directly into projects. For city-based projects sourced by UNCDF and United Cities and Local Governments, this funding would be mainly, but not solely, in the form of senior debt instruments for municipal projects, whereas for larger projects with multiple capital layers, it would be a mezzanine-style risk-reduction facility that would fall between debt and equity in the project's capital structure.

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25 See https://www.uclg.org/sites/default/files/malaga_global_coalition_for_municipal_finance.pdf

Case Study 2: Directing Private Investment for Mitigation in Cities through Comprehensive Urban Spatial Planning and Design

© Dominic Chavez/World Bank

Structure	Technical assistance, including city scans, rapid capital assessments, and dedicated financial advisory services to identify and structure deals
Size	€100 million
Region or country	Global
Stage	In development
Barriers addressed	Urban planning and pipeline development

Cities are growing rapidly and haphazardly, particularly in Africa and South Asia. If current trends persist, by 2050, cities will contain 70 percent of the population vulnerable to disasters, energy demand from cities will have grown by 70 percent, and carbon emissions will have increased by 50 percent. These trends will negatively impact' air quality and the welfare of urban residents while locking cities into long-term choices that are costly to reverse. Therefore, how we plan, design, and densify our cities is critical to achieving a lower carbon footprint and enhancing climate and disaster resilience. While cities may have identified ways to decrease emissions, congestion, and pollution, they often lack the resources and expertise to put solutions in place.

The City Climate Finance Gap Fund will address the critical lack of grant funding needed to mature pipelines of projects from concept to a stage at which they can be advanced toward full feasibility analysis and investment. This will significantly increase the pipeline of high-quality, bankable, climate-friendly, urban infrastructure projects that must be advanced to meet the urgency of the climate crisis.

The Gap Fund aims to raise more than €100 million in grants to unlock investments of €4 billion in urban infrastructure projects. Germany intends to provide up to €40 million and Luxembourg up to €10 million. The Gap Fund will support project preparation activities for resilient low-carbon urban infrastructure projects by pursuing three principal objectives:

1. Capacity building: Enhance cities' and local authorities' ability to mature high-quality project ideas to late-stage project preparation.

2. Pipeline building for late-stage technical assistance: Build a solid portfolio of project business cases for initiatives and institutions that provide technical assistance for late-stage project preparation.

3. Pipeline building for investors: Source pipeline projects and help enhance the bankability of these projects.

Case Study 3: Expanding Urban Investment through Policy Risk-Reduction

© 1255k/Getty Images

Structure	$20 million in grants and technical assistance to crowd-in $80 million in private and $20 million in public investment in energy-efficient building retrofits
Size	$20 million
Region or country	Armenia
Stage	Implementation
Barriers addressed	Policy and regulatory

Armenia is a small, poor, land-locked country in the heart of Eurasia and is highly vulnerable to the effects of climate change. Unsustainable energy use in buildings exacerbates Armenia's closely intertwined development, security, and climate-related challenges.

- Approximately 30 percent of Armenian households are energy poor, with energy poverty (often called fuel poverty) defined as households spending more than 10 percent of their budget on energy.
- Fifty percent of energy use in buildings depends on imported fossil fuels.
- Twenty-four percent of carbon dioxide emissions come from energy use in buildings.

- Energy use can be more than halved using energy-efficient retrofits. Improving energy efficiency in buildings has been assigned the highest priority in Armenia's housing, energy, and climate strategies, including its intended nationally determined contribution.

To address these challenges, UNDP is working with the Armenian government, Yerevan city administrators, the European Investment Bank, private sector stakeholders, and local banks to deploy the most cost-effective combination of policy and financial risk-reduction instruments and targeted financial incentives to address market barriers and achieve a risk-return profile for energy-efficiency building retrofits that can attract private investments.

Through a coordinated combination of policy and financial risk reduction, this project aims to create a favorable market environment and expandable business model for investment in energy efficiency building retrofits in Yerevan, leading to sizeable energy savings and GHG emission reductions (savings of up to 5.8 million tons of direct and indirect carbon dioxide emissions over the 20-year equipment lifetime), green job creation, and energy poverty reduction. The project will directly benefit more than 200,000 people and catalyze private and public sector investment of approximately $100 million.

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The project involves a combination of investment and technical assistance. For investment, the Green Climate Fund is contributing $14 million to address the needs of vulnerable households and remove financial barriers by making loans for energy efficiency building retrofits more affordable to local multi-owner buildings, such as condominiums. The municipality of Yerevan will contribute $8 million in co-financing; the Green Climate Fund will provide $6 million to remove market and policy barriers to energy efficiency building retrofits; the Ministry of Nature Protection will provide co-financing of $0.4 million; and UNDP, the accredited entity managing the project, will provide $1.42 million.

Currently, multi-owner buildings are responsible for approximately 20 percent of Armenia's GHG emissions, and it is difficult for homeowner's associations to access affordable commercial loans through local financial institutions for energy efficiency retrofits. To address this challenge, this project will work directly with local and national government stakeholders to improve and standardize multi-owner building management frameworks, as well as building passports which are essentially databases with all building data from design to demolition. The combination of these two activities will enable homeowners' associations for multi-owner buildings to increase their creditworthiness and access loans for energy efficiency upgrades, resulting in cost savings and emissions reductions.

The project has potential to leverage considerable additional resources. To maximize this potential, UNDP is working to develop a PPP model with local commercial banks to channel concessional loans for the public and residential sectors, making these retrofits more affordable for stakeholders. Overall, $20 million in concessional financing from the Green Climate Fund is expected to leverage more than $80 million in private investment and $20 million in public investment in energy efficiency retrofits. The project is being implemented and is expected to continue until 2023.

Case Study 4: Combating Climate Change and Pollution through Municipal Bonds

© Joel Carillet/Getty Images

Structure	Fixed-income security, issued by urban local authorities in developing countries, that invests in projects that reduce air pollution and greenhouse gas emissions
Size	TBD
Region or country	Global
Stage	Piloting
Barriers addressed	Financing

Poor air quality directly affects urban populations and is associated with health risks (respiratory disease). Ninety-seven percent of cities in low- and middle-income countries with populations greater than 100,000 do not meet World Health Organization air quality standards. In addition to being a health risk, air pollution is an economic burden. The global cost of air pollution–related welfare losses was estimated to be approximately $5.1 trillion in 2015 (OECD).

The Breathe Better Bond (BBB) is a newly developed fixed-income instrument that invests in projects reducing air pollution and GHG emissions, and is designed to be issued by urban authorities in developing countries. These projects provide dual benefits to cities by improving health while helping combat climate change. Funding from BBBs will

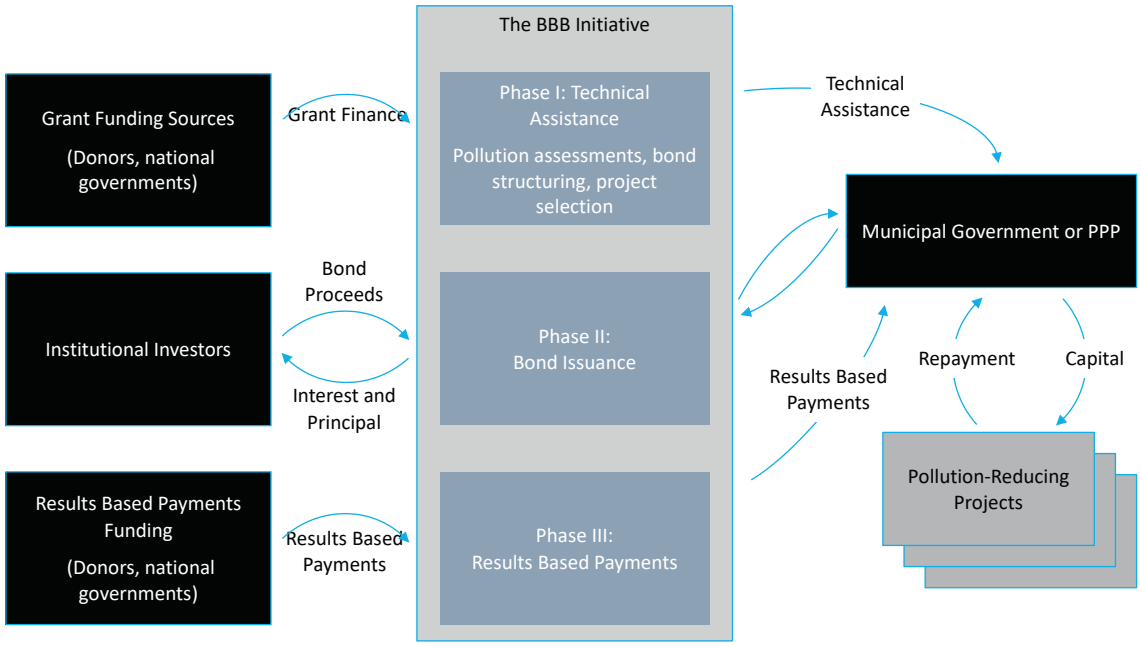
support projects that reduce air pollution and GHGs (e.g., black carbon, methane). Lower pollution levels are expected to produce economic benefits to cities (lower health care costs from pollution-related diseases such as asthma, heart disease, and emphysema; higher GDP) and improve quality of life. IFC intends to act as an anchor investor in each BBB.

BBBs will also incorporate a technical assistance component and financial support through results-based payments or concessional finance. Each BBB will first use grant funding for technical assistance to address gaps in understanding of pollution levels and the ability to address them. Technical assistance components may include air pollution emissions inventory assessments; project identification and preparation; bond structuring; and improving monitoring, reporting, and verification capabilities at the project and city level.

IFC has also begun discussions with potential BBB issuers and is assessing candidates based on several criteria, including ability to issue bonds, credit rating, severity of pollution problem, and engagement in pollution initiatives. Use of proceeds will vary between cities, but potential projects include solar generation, landfill management, sustainable transport, and energy efficiency.

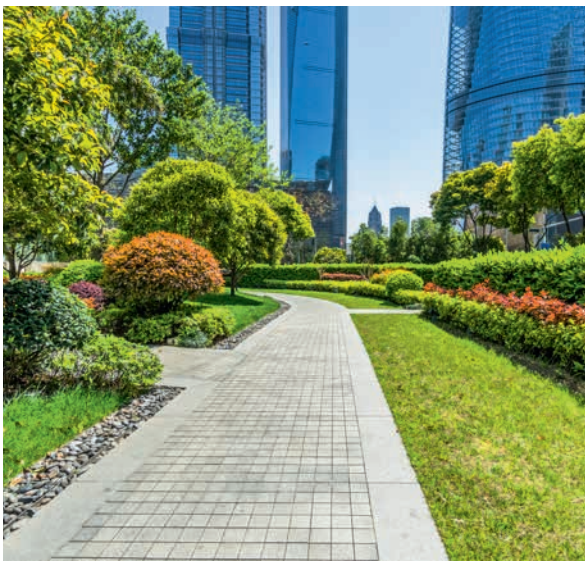
In September 2019, the BBB initiative was formally endorsed by the Climate Policy Initiative Global Innovation Lab for Climate Finance, designed to identify, develop, and support transformative sustainable finance ideas.

Figure 4 Breathe Better Bond Structure Diagram



IFC International Finance Corporation WORLD BANK GROUP
Creating Markets, Creating Opportunities

Case Study 5: Leveraging Green Urban Private Investment through Blended Finance Mechanisms



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Structure	Equity, green bonds, longer loan tenors[27] for borrowers, liquidity facility
Size	$300 million
Region or country	China—Yangtze River Delta Region
Stage	Implementation
Barriers addressed	Financing

The Shanghai Green Urban Financing and Service Company (FSC) is a green infrastructure fund recently established with support from the World Bank and the German Development Bank (*Kreditanstalt für Wiederaufbau* (KfW)).[26] The fund was financed initially with $300 million in shareholder equity and two co-financed loans under the China Green Urban Financing and Innovation Project ($200 million from the World Bank, €150 million from KfW). The main objective of FSC is to provide long-term sustainable financing to green investments in small towns in the Yangtze River Delta, a region especially prone to the effects of climate change. FSC will focus on green investments in water supply, wastewater treatment, and solid waste management. In particular, FSC has developed a set of green criteria for screening investments that will contribute substantially to climate change mitigation and adaptation and will increase the resilience of small cities and towns in the region. As of May 2019, the pipeline is estimated to be $3.8 billion.

FSC introduces several innovations to green urban finance in China, including lengthening the tenor and minimizing borrowing costs for final borrowers, issuing green bonds on pooled assets for lower-tier cities, adopting international green standards at the subnational level, and creating a liquidity facility for credit enhancement. FSC will also have a catalyzing effect and support direct mobilization of private funds to increase leverage. It is expected to mobilize approximately $800 million in private funds from 2020 to 2025.

26 See: https://www.worldbank.org/en/news/press-release/2019/05/21/innovative-financing-facility-to-help-small-cities-in-china-close-the-green-infrastructure-gap

27 A tenor is the length of time until a loan is due.

Case Study 6: Unlocking Viable Investment Pipelines for Resilience

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Structure	Technical assistance, including city scans, rapid capital assessments and dedicated financial advisory services to identify and structure deals
Size	$13.8 million
Region or country	Global
Stage	Active
Barriers addressed	Commercial barriers and bankability of city resilience projects

The City Resilience Program (CRP) - a partnership between the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) - is a multi-donor initiative aimed at increasing investment for urban resilience and helping cities identify a pipeline of viable, well-informed city resilience projects that mobilize multiple types of financing, including private capital. The program aims to achieve this through three thematic areas: planning for resilience; financing for resilience; and partnerships for resilience.

Under the finance for resilience area, CRP helps cities look both at a) financing - how to mobilize the private sector to deliver resilience-related infrastructure projects (i.e. concessions or PPPs) and b) funding - how cities can capture portions of the economic value generated by investments through land value capture mechanisms. To this end, CRP provides tailored operational and technical support through:

1. Upstream diagnostics such as the Rapid Capital Assessment tool (RCA) to help understand the general context for partnering with the private sector in resilience related infrastructure investments. This upstream work includes review of national and local track records and economic conditions for both PPP type contracts and land value capture mechanisms. Outputs include both strategic recommendations and identification of specific transaction opportunities.

2. Midstream financial and regulatory analysis related to a specific project (or program) concept to identify opportunities for a sustainable engagement with the private sector, and associated World Bank Group financing support to enable private capital mobilization. It includes identification of the underlying project economics (customer demand, revenue streams and costs); the technical solution (cost benefit analysis, financial or fiscal analysis, risks analysis) and regulatory factors (environmental, social and governance (ESG) analysis) as well as market sounding in many cases. Examples of where this support has been deployed include Accra, Barranquilla, Medellin, Porto Alegre, Casablanca, Irbid, Abidjan, Buenos Aires, Quilmes and Dakar.

3. Downstream transaction advisory services to support governments in their implementation of identified transactions that appear viable in terms of private capital mobilization through concessions or PPPs, and/or their ability to generate privately funded cash flows to city authorities (i.e. land value capture). Support at this stage is generally focused on providing advice to World Bank teams, in parallel to transaction advisory mandates executed by cities themselves. Where necessary, support may include partial funding of the city-led transaction advisory mandates themselves. The outcome of this stage is generally a procurement process leading to signing of contracts with the private sector.

For example, in Abidjan, Cote D'Ivoire, CRP is providing financing support to identify ways to bring private sector expertise and investment into the solid waste sector. In cities like Dar es Salaam (Tanzania), Quilmes (Argentina), Porto Alegre (Brazil) and Medellin (Colombia) CRP has provided support to develop land-based financing, combining land value capture funding with actual mobilization of private capital. For example, in Porto Alegre, CRP identified opportunities for catalytic urban regeneration in the city's 4th District whereby the private sector could partially cover area-wide streetscaping and drainage improvements. In Dar-es-Salaam, CRP examined the market potential for developing a 57-hectare regularly flooded area near the city center and identified the private sector's capacity to include affordable housing and drainage improvements in mixed-use real estate investment programs.

On the funding side, an example of CRP's work is in Buenos Aires where local authorities and the Ministry of Transport are aiming to redevelop a publicly owned 2.5-hectare site near Saenz Peña Metro Station, on the outskirts of the city. The station will benefit from infrastructure upgrades that will increase access and ridership. Supported by Cushman & Wakefield, CRP support helped identify the best, highest use of the targeted site in a way that meets the city´s objectives and captures the future increase in land values. After market sounding, it was recommended that the site be put on the market on a parcel-by-parcel basis after some infrastructure upgrades were made. The CRP-funded study showed that the final sale price could be maximized to approximately $16.5 million (more than 50 percent more than in the original plan). This engagement exemplifies an approach to generating additional financial resources for public infrastructure upgrades through monetization of underused public assets. It may be replicated on a wider scale, especially where productive land uses are constrained because of infrastructure deficiencies, including exposure to flooding and lack of transit infrastructure.

In Dar es Salaam, CRP supported a study of the potential effect of urban flooding on firms and supply chains that highlighted the importance of resilient infrastructure systems and the need to consider infrastructure disruptions in spatial planning activities. Specific objectives of the study were to understand the spatial distribution of infrastructure disruptions within cities, the role of urban flooding in these infrastructure disruptions, and what share of the urban economy flooding affects directly and indirectly. Using data from the World Bank Enterprise Survey and two sets of flood maps, the analysis showed that firms in flood zones tend to experience more infrastructure disruptions but that those outside of flood zones experience almost as many disruptions, illustrating that, although flooding may occur locally, the effects spread quickly across infrastructure networks. The analysis also showed that floods directly threaten areas with high employment densities and thus a large portion of all economic activity.

Going forward, CRP will be complimented by the Resilient City Development Program (RECIDE), a partnership with AECID managed by CRP, to access resources from the EU External Investment Plan of up to EUR 100 million in guarantees and EUR 14 million in technical assistance to source, originate, and execute transactions for empowering cities in Sub-Saharan Africa to strengthen resilience, and to access a broader range of financing options.

Case Study 7: Reducing Transaction Costs through Green Bulk Procurement of Electric Buses in Santiago Chile

© Getty Images

Structure	Green bulk procurement for electric buses
Size	455 electric buses, estimated at $ 136.5 million
Region or country	Santiago, Chile
Stage	Implementation
Barriers addressed	Transaction costs

More cities are testing electric bus (e-bus) technology to address urban air pollution while providing flexibility at lower costs than building light rail or metro systems. Globally, sales of e-buses increased 80-fold between 2011 and 2017 (WRI 2019).

City-level bulk procurement and PPPs can reduce transaction costs and catalyze private investment and manufacturing. For example, in the past few years, Santiago, Chile, has procured an impressive 455 e-bus and now has the largest city fleet outside of China (CleanTechnica 2020). It was achieved through a bulk procurement process, expanded over several years, combined with an innovative financial model under which electricity suppliers Enel and Engie acquired the buses from Chinese

manufacturers BYD and Zhengzhou Yutong, leased them to the local operators, installed charging stations, and supply electricity (Azzopardi 2020). The first e-bus was piloted in 2016, providing free transit for locals and visitors in the city center until the end of 2017. In 2017, Enel X acquired an additional 100 e-buses from BYD. A combination of a grid capacity analysis (utility company), pilot test (operator), route selection analysis (consulting institute), and determination of business and service models (with the manufacturer) were conducted jointly (Orbea 2018), giving local stakeholders confidence and enabling them to prepare, which led to ambitious adoption targets (WRI 2019). In 2018 and 2019, an additional 300 e-buses were added to the fleet.

E-buses are helping the city reduce operating and maintenance costs significantly (70 percent lower than for diesel-powered units). At approximately $300,000 each, electric buses cost almost twice as much as conventional buses, but the savings in operating and maintenance costs are huge, potentially allowing fare reductions. At current power prices in Santiago, they cost just $0.10 per kilometer, against more than $0.35 per kilometer for diesel buses.[28] Furthermore, the fleet generates no tailpipe emissions, which is helping the city reduce air pollution, which is costly to the economy in terms of productivity and human health. E-buses are also increasing the attractiveness of ridership thanks to air conditioning; better design; and a smoother, quieter rider experience than with the old buses. With happier customers, operators report less bus fare avoidance, and none of the e-buses were torched during the recent riots.

With this positive model, Chile's transport minister, Gloria Hutt, has launched a tender to replace more than 2,000 buses in Santiago, with electric vehicles being prioritized. Although the tender is open to conventional diesel buses and natural gas and hybrid alternatives, the government is encouraging operators to prioritize e-buses by offering them 14-year contracts rather than the 10-year deals offered for other technologies. The conversion to e-buses in Chile may have started in Santiago, but similar plans are in place across the country in major cities such as Antofagasta, Valparaiso, Concepcion, and Temuco. Not surprisingly, President Sebastian Piñera has set ambitious targets of having 10 times as many electric vehicles (of all kinds) on Chile's roads by 2022 and replacing all the country's buses with e-buses by 2040.

Bus procurement models should consider total cost of ownership over the lifetime of the investment, rather than just upfront cost, and include a mechanism to manage the risks and uncertainties of e-buses as a new technology, such as financial leasing and operational leasing mechanisms in the case of Santiago. Financial leasing mechanisms can reduce costs for bus operators, which do not need to pay the up-front cost and have the flexibility to procure the asset at the end of the leasing period. Operators make regular payments to lessors, and lessors might receive a tax benefit if the buses are recorded as an asset on their balance sheets (instead of on those of the operators) (WRI 2019).

The case of Santiago e-buses shows the power of green bulk procurement. Globally, public procurement accounts for 10 percent to 15 percent of global GDP, much of which is from cities. This represents a huge degree of purchasing power. Procurement modeling and decisions can significantly affect the market and encourage provision of sustainable, resilient goods and services. Cities are driving new technologies and solutions by providing an invaluable launch market and helping suppliers achieve economies of scale (IFC 2017).

28 See https://www.enelx.com/cl/en/electric-mobility/products/public-administration/bus-electrico

Case Study 8: Trailblazing Investment in Urban Vertical Farming Technology

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Structure	Accelerator Programme
Size	$100 million
Region or country	Abu Dhabi
Stage	Active
Barriers addressed	Financing and Green Technology Risk

Recent investments in vertical farming companies include $90 million in Bowery Farming by GV with the funds coming from investors such as Singapore's Temasek, $200 million invested in Plenty by Softbank's Vision Fund, and an anticipated $55 million being invested by AeroFarms in its 138,000 square foot Cane Creek Industrial Park building. The global vertical farming market, which includes operations in the United States, Canada, Germany, the United Kingdom, Japan, India, China, South Korea, South Africa, Brazil, Mexico, Argentina, Netherlands, and Belgium, was estimated to have reached between $2.23 billion and $3.16 billion in 2018 and is projected to reach $12.77 billion to $22.07 billion by 2026. In the United States these transactions are supported upstream by the US

2018 Farm Bill that provides additional support for urban, indoor, and other emerging agricultural production and established the Office of Urban Agriculture and Innovative Production within the US Department of Agriculture.

AeroFarms, which previously received $590,000 in grants to construct its Cane Creek Industrial Park in Virginia, recently announced it will be one of four companies to receive funding from the Abu Dhabi Investment Office under the $272 million AgTech Incentive Programme. The initial $100 million funding round for the Programme will be allocated to four companies to build facilities in Abu Dhabi. AeroFarms will utilize these funds to build a 90,000 square foot indoor vertical farm dedicated to R&D and commercialization of crops using vertical farming techniques. The AgTech investment includes cash and non-cash incentives, including a rebate of up to 75 percent for R&D expenditures that later lead to commercialization.[29]

Indoor and vertical farming may be part of the solution to rising demands for food and limited resources, and provides significant climate mitigation and resilience benefits, especially in urban environments. Vertical farming uses hydroponics, aquaponics, and aeroponics to raise crops in vertically stacked layers housed in climate- and environmentally controlled buildings that protect against weather and pests. It would provide fresh, local produce with significant benefits including greater crop yields of 10 times or more per hectare, the potential to reduce water usage by up to 95 percent, and organic produce without the use of pesticides and chemical fertilizers. Furthermore, as these facilities are enclosed, they are resilient from a climate perspective and can be built in any environment to raise a variety of crops. The proximity of vertical farms to urban markets has the potential to reduce significant amounts of emissions from shipping and freight. Agriculture was estimated to account for as much as 31 percent of all freight in the United States, for example. Produce harvested at a local urban farm, only a few hours before its sale or consumption, would also save on the energy needed for the agricultural cold chain or refrigeration and could also help reduce food loss and associated GHGs.

Vertical farming requires significantly less land to provide the same crop yield, with growing year-round rather than seasonal. This efficient and year-round vertical production can free up horizontal land for potential use in renewable power generation, for new buildings, or for reforestation and afforestation and has the potential to reverse the trend in deforestation. Energy needs are significant for vertical farms because they use constant lighting, with electricity representing one of vertical farming's greatest costs, which is one of the industry's greatest challenges. Models that enable vertical farms to source renewable electricity at utility-scale prices would reduce costs and reduce carbon emissions for agriculture.

29 See https://www.usda.gov/media/blog/2018/08/14/vertical-farming-future and https://aerofarms.com/our-project-partners/ and https://businessfacilities.com/2015/03/worlds-largest-indoor-vertical-farm-to-be-developed-in-newark-nj/

Case Study 9: Developing Natural Capital Insurance Products for Urban Coastal Resilience

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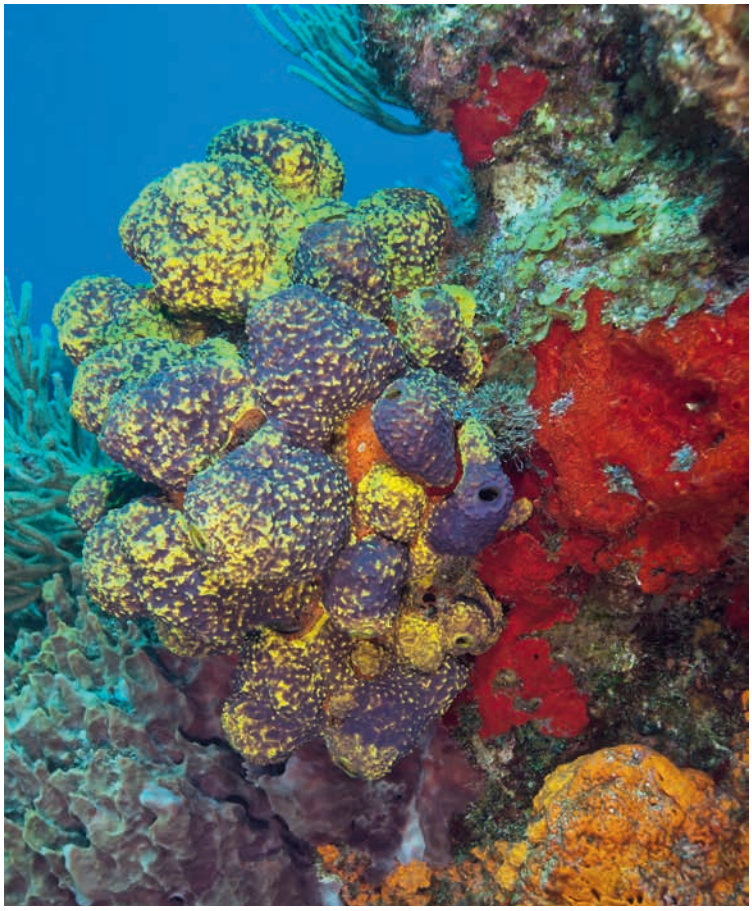
Structure	Insurance policy with revolving loan facility
Size	Policies ranging from $2 million to $5 million and revolving loan structures planned for $10 million by region
Region or country	Currently Mexico, expanding to Southeast Asia and Caribbean
Stage	In pilot in Mexico; in development in Southeast Asia and Caribbean
Barriers addressed	Monetizing resilience and adaptation

Natural capital–driven solutions offer substantial opportunity to enhance urban climate resilience, including protecting coastal infrastructure, improving water conservation, and reducing urban heat island effects. Nature contributes more than $125 trillion annually to the global economy, and integrating conservation- and nature-based solutions such as green roofs, mangrove restoration, coral reef rejuvenation, and watershed protection into sustainable infrastructure design can lower operational costs, unlock new revenue streams, and increase climate resilience (Blended Finance Task Force 2019). Integrating natural solutions into infrastructure could generate economic cost savings of $100 billion based on natural disasters, with $50 billion in savings from insurance losses alone (Blended Finance Task Force 2019).

When considering tourism in urban coastal environments, natural capital, such as coral reefs, is an integral part of the protection of onshore assets and the local economy. Reefs are critical natural barriers that protect communities from volatile weather hazards such as ocean surges and flooding and are a source of economic opportunities including tourism and fishing. The global economic value derived from reefs is estimated to be $375 billion annually, but they are maintained and restored on a small scale, with limited and unpredictable funding. There is an urgent need to care for this natural protective barrier because 20 percent of the world's reefs have been lost, and a further 15 percent are severely threatened (Rockefeller Foundation n.d.).

Reef2Resilience is an innovative, natural capital-driven insurance instrument that addresses climate resilience before and after a severe weather event. Developed by UNDP, the Nature Conservancy, and insurance industry partners, Reef2Resilience will monetize the resilience benefits of the global reef system and is being piloted in Mexico on the Meso-American reef—the second largest in the world. Benefits include absorbing waves and storm surges, protecting against inland flooding, and avoiding beach erosion. A healthy coral reef can absorb 97 percent of a wave's energy before it hits shore, placing the reef's protective ecosystem services on par with more expensive, less-durable man-made protections such as breakwaters and seawalls. In Mexico alone, it is estimated that a one-meter loss of reef height would translate into 1,300 km2 of inland flooding and $20 billion in lost infrastructure, imperiling the lives and livelihoods of vulnerable people. Coral reefs also provide other important ecosystem services to coastal communities; the value of services they provide globally has been estimated at as much as $9.9 trillion (Costanza et al. 2014). Before a severe weather event, Reef2Resilience structures and distributes a parametric insurance product linked to natural assets to insure the local reef and reduce the effect of disasters, reducing financial risk and damage to coastal communities and their livelihoods and speeding socioeconomic recovery. After a severe weather event, Reef2Resilience identifies opportunities for resilient infrastructure investments and packages them into a resilience bond or marketing them as direct investments to the private sector to increase protection for local communities in the event of natural disasters.

The Reef2Resilience model operates like a trust fund, with local businesses such as hotel associations paying into a coastal zone management trust. The fund then invests in the restoration and maintenance of the reef and purchases insurance to pay for recovery in the event



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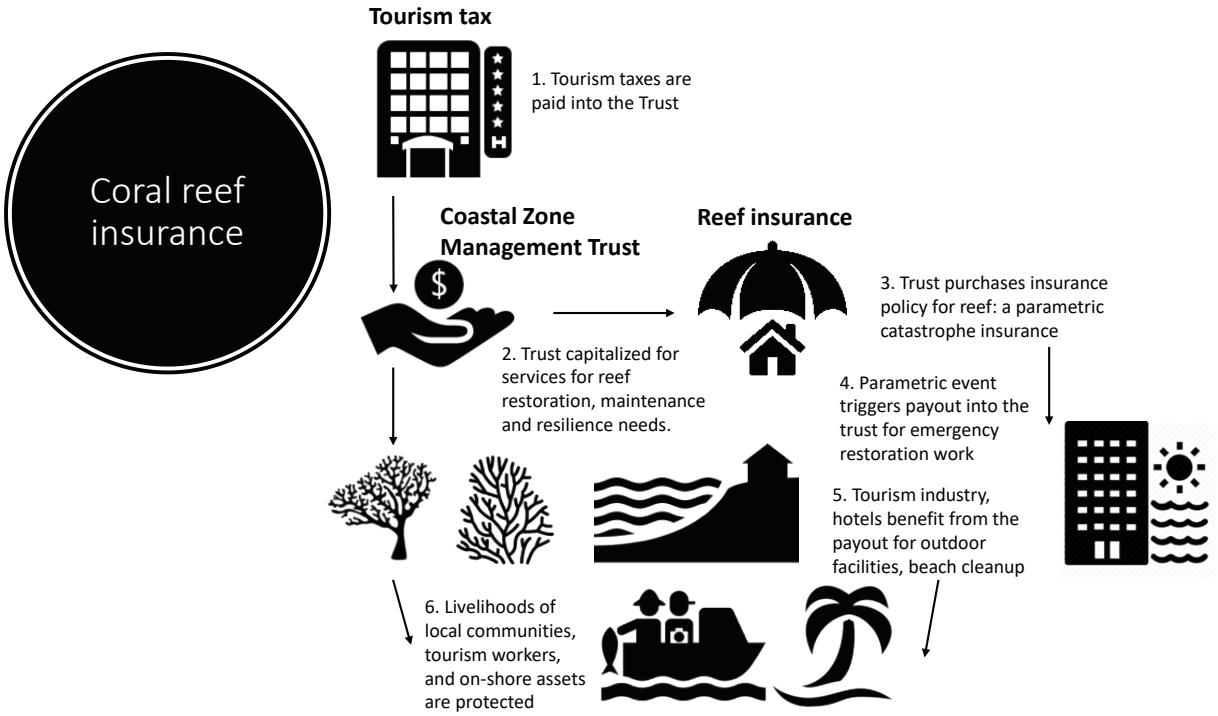
of a disaster. The insurance product is a parametric catastrophe insurance policy[30] for the reef because recovery work needs to be done quickly. The policy will cover beach erosion for hotels as an incentive to participate in the initiative. If a parametric event occurs (e.g., high winds or waves), a payout is triggered that goes into the trust to support emergency restoration work on the reef. The tourism industry, ranging from luxury hotels to local fisherman, benefits from coastal protection from the payout, including outdoor facilities and beach cleanup.

The model is being piloted in the province of Quintana Roo and the city of Cancun, Mexico. Discussion is ongoing about expanding the model to coral reefs in Southeast Asia and the Caribbean, especially for Small Island Developing States (SIDS) (Spaulding et al. 2016). A summary of the Reef2Resilience structure is in figure 5.

Figure 5 Reef2Resilience Structure Diagram



30 The term parametric insurance describes a type of insurance contract that insures a policyholder against the occurrence of a specific event by paying a set amount based on the magnitude of the event, as opposed to the magnitude of the losses in a traditional indemnity policy. See: https://content.naic.org/cipr_topics/topic_parametric_disaster_insurance.htm

Case Study 10: Building Software Planning Tools for Cities

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The IFC is piloting a new software called the Environment Positive Innovations for Cities (EPIC) to help cities prioritize and transition to a low-carbon and resource efficient urban growth pathway.[31]

The online software is an early-stage prefeasibility climate investment tool that helps cities identify and evaluate green investments, policies, and planning opportunities.

EPIC starts with a baseline-case, projected business-as-usual scenario to 2030. Users can quickly see the effect of different measures on the city's business-as-usual performance into the future, including on future energy consumption, water requirements, waste production, private vehicle travel, carbon

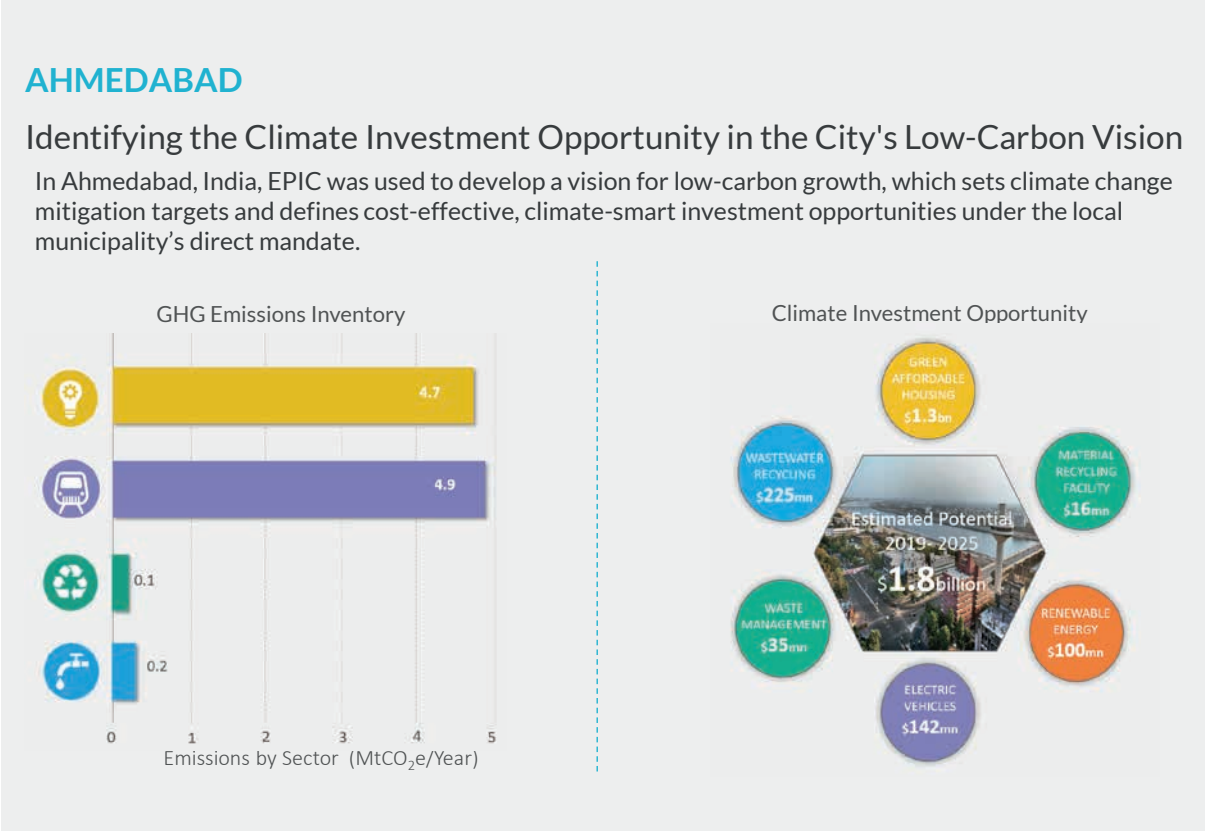
Structure	Planning software
Size	N/A
Region or country	Global
Stage	Being piloted
Barriers addressed	Long-term planning barriers

31 Please note the EPIC tool has been built on and evolved from a previous version developed by the World Bank in collaboration with C40, Bloomberg Philanthropies, and the Global Covenant of Mayors, known as CURB (Climate Action for Urban Sustainability) and applies the same GHG methodologies and approaches.

emissions, and air quality. It then aggregates emissions, showing the baseline case and the target trajectory with the savings from selected measures. EPIC will be used to identify a list of low-carbon investments and track the effect of investments based on costs, payback, GHG emissions, and feasibility, leading to a pipeline for climate financing, (e.g., green bonds, green loans).

In Ho Chi Minh City, Vietnam, EPIC helped identify essential policy and planning actions needed to ensure the efficacy of public transport investments. In Ahmedabad, India, EPIC was used to assess actions in the city's "carbon neutrality vision" presenting a climate investment opportunity of $1.8 billion. IFC is in the process of investing in Ahmedabad Municipal Corporation.[32]

Figure 6 Identifying the Climate Investment Opportunity in Ahmedabad



32 See https://www.proptiger.com/guide/post/ahmedabad-municipal-corporation-to-raise-through-dollar-bonds

06

CONCLUSION

06 | Conclusion

Challenge and Opportunity

Cities are at the forefront of climate change and mayors and other local decision makers are facing many challenges and compounding risks. As the world's population becomes increasingly urban, cities must invest in well-planned and well-coordinated physical infrastructure and natural capital solutions that enable them to reduce their emissions and increase their resilience to climate change and other shocks and stresses. With an annual investment gap of $2 trillion to $3 trillion for critical infrastructure to fight climate change, cities in the developing world need rapidly expandable solutions that can leverage limited public funding to attract private investment. Infrastructure needs are particularly acute in rapidly growing cities in the Africa and South Asia, who risk locking in to high-emissions and highly vulnerable pathways.

Climate change may accelerate urbanization in some cities as subsistence farmers and pastoralists in rural areas lose their livelihoods because of drought and are forced to move to areas where other livelihood opportunities are more promising (Rigaud et al. 2018). In other cities, climate impacts may ultimately shrink the amount of land available for habitation or affect the viability of economic activity on that land (Hallegatte et al. 2013). Aging infrastructure systems may be especially prone to damage as temperature levels rise, extreme weather events grow in severity, and higher sea levels and storm surges become more problematic, overwhelming the design capacity of these systems (WBG 2018).

Climate smart urban investments will be critical for creating attractive cities that offer livable, healthy and active lifestyles. Climate investments not only improve the environment but also improve the cost efficiency of businesses and enhance through cost efficiency and improve citizen quality of life with lower pollution levels; more green and active spaces and improved citizen health. These elements help; make cities more competitive by attracting talent and businesses. Not doing so may create the opposite effect of reverse urbanization in the future.

While not all sectors fall within cities financing purview - especially utility scale energy and industry - cities can play a crucial role in pushing their urbanization and infrastructure systems toward resilient, low-carbon pathways. The city can influence private investment by purchasing, investing in, and mobilizing capital for low-carbon goods and services. As highlighted in Table 1, cities can influence or direct private investment towards low carbon, resilient infrastructure through the implementation of standards, land zoning, permitting, taxation policies, or other incentives.

Integrated spatial planning is an important city-level policy lever to shape urban development choices and serves as a strategic point of engagement to analyze sources of urban emissions and urban vulnerabilities, identify local capacity to act and avoid carbon lock-in, model long-term implications of policy options and assess costs, benefits, and cost-effectiveness. The greatest opportunities for future urban GHG emission reduction are in rapidly urbanizing areas in developing countries where urban form and infrastructure are not yet locked in.

The private sector has an important role to play and its perception of climate investment is changing, particularly in cities. Some $29.4 trillion in opportunities exist in developing countries alone across six urban sectors that reduce emissions: renewable energy, public transportation, climate-smart water, electric vehicles, and green buildings (IFC 2017). Climate resilience also presents significant private investment opportunities as climate change becomes an increasingly powerful macroeconomic trend impacting the real economy. As the climate change crisis gets bigger, better understood by markets, and better priced, so will the value, importance and return of companies and assets that are intrinsically resilient or provide resilience solutions.

Importance of Enabling Environment

Despite the investment potential, cities face unique barriers to financing their climate ambitions. Many of the barriers cities face in attracting private investment are rooted in their limited control over broader enabling environmental conditions, such as national policies and regulations, and limited institutional capacity to plan and design climate-aligned investment opportunities for the private sector, difficulty raising taxes or debt, the existence of sovereign credit ceilings, and inability to access concessional capital from development finance institutions and climate funds directly.

Private investors face their own challenges when financing urban climate projects. Investors are often less familiar with municipal governments and their financial conditions and finding well-structured projects suitable for private investment can be difficult. Meanwhile, underdeveloped capital markets, already a challenge in most emerging markets and developing economies, are more pronounced in cities.

Furthermore, large, complex, and cross-sectoral investments are needed to achieve climate-smart cities. Turning the main sources of GHGs in urban areas into opportunities for green growth and creating livable cities requires integrated systems-based approaches and coordination with regional and national government agencies. The scale and complexity of investment requires capability, capacity and coordination in municipal local markets, national governments, and the private sector.

For the reasons above, supporting a positive enabling environment at the national level will be critical to attract and scale climate-smart investment at the city level. As cities are key levers in the transition to a resilient, low-carbon world, more efforts should be made to engage cities explicitly and directly in national and international processes and coalitions that acknowledge them as important climate stakeholders from the beginning.

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Importance of Innovative Financial Structures

Innovative financing, policy, and risk allocation approaches such as those highlighted in this report can help climate-smart cities address these barriers to investment and unlock private sector investment. In general:

- *Comprehensive urban planning*, including long-term strategic plans, spatial plans, and climate action plans, set the foundation for low carbon, resilient urban investment, and are supported by dedicated climate-finance grants such as the EPIC tool and City Climate Finance Gap Funds. Comprehensive planning is key to inform targeted taxes, subsidies, and other incentives deployed by city governments that can be used to encourage investment in resilient infrastructure. It does so by favoring density over urban sprawl, and by prioritizing transit-oriented development, a circular economy instead of single-use waste, and low-carbon energy over fossil-fuel sources.

- *Land value capture* mechanisms, as presented by the City Resilience Program case study, can encourage green and resilient infrastructure development while leveraging private finance. Municipal governments recover a portion of the increase in land and property values that results from public investments (transport, green spaces, resilience) to improve nearby urban infrastructure.

- *Long term PPP contractual approaches* to develop or manage municipal assets or services are a primary mechanism for financing capital-intensive sustainable infrastructure by allocating risks between parties, leveraging private sector capital and expertise, and providing performance based renumeration. As described in the Santiago e-bus project, the purchasing power of cities can be leveraged to enact change through green bulk public procurement.

- *Municipal-type bond debt financing instruments* such as the Breathe Better Bond can leverage institutional investment by allowing cities to acquire long-term debt at stable prices.

- *Concessional blended finance approaches*, such as described in the Shanghai Green Urban Financing case study, can be used to reduce risk and leverage institutional investors, using multilateral development climate finance to reduce the risks of infrastructure.

- *Climate insurance products* can be used to finance repairs and rebuilding after climate events, ensure a city's or business's long-term financial risk coverage, and ensure continuity. The Reef2Resilience case study offers an innovative insurance mechanism that leverages the economic and protective value of natural capital such as coral reefs.

- *Dedicated trust fund vehicles*, such as the International Municipal Investment Fund can be established to receive national and international donations or private sector investment to finance urban climate projects.

Call to action

Finally, as highlighted in the report, there are numerous innovative financing approaches being developed and deployed to address investment barriers for climate smart cities. However, progress in scaling up sustainable urban infrastructure finance is slow and the risk of locking in high-emissions pathways is real. Significantly more needs to be done to support subnational governments in achieving low carbon, resilient urban development pathways, especially in fast- urbanizing cities in developing countries. No single solution exists to overcome the complex, multifaceted barriers that cities face in financing climate change projects.

Meeting the need will require investments in the underlying enabling environment, policy and planning capacity and policy preparation, as well as creative investment vehicles for leveraging large volumes of capital. The options include expanding municipal green and resilience bonds, enhancing policy and regulatory reform, developing urban green banks, investing in project structuring support, and expanding access to financial risk-reduction instruments. There is a need to expand local currency approaches to scale investments namely as i) many emerging markets do not have swap markets, ii) because many regulations only allow cities to borrow in local currency, and ii) because it's most prudent since city revenues are in local currency.

Furthermore, mobilizing private investment can only be achieved through the establishment of sustainable infrastructure as an asset class. Taking the development of the green bond market as a model, this will ideally be an inclusive stakeholder process that creates a credible labeling system for sustainable infrastructure investments. All can contribute to increasing critical climate investment in cities and upholding our global commitment to keep global warming to less than 1.5°C. The success of these approaches is contingent on cities having a long-term vision, a commitment to green investment, and a clear pipeline of projects.

International development organizations such as multilateral development banks, development finance institutions, and bilateral donors can be particularly helpful in this context. Among other things, they can play the critical role of supporting cities and infrastructure investors in allocating risk and return among transaction counterparties. International development organizations can support developing economies in leveraging private capital for infrastructure by offering a range of concessional finance products (low-interest loans, equity investments, credit guarantees) and helping mitigate risk through technical assistance.[33] In parallel, international organizations can improve the enabling environments at the municipal and national levels by developing the appropriate policies, regulations, and legal frameworks to encourage private investment.

33 See https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Public-Sector/gx-smart-cities-economies.pdf

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References

Azzopardi 2020. "Electric Buses Could Help Appease Disgruntled Chileans"

Blended Finance Taskforce 2018. "Better Finance, Better World."

Blended Finance Taskforce 2019. "Better Finance, Better Infrastructure."

C40 2018. "The demand for financing climate projects in cities."

C40 and ODI (Overseas Development Institute) 2019. "Financing the Sustainable Urban Future: Scoping a green cities development bank."

CCFLA (Cities Climate Finance Leadership Alliance) 2015. "State of City Climate Finance 2015."

CFLI (Climate Finance Leadership Initiative) 2019. "Investment Readiness Guidelines."

CPI (Climate Policy Initiative) 2019. "Global Landscape of Climate Finance 2019"

CleanTechnica 2020. "Chile Orders 150 Electric Buses From BYD"

Climate Bonds Initiative 2014. "Bonds and Climate Change: State of the Market in 2014."

Coalition for Urban Transitions 2018. "Global Review of Finance For Sustainable Urban Infrastructure: 2018."

Coalition for Urban Transitions 2019. "Climate Emergency, Urban Opportunity."

Coalition for Urban Transitions 2019b. "Scaling up Investment for Sustainable Urban Infrastructure: A Guide to National and Subnational Reform."

Coalition of Finance Ministers for Climate Action 2019. "Overview of the Santiago Action Plan."

Costanza et al. 2014. "Global Environmental Change: Changes in the Global Value of Ecosystem Services."

Energy Policy Institute of the University of Chicago n.d. " Air Quality Life Index"

ESMAP (Energy Sector Management Assistance Program) 2014. "Spatial Planning, Urban Form and Energy Efficient Cities."

GCA (Global Commission on Adaptation) 2019. "Adapt Now: A Global Call for Leadership on Climate Resilience."

GCEC (Global Commission on the Economy and Climate) 2018. "Unlocking the Inclusive Growth Story of the 21st Century – Accelerating Climate Action in Urgent Times."

GFDRR (Global Facility for Disaster Reduction and Recovery) 2015. "Investing in Urban Resilience: Protecting and Promoting Development in a Changing World." World Bank Group, Washington, DC.

Hogg, J. 2013. World Bank. "Financing Sustainable Cities, How we're helping Africa's cities raise their credit rating."

IFC (International Finance Corporation) 2017. "Climate Investment Opportunities in Cities." IFC, Washington, DC.

IIGCC (Institutional Investors Group on Climate Change) 2019. "Launch of the Coalition for Climate Resilient Investment (CCRI)."

IISD (International Institute for Sustainable Development) 2015. "Currency Risk in Project Finance."

IPCC (Intergovernmental Panel on Climate Change) 2014. "Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change."

IPCC 2018. "Global Warming of 1.5°C."

Ivanyna, M. and A. Shah 2012. "How Close Is Your Government to Its People? Worldwide Indicators in Localization and Decentralization." World Bank Policy Research Working Paper 6138. World Bank.

Kerschberg, B. 2019. "How Private Equity Can Fight Climate Change." Forbes.

Lall, S. and Sameh W. 2020. "No Urban Myth: Building Inclusive and Sustainable Cities in the Pandemic Recovery." World Bank

Lloyds 2018. "City Risk Index."

McKinsey & Company 2015. "Building the Cities of the Future with Green Districts."

NCE (The New Climate Economy) 2018. "Unlocking The Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times"

NCE 2016. "Financing the Urban Transition for Sustainable Development: Better Finance for Better Cities, Contributing paper for The Sustainable Infrastructure Imperative: Financing for Better Growth and Development."

Orbea, J. 2018. "How Santiago de Chile Became a Global Leader on Electric Buses."

Rockefeller Foundation. n.d. "Reef & Beach Resilience Insurance Fund."

The Nature Conservancy 2016. "Atlas of Ocean Wealth."

UNISDR 2015. "UN-Habitat Global Activities Report 2015, Increasing Synergy For Greater National Ownership"

UNESCO and World Bank 2018. "Culture in City Reconstruction and Recovery"

World Bank 2010. "Cities and Climate Change: An Urgent Agenda."

World Bank 2018. "City Creditworthiness Initiative: A Partnership to Deliver Municipal Finance"

World Bank 2019. "The Coalition of Finance Ministers for Climate Action."

World Bank Group (WBG). 2018a. "Financing a Resilient Urban Future: A Policy Brief on World Bank and Global Experience on Financing Climate-Resilient Urban Infrastructure."

WBG 2018b. "Urban Population (% of Total Population)."

WBG 2019a. "Urban Development."

WBG 2019b. "Lifelines for Better Development."

WBG 2020. "Progress Report on Mainstreaming Disaster Risk Management in World Bank Group Operations, 2020"

WEF (World Economic Forum). 2020. "The Global Risks Report 2020."

WEF 2020b. "5 Things We Learned About Climate Change at Davos 2020."

WRI (World Resources Institute) 2019. "Barriers to Adopting Electric Buses."

Appendix 1: Invest4Climate

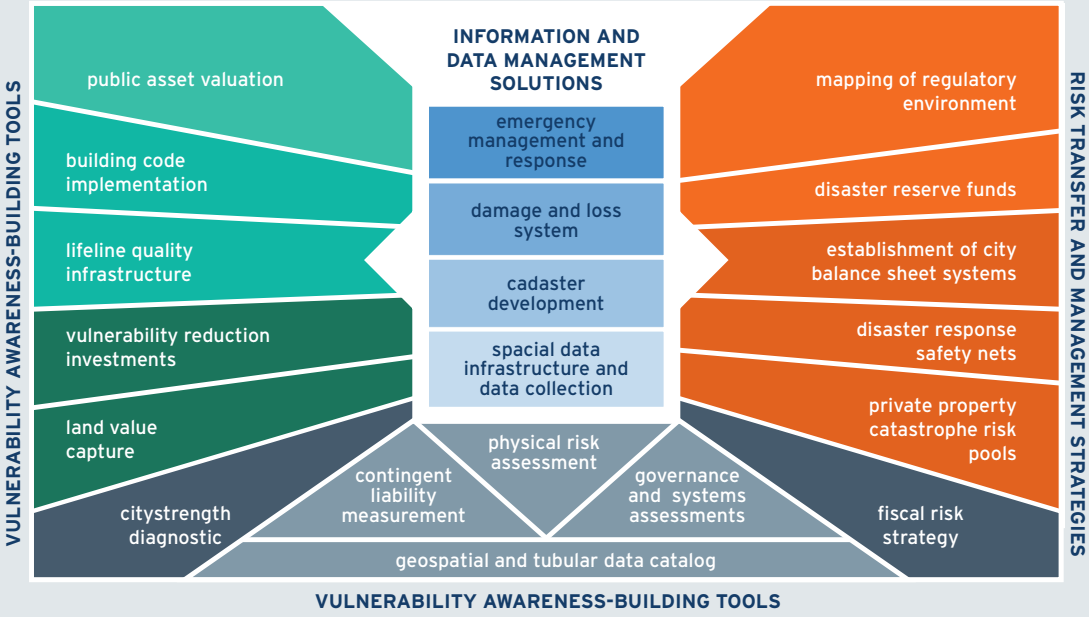
To address the climate investment gap, the World Bank Group and the United Nations Development Programme (UNDP) co-launched the Invest4Climate platform in September 2017. Invest4Climate aims to mobilize, coordinate, and deliver finance to close the climate financing gap and help countries transition to a resilient low-carbon future that supports jobs and growth.

Invest4Climate **acts as a convener, facilitator and knowledge provider to leverage finance and facilitate scaled-up approaches to tackle climate's biggest challenges**

	Convener	Deal Facilitator	Knowledge Provider
– Mobilizing existing teams and relationships in developing countries – Drawing on WBG unique suite of financial tools, resources and knowhow – Incorporating blended finance and maximizing finance for development approaches – Amplifying success stories at global scale to influence the regulatory and policy environments	– Convening potential providers of finance at senior decision-making level around common challenges and specific climate mitigation and resilience investment opportunities – Convening governments, financial institutions, investors, philanthropists, and multilateral banks to support policy reform and crowd in private investment	– Bringing respective UN & WBG experience in pipeline identification – Assisting potential climate focused transactions to prepare for and come to market for finance – Facilitating the identification and allocation of risks to providers of finance that can best manage them. – Leveraging investment and de-risking instruments though targeted policy and regulatory support; technical assistance and advocacy; financial engineering (loans, grants, guarantees, policy lending, results based finance	– Driving knowledge sharing and capacity building on climate action and finance – Piloting and demonstrating viable deals, standardization and new models for de-risking and scaling climate investment

Appendix 2: Sample Menu of Options for Urban Resilience Investments

Figure 4.3: Sample menu of options for urban resilience investments



Source: GFDRR 2015, 76.

Appendix 3: Key Financial Regulations and Their Effect on Institutional Investor Segments in the United States, European Union, and United Kingdom

	Legislative Region	Leverage limits	Collateral req.	Liquidity req.	Central clearing	Private equity limits	Trading tax	Brokerage fee limits	Deposit and reporting req.	Compensation limits	Pension funds	Insurance companies	Banks	Asset/wealth managers	Private equity
Dodd-Frank Wall Street Reform and Consumer Protection Act	US	■	■	■	■								■		■
619 (12 U.S.C. 1851) of the Dodd-Frank Act (Volcker Rule)	US					■							■		■
Foreign Account Tax Compliance Act	US								■				■	■	■
Third Basel Accord / Capital Requirements Directive	All	■	■	■				■	■	■			■	■	■
Undertakings for the Collective Investment of Transferable Securities V	EU								■					■	
Alternative Investment Fund Managers Directive	EU								■					■	■
Solvency II Directive	EU	■	■									■	■		■
Markets in Financial Instruments Directive II	EU							■	■			■			■
European Market Infrastructure Regulation	EU		■		■				■					■	
European Commission's Liikanen proposals	EU					■						■	■	■	
Financial Transaction Tax	EU					■							■	■	
Packaged Retail Investment Products	EU								■			■	■	■	
International Financial Reporting Standards	EU/ US		■						■		■		■		■
Retail Distribution Review	UK							■						■	

Source: Better Finance, Better World 2018 Report.