



# FINANCING AFRICA'S URBAN OPPORTUNITY

*THE 'WHY, WHAT AND HOW' OF  
FINANCING AFRICA'S GREEN CITIES*

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## About this report

This report was prepared by the Coalition for Urban Transitions, a global initiative to support national governments accelerate economic development and tackle climate change by transforming towns and cities, in collaboration with Climate Policy Initiative (CPI) and Vivid Economics on behalf of FSD Africa. The paper builds on extensive consultations with global and local organisations, namely the European Bank for Reconstruction and Development (EBRD), Global Development Incubator (GDI), African Development Bank (AfDB), African Centre for Cities (ACC), FSD Africa, Atlantic Council, World Resources Institute (WRI) and New Climate Economy (NCE). The opinions expressed and arguments employed are those of the authors.

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Cover Photo: Johannesburg, South Africa cityscape. Credit: Finn Stock/Shutterstock.

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## Contents

Forewords	6
Executive Summary	8
Introduction	15
1. Why compact, connected, clean and resilient cities matter for Africa?	18
2. The economic benefits of compact, connected and clean cities for African countries	28
3. What is the scale of investment needed?	34
4. Barriers to realising these investments	44
5. National action to overcome barriers to investing in cities	53
6. Financing mechanisms for investing in compact, connected, clean and resilient cities	61
Conclusion	78
Appendix	82
Acknowledgements	87
Endnotes	88

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## List of figures

<b>Figure ES.1:</b> The six benefits of compact, connected, clean and resilient (3CR) cities in Africa	9
<b>Figure ES.2:</b> Expected returns on investment in compact, clean and connected city interventions after payback (i.e. NPV) to 2050	10
<b>Figure 1:</b> Economic costs of unplanned urban development relative to the potential contained in low-carbon, climate-resilient urban development in African cities	22
<b>Figure 2:</b> The six benefits of compact, connected, clean and resilient (3CR) cities in Africa	24
<b>Figure 3:</b> The impact of investment in urban climate interventions across 35 major cities in Kenya, Ethiopia and South Africa	32
<b>Figure 4:</b> Total incremental investment required by 2050 to deliver low-carbon interventions	35
<b>Figure 5:</b> Expected returns on investment in compact, clean and connected city interventions after payback (i.e. NPV) to 2050	38
<b>Figure 6:</b> Case Study—City Creditworthiness Initiative	57
<b>Figure 7:</b> Case Study: Freetown property tax reform	60
<b>Figure 8:</b> Case Study—Philippines City Disaster Insurance Pool	66
<b>Figure 9:</b> Case Study—Cooling as a Service	68
<b>Figure 10:</b> Case Study—Pay As You Save for Clean Transport	70
<b>Figure 11:</b> Case Study – Nagpur Water Supply PPP	72
<b>Figure 12:</b> Case Study—Breathe Better Bond	75
<b>Figure 13:</b> Case Study—Kenyan County Climate Funds	77
<b>Figure 14:</b> Instruments to enable investments in compact, connected, clean and resilient cities	80

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## List of tables

<b>Table ES.1:</b> Barriers to investing in compact, connected, clean and resilient cities	12
<b>Table ES.2:</b> Six instrument case studies by city role and contributions to 3CR objectives	14
<b>Table 1:</b> Compact, connected, clean and resilient cities are closely aligned with the SDGs and Agenda 2063 targets	27
<b>Table 2:</b> Low-carbon interventions considered in this analysis that contribute to compact, connected and clean cities	30
<b>Table 3:</b> City-level benefits for capital city and a major regional hub in each country	33
<b>Table 4:</b> Average annual investment required and comparators for major cities in Ethiopia, Kenya and South Africa	37
<b>Table 5:</b> City-level incremental investment requirement for the capital city and a major regional hub in each country	39
<b>Table 6:</b> Estimated per capita municipal budgets in select African cities	45
<b>Table 7:</b> Barriers to investing in compact, connected, clean and resilient cities	47
<b>Table 8:</b> Six instrument case studies by city role and contributions to 3CR objectives	64
<b>Table A1:</b> Financial instruments and funding models for investing in urban infrastructure	82
<b>Table B1:</b> List of interventions modelled	83
<b>Table B2:</b> List of major cities included	84
<b>Table B3:</b> Cost parameter assumptions for Ethiopia, Kenya and South Africa	85

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## Forewords

“Africa’s urban population is growing faster than in any other region of the world with over a billion more people expected to be crowded into its cities by the year 2050. No other region is experiencing such a massive shift during this period of acute and growing climate anxiety. And Africa is already far more exposed to the impact of climate change than any other continent.

The challenge facing Africa’s cities is how to balance the need for urgent action to avert this crisis with the growing demands of its urban population for jobs, a decent standard of living and places to live that are safe and clean.

As this timely report tells us, the good news is that this is not a binary choice between development and a more sustainable future. Investing now in low-carbon, climate-resilient urban development through more compact urban growth, connected infrastructure and clean technologies will deliver a better future for the environment and for Africa’s urban population

In this year of COP26, it is right that we should be paying serious attention to the way this can be achieved.”

### **Vicky Ford**

*Minister for Africa, UK Foreign, Commonwealth & Development Office*



“Just as Africa comes to terms with the economic consequences of COVID-19, climate change threatens to impose massive additional costs on the continent. Africa’s cities are more exposed than cities in other regions to the impacts of climate change. If we are to climate-proof our future in Africa we need to invest now in urban development in ways that create opportunities for our growing population and put resilience at the forefront of our decision-making so that we avoid the immense costs that we can ill-afford when climate-related shocks occur. We must do this to safeguard the economic well-being and health of our people.

The greening of Africa’s cities will cost billions of dollars but, as this insightful report tells us, the returns will be even greater. Securing the investment needed will not be easy. It will require public and private sector partnership. It will also need domestic and international financiers to work together, pooling their capital and ideas. Above all, it will take extraordinary vision and ambition from political and community leaders.

Importantly, the report goes beyond analysis to recommend specific steps cities can take to secure the private investment needed. In particular it highlights six overarching finance mechanisms, from innovative pay-as-you-use cooling subscriptions to leasing contracts for electric bus fleets, that have already been demonstrated to be effective, scalable and to contribute positively to sustainable urban development across Africa’s diverse cities.”

### **Anthony Nyong**

*Regional Director, Africa, Global Center on Adaptation*



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“Climate change brings huge challenges for Africa’s cities, already burdened by the problems associated with rapid urbanisation, of inadequate infrastructure, congestion and unhealthy living conditions. But, as this report sets out, with the right interventions and the right investment we can create cities that are not only more sustainable but provide a more liveable future for all their residents. Key to this will be unlocking flows of private capital which has historically seen urban infrastructure in Africa as a relatively unattractive proposition. This report will take forward our thinking on this topic and help stimulate a collaborative effort to develop innovative financial solutions that are appropriate to the African context whilst also drawing on international expertise. We know this is possible. Just look at how innovations in Africa’s retail banking sector such as mobile banking have had a transformative effect on the lives of millions of Africans. Now we need to apply that same spirit to urban climate finance.”



**Jean-Paul Adam**

*Director for Technology, Climate Change and Natural Resources Management, UNECA*



“Africa faces major challenges to address rapid urbanisation and industrialisation in a way that does not exacerbate the threats posed by climate change. While Africa is not a big emitter on the world stage, it risks becoming one without environmentally sustainable approaches to address its rapid urbanisation. There is a window of opportunity to find ways to adequately fund Africa’s urban transition in a way that provides resilience and security for its urban populations.

The economic case for sustainable and resilient cities is clear: the benefits to prosperity and quality of life will ultimately pay off the considerable investment required to get there. This report addresses *how* to finance Africa’s urban opportunity.

The solutions here provide examples of innovative instruments emerging from the digital and energy worlds alongside tried and tested partnerships and green financing

It will require strong leadership and collaboration between levels of government, civil society and the private sector to unlock the required investment. But with robust action and engagement, Africa can unlock its urban potential and look forward to a path of prosperity and resilience.”

**Wanjira Mathai**

*Vice-president and Regional Director for Africa, WRI*



Kampala, Uganda outskirts. Credit: Dennis Wegewijs/Shutterstock.

## Executive Summary

Africa's future will depend on the success of its cities. With an astounding increase in the continent's urban population and the fastest urban growth rate in the world, the region is expected to see a two-and-a-half-fold increase in its urban population in the next 40 years. While this urbanisation holds great transformative potential for the continent's development, Africa is struggling to secure its urban dividend. Fragmented, disconnected, polluted and costly: this business-as-usual pattern of urbanisation is imposing significant economic and social costs on African cities.

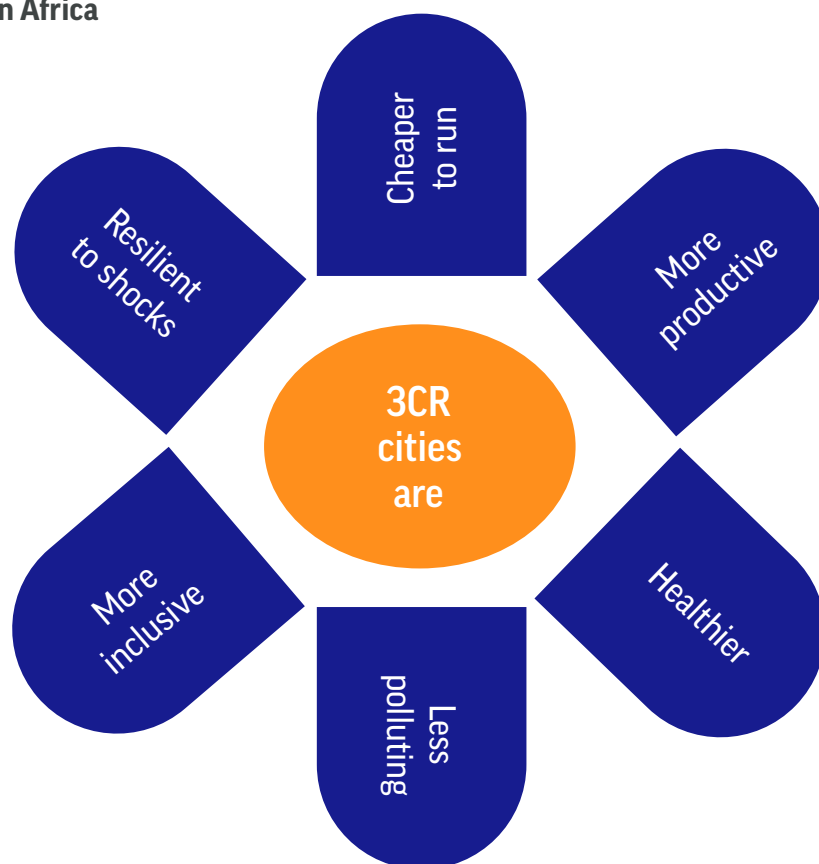
The unprecedented scale of urban growth has made efficient and inclusive urban planning extremely difficult. Poorly planned cities are characterised by unmanaged sprawl, increased distance between residents and work opportunities, rapid growth of informal settlements on the urban periphery, increased cost of service delivery, severe congestion, local air pollution, inefficient energy use, high greenhouse gas (GHG) emissions and other negative spillovers. This has led to a lack of socially inclusive, compact cities serviced by public transport, potable water and clean energy, largely due to the relative low-income levels against which urbanisation is taking place and the resulting low level of resources that can potentially be mobilised for urban investments. Power centralisation, inefficient taxation and the absence or low quality of land cadastre are other factors that have made sprawl the default urban form.



Climate change is bringing the urban development deficit into sharper contrast. Africa accounts for less than 2% of current GHG emissions, yet it is the most vulnerable to climate change. Much of the continent is already warming more quickly than the rest of the world. By 2050, mean atmospheric temperatures in Africa will almost certainly be at least 2°C above the long-term average. Consequently, Africa's urban development is likely to confront unprecedented biophysical risks. Low capacity to withstand the impacts of natural disasters costs Africa an estimated US\$832 million every year, with a growing share of this cost being borne by cities. Seventy-nine of the fastest-growing African cities, including 15 African capitals and many of the continent's key commercial hubs, are at 'extreme risk' from climate change.

Three pillars will be crucial for low-carbon, climate-resilient urban development: compact urban growth, connected infrastructure and clean technologies. They can drive cost and resource efficiencies, create jobs through the benefits of economies of scale and agglomeration and foster resilience and productivity. When these pillars are delivered with emphasis on principles of resilience and inclusivity, they have the potential to create long-lasting change for all.

**Figure ES.1: The six benefits of compact, connected, clean and resilient (3CR) cities in Africa**



**Source:** Adapted from Coalition for Urban Transitions, 2019. Climate Emergency, Urban Opportunity.

Across 35 major cities in Ethiopia, Kenya and South Africa, investment in more compact, clean and connected cities is expected to deliver total benefits equal to US\$1.1 trillion by 2050, supporting hundreds of thousands of additional jobs compared to conventional fossil fuel investment. By 2050, investment in urban climate interventions in major cities in Ethiopia, Kenya and South Africa could deliver US\$240 billion, US\$140 billion and US\$700 billion in benefits, respectively —equivalent to 250% of annual GDP (2020) in Ethiopia, 150% in Kenya and 200% in South Africa. New investment in urban climate interventions is also expected to generate significant wider economic

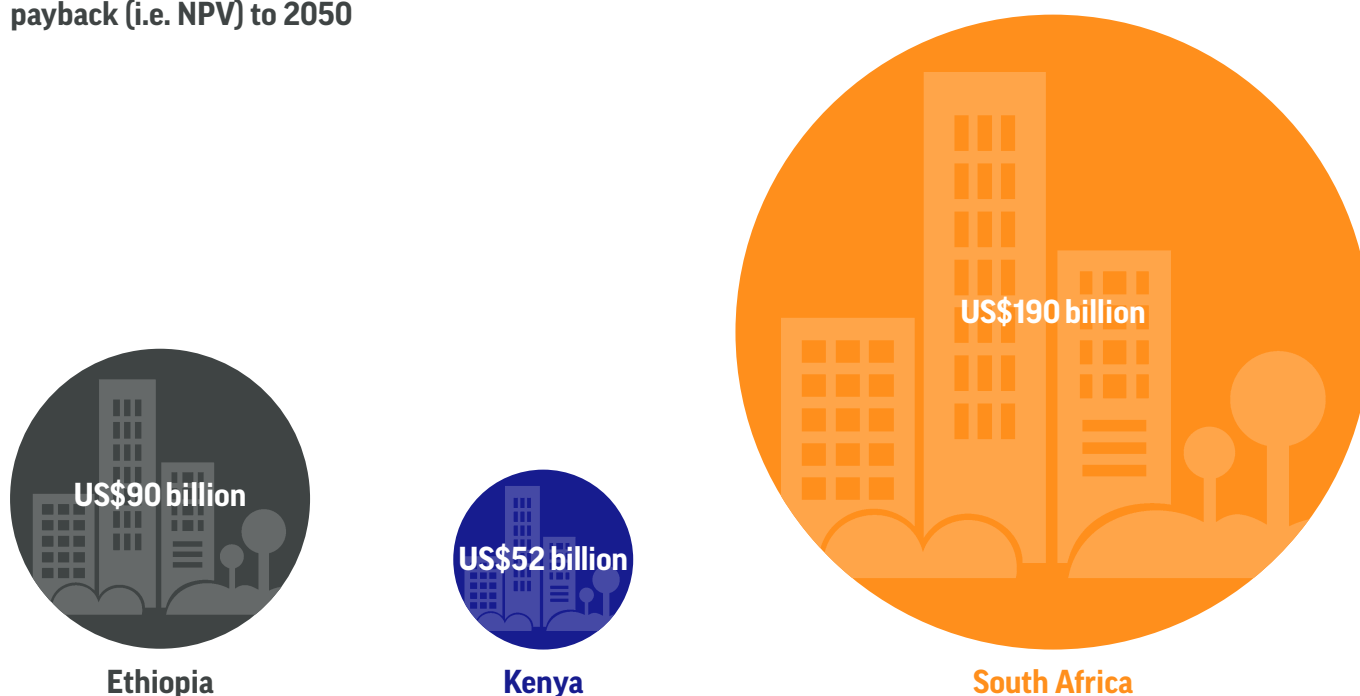
**While a significant amount of investment is required to deliver compact, clean and connected cities in Africa, the case for investment rests on robust returns.**

benefits, including additional employment compared to traditional fossil fuel energy consumption, resulting in an average of 210,000 net new jobs in Ethiopia, 98,000 in Kenya and 120,000 in South Africa to 2050.

For the 35 major cities in Ethiopia, Kenya and South Africa, delivering compact, connected and clean cities will require US\$280 billion of incremental investment by 2050—a significant level of investment when compared to forecasted spending to deliver national climate targets across the three countries. While a significant amount of investment is required to deliver compact, clean and connected cities in Africa, the case for investment rests on robust returns. Across

all three countries, the net present value (NPV) or the extent to which benefits exceed costs over the period to 2050 yield very significant positive net returns. For major cities in Ethiopia, Kenya and South Africa, they are expected to be US\$90 billion, US\$52 billion and US\$190 billion, respectively.

**Figure ES.2: Expected returns on investment in compact, clean and connected city interventions after payback (i.e. NPV) to 2050**



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Realising these investments is a difficult task for cities and local authorities on the continent, the vast majority of which face budgetary constraints, high debt levels and poor creditworthiness. The complex, diverse and unevenly developed landscape in which sub-Saharan cities operate makes for a challenging environment to attract and deploy urban investment. The majority of cities in Sub-Saharan Africa (SSA) remain deficient in creditworthiness, capacity, accountability, organisational structure and governance. Unless these barriers are addressed, finance is unlikely to flow at the necessary scale. In particular, without sound financial management, subnational governments will continue to lack the ability to generate meaningful own-source revenues or to attain the required creditworthiness or market access to attract financing from capital markets.

Addressing these barriers is not something that subnational governments can manage alone. This will require significant leadership from and collaboration with national governments. National governments play a strong enabling role in setting market conditions that draw in private sector capital for sustainable infrastructure programmes through a mix of non-financial actions such as enacting supportive policies, standards and regulations, as well as providing pricing signals and improving information flows. Four instruments that fall under the control or influence of national governments stand out here: National Urban Policies, fiscal decentralisation (under the right conditions), building city creditworthiness and land value capture.

While national governments must establish and execute comprehensive, actionable development strategies to enhance investment flows for sustainable urban infrastructure, cities can deploy a wide variety of financial instruments to implement the range of compact, connected, clean and resilient (3CR) interventions highlighted earlier. Of course, the exact instruments that cities consider will continue to be determined by their fiscal, financial and administrative capacities as well as their legal authority.

The report proposes six demonstrable financing instruments, all shown through pilots to be effective, scalable and to contribute positively to sustainable urban development: insurance pools to provide infrastructure repairs following extreme weather events; pay-as-you-use subscriptions for cooling and other energy efficiency services across domestic and public buildings; leasing agreements between city authorities and utility providers to leverage financial and technical capabilities for high upfront cost green infrastructure projects; public-private partnerships to outsource improvements and management of key infrastructure to the private sector; green bonds issued to raise finance for climate-friendly projects; and community-driven climate funds which enable local involvement prioritising which adaptation and resilience projects to fund from the dedicated climate budget.

**Table ES.1: Barriers to investing in compact, connected, clean and resilient cities**

Barrier	Summary	Manifestations of barriers	Barrier addressed by:	
			National action	Financial instrument solutions
<b>Jurisdictional barriers</b>	Overly restrictive laws or regulations limit the financial and/or operational autonomy of cities.	<ul style="list-style-type: none"> <li>• Proliferation of local government entities and parastatal agencies leads to overlapping or conflicting organisational mandates.</li> <li>• National government restrictions limit the ability of cities to raise revenue through taxation on income, sales or land value.</li> <li>• Poorly coordinated elements of the subnational fiscal system are unable to fill gaps in funding and capacity when different departments within the national finance ministry have responsibilities for different functions (budget, local revenues, transfers and lending) and compete to control policy agendas and funding.</li> <li>• Requirements to obtain state or national government approvals slow or prevent development of locally funded and developed infrastructure projects.</li> <li>• Most large-scale urban infrastructure in urban areas is provided by state-owned enterprises, meaning that central government approval is necessary, and that projects may not be compatible with local plans and priorities.</li> </ul>	✓	
<b>Political economy and governance</b>	Political realities often discourage or prevent cities from pursuing long-term, large-scale infrastructure projects.	<ul style="list-style-type: none"> <li>• Cities themselves are often reluctant to take on the responsibility of making politically unpopular decisions to raise their own taxes or to monetise public services.</li> <li>• Fluctuation in priorities of city leadership means constant changes in which projects are prioritised.</li> <li>• Rapid turnover of officials, often driven by political parties and interests, makes it difficult to plan and implement projects, especially partnerships with the private sector.</li> <li>• Lack of political will to implement low-carbon projects that have longer payoff periods and may not enter operation or provide meaningful benefits during the current electoral cycle.</li> <li>• Where urban areas are controlled by opposition parties, national governments are often reluctant to empower municipal authorities or relinquish control over visible public services.</li> </ul>	✓	
<b>Organisational barriers</b>	Internal limitations on the ability and willingness of city governments to finance climate projects arise from capacity constraints and risk aversion.	<ul style="list-style-type: none"> <li>• Institutional lack of knowledge and skills, financing mechanisms, emerging low-carbon technologies and co-benefit investments (i.e. projects that address mitigation and adaptation simultaneously).</li> <li>• Cities have project ideas and wish lists, but these are rarely well-structured or designed in terms of bankability due to analytical and technical capacity constraints.</li> <li>• Structuring procurement and financing approaches, such as public private partnerships or green bonds, takes several years.</li> <li>• Lack of experience and knowledge implementing complex financial structures and/or gaps in sectoral or industry expertise prevent cities from being able to implement specific types of financing structures.</li> </ul>	✓	✓



<b>Inability to access capital markets</b>	Cities have little to no access to public (bond) or private (commercial bank) debt markets.	<ul style="list-style-type: none"> <li>• Subnational borrowing is heavily regulated in many countries with cities not allowed to borrow from foreign banks, and domestic credit may be constrained due to financial repression policies.</li> <li>• Cities lack authority to raise municipal debt ceilings, which are often set at arbitrarily low levels.</li> <li>• Subnational governments struggle to service debt due to heavy dependence on budgetary appropriations from state and national governments, poor financial planning and inadequate levels of own revenues.</li> <li>• Banks need to charge higher interest rates to offset elevated default risk from subnational governments, resulting in prohibitively high borrowing costs.</li> </ul>	✓	✓
<b>Difficulty monetising social benefits</b>	Cities cannot collect the revenue required to offset the costs of constructing and maintaining public goods and services.	<ul style="list-style-type: none"> <li>• Cities often provide certain socially beneficial services for free or at rates that reflect a heavy discount from the true cost to provide the service, such as parking, water supply or waste disposal; this underpricing compromises cities' financial health and ability to fund improvements to public infrastructure.</li> <li>• This barrier is exacerbated by the free-rider problem: When cities invest in "intangible" outcomes like cleaner air, reduced emissions and more resilient infrastructure, all residents benefit regardless of their willingness or ability to pay, so the city's "return" on investment does not include cashflows to pay back initial expenditures.</li> </ul>	✓	✓
<b>Lack of upfront capital</b>	Cities lack the upfront capital to fund their investment priorities.	<ul style="list-style-type: none"> <li>• Subnational governments often struggle with high debt ratios, low capital reserves, limited revenue sources, inadequate revenue collection from municipal services and fees and/or restricted revenue-raising powers, insufficient or inaccessible collateral, etc, limiting their ability to directly fund infrastructure projects.</li> <li>• Technologies that contribute to 3CR development, including solar energy, battery-electric buses and energy-efficient buildings often have higher upfront costs than "conventional" alternatives, discouraging cities from investing despite clear long-term savings opportunities from construction of low-carbon, climate-resilient infrastructure.</li> </ul>		✓
<b>Insufficient project pipeline</b>	Cities lack a deep pool of high-quality, bankable infrastructure projects.	<ul style="list-style-type: none"> <li>• Subnational governments lack financial resources to conduct the rigorous project preparation that is key to bringing forward bankable projects for financing and development.</li> <li>• Few projects are fully evaluated for implementation due to exceptionally high costs of pre-feasibility and feasibility studies relative to other regions due to the underdeveloped academic and consulting sphere in most African countries</li> <li>• Absence of local capacity means feasibility studies are often produced by consultants from outside the continent using unrealistic templates that are not relevant to African cities, reducing investor confidence and willingness to commit capital.</li> </ul>		✓
<b>Foreign exchange and interest rate risks</b>	Fluctuations in foreign exchange and interest rates can threaten cities' ability to finance critical projects.	<ul style="list-style-type: none"> <li>• Foreign exchange rates and interest rates fluctuate in response to many macro factors, including foreign and domestic monetary policy, business cycles, political events and other outcomes that impact the costs of currency or debt, which can in turn adversely impact borrowers' ability to repay loans, especially over the course of a costly, long-lived infrastructure project.</li> <li>• This barrier is especially prevalent for cities in nations with both high inflation rates and limited local currency capital available through financial institutions or public exchanges, two characteristics that are especially common in low- and lower-middle-income countries in sub-Saharan Africa.</li> </ul>		✓

**Source:** Author elaboration based on expert interviews; Floater et al., 2017. *Global Review of Finance for Sustainable Urban Infrastructure*.

The report is the first of its kind to present the economic benefits of compact, connected, clean and resilient cities in Africa, while identifying key mechanisms and innovative financial instruments to raise the resources needed to achieve the transition. The findings are based on literature review, original economic modelling and 12 expert interviews. They include 11 case studies, four enabling mechanisms and six innovative financing instruments.

**Table ES.2: Six instrument case studies by city role and contributions to 3CR objectives**

City Role	Instrument	Contribution to 3CR cities			
		COMPACT urban Growth	CONNECTED infrastructure	CLEAN technologies and environmentally friendly practices	RESILIENT planning, governance and finance
City as Mobiliser	<i>Philippines City Disaster Insurance Pool</i>	Cities incentivised to limit urban sprawl and development in environmentally sensitive areas to reduce insurance premiums	Parametric insurance pays out quickly, funding repairs to critical transportation, sanitation and communication infrastructure		Affordable insurance to enable fast recovery from extreme weather events
	<i>Cooling as a Service</i>			Incentivises deployment of energy-efficient cooling equipment	Affordable cooling services improve urban residents' productivity, health and safety during extreme heat events
City as Partner	<i>Pay As You Save for Clean Transport (PAYS)</i>	Improved public transport encourages dense, mixed-use development and walkable neighbourhoods	Stronger, higher performing public transport networks connect urban residents to employment, social services and other amenities	Increases affordability of battery-electric buses, which reduce carbon emissions and local air pollution	
	<i>Nagpur Water Supply Public-Private Partnership (PPP)</i>		Water supply contract includes provisions for maintenance and improvement of city-owned infrastructure		PPP employs private sector partners to manage infrastructure and service delivery, freeing up city personnel to tackle other important city planning and governance challenges
City as Leader	<i>Breathe Better Bond (BBB)</i>			Helps cities raise funds for projects to address local air pollution and reduce GHG emissions	
	<i>Kenyan Country Climate Funds</i>		Local citizens' councils identify and prioritise critical local infrastructure projects based on community needs		Government funds allocated at city level based on citizens' input, enabling targeted investment in local resilience

**Note:** GHG = Greenhouse gas. **Source:** Climate Policy Initiative for the Coalition for Urban Transitions.



Street in Addis Ababa, Ethiopia. Credit: RVDW Images/Shutterstock.

## Introduction

*We aspire that by 2063, Africa shall be a prosperous continent, with the means and resources to drive its own development, and where: African people have a high standard of living, and quality of life, sound health and well-being; Well educated citizens and skills revolution underpinned by science, technology and innovation for a knowledge society; Cities and other settlements are hubs of cultural and economic activities, with modernised infrastructure, and people have access to all the basic necessities of life including shelter, water, sanitation, energy, public transport and ICT [information and communication technology]; Economies are structurally transformed to create shared growth, decent jobs and economic opportunities for all.*

African Union, Agenda 2063: The Africa We Want

Africa's future will depend on the success of its cities. With an astounding increase in the continent's urban population and the fastest urban growth rate in the world, the region is expected to see a two-and-a-half-fold increase in its urban population in the next 40 years.<sup>1</sup> While this urbanisation holds great transformative potential for the continent's development, Africa is struggling to secure its urban dividend. Fragmented, disconnected, polluted and costly: this business-as-usual pattern of urbanisation is imposing significant economic and social costs on African

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cities. Urban sprawl is reducing the resources available for investment in basic urban infrastructure and services, as well as in public transport. The combined effects of urban sprawl and motorisation are increasing social fragmentation and leading to severe congestion and long travel times. High road fatality rates and urban air pollution are prime public health concerns.<sup>2</sup> While many countries across the globe continue to see rising urban populations, Africa is unique in that it is the only continent to experience meaningful urbanisation under severe climate change. African cities now increasingly need to cope with pressures from global climate and environmental changes. Climate change is bringing the urban infrastructure deficit in these cities into sharper contrast, with many of the continent's important commercial urban hubs at "extreme risk" from climate change.<sup>3</sup>

Low-carbon, climate-resilient urban development through a shift to more compact urban growth, connected infrastructure and clean technologies offers considerable benefits and potential accelerated growth across the continent. Taking the form of high (yet liveable) density, mixed neighbourhoods; high-capacity public transport; and smarter, more efficient buildings and utilities, compact, connected, clean and resilient cities offer clear "win-win" opportunities.<sup>4</sup> They provide ideal locations for economic diversification and the development of new industrial and manufacturing sectors; they facilitate engagements of the continent's youthful workforce and create employment opportunities and innovation in new city-related products and services; they boost long-term urban productivity; they support more balanced and inclusive development; and they reduce vulnerability to climate change.

While the nature of the urbanisation holds profound implications for the continent's economic prospects, it is important to note that this transition itself will be determined by the specific characteristics of each region. African cities are not uniform or homogenous places. There are differences across regions depending on the level of development of each country; different geographical, biophysical and cultural conditions; and varied relative levels of wealth and poverty. There is no generic or simplified solution to the continent's urban challenges. Further, the scale of projected investments to drive compact, connected, clean and resilient urban development is varied and depends on country-specific characteristics, as do the challenges of financing these investments. Yet Africa's urban transformation is characterised by some key common features and particularities.<sup>5</sup> This report draws on these features and particularities to bring African cities into a common discussion.

It explores how the simultaneous climate and urban challenges might catalyse an alternative, more appropriate, agenda for development in African cities, rather than the observed path of urban growth. In doing so, it focuses on three key questions:

- Why: Why compact, connected, clean and resilient cities are critical to Africa's future economic, social and environmental development?
- What: What is the economic case for investment in compact, connected and clean cities in Africa, and what is the quantum of investments required?
- How: How can the barriers to financing these investments be overcome and the urban opportunity be realised?



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The report is the first of its kind to present the economic benefits of compact, connected, clean and resilient cities in Africa, while identifying key mechanisms and innovative financial instruments to raise the resources needed to achieve the transition. The findings are based on literature review, original economic modelling and 12 expert interviews. They include 11 case studies, four enabling mechanisms and six innovative financing instruments.

Section 1 examines the current state of sub-Saharan African cities and their history with climate finance. Current urbanisation trends are unsustainable, with high pollution, unmanaged sprawl, high cost of services and unhealthy living conditions making a case for urban investment that helps to create compact, clean, connected and resilient cities.

Section 2 outlines the economic case for investment with support from new economic modelling on the costs and benefits of action in major cities in Ethiopia, Kenya and South Africa. There is a strong case for investment, with benefits including energy savings and other avoided costs such as reduced vehicle costs and lower material costs for construction, and wider economic benefits such as job and gross value added (GVA) creation by 2050.

Section 3 details the scale of investments needed in major cities across selected countries. While a significant amount of investment is required to deliver compact, clean and connected cities in Africa, the case for investment rests on robust returns. The report presents three case studies on existing initiatives from all three countries, demonstrating the relevance of modelled interventions.

Section 4 addresses the barriers to realising investments, including jurisdictional, governance, organisational and fiscal barriers. These fall into two categories regarding possible solutions: enabling environment interventions or financial instrument solutions. While these barriers are not unique to the African region, they are compounded by the lack of maturity and inaccessibility of African financial markets.

Section 5 focuses on the barriers regarding enabling environments. It confronts the challenge of attracting and deploying urban investments in the diverse and complex landscape of sub-Saharan cities, where creditworthiness remains deficient. Four proposed enabling mechanisms include National Urban Policies, fiscal decentralisation, improving city creditworthiness and implementing land value capture (LVC).

Section 6 follows with financing barriers and the instruments and mechanisms available for investing in compact, connected, clean and resilient cities. The exact instruments used will vary with cities' sizes and degree of municipal government involvement. However, there are six recommended instruments and models that meet criteria for effectiveness, scalability and contribution to sustainable urban development.



City street in Mombasa, Kenya. Credit: PrzemoleC/Shutterstock.

## 1. Why compact, connected, clean and resilient cities matter for Africa?

### THE COST OF URBANISATION AS USUAL

Over the past 60 years, economic activity across the African continent has shifted markedly from rural to urban areas.<sup>6</sup> As of 2015, over half of the continent's population lived in one of the 7,617 urban agglomerations.<sup>7</sup> In absolute terms, the urban population has increased by 2000%, from 27 million in 1950 to 567 million in 2015.<sup>8</sup> Estimates suggest that 143 cities generate a combined US\$0.5 trillion in economic output, totalling 50% of sub-Saharan Africa's (SSA) GDP.<sup>9</sup> It is no surprise then that the African Union's Agenda 2063 sees functioning urban sectors as "a major driving force in the continent's transformation" through their contribution to economic growth, employment generation and poverty reduction.

The unprecedented scale of urban growth has made efficient and inclusive urban planning extremely difficult. Poorly planned cities are characterised by unmanaged sprawl, increased distance between residents and work opportunities, rapid growth of informal settlements on the edge of cities,<sup>10</sup> increased cost of service delivery, severe congestion, local air pollution, inefficient energy use, high greenhouse gas (GHG) emissions and other negative spillovers.<sup>11</sup> This has led to a lack of socially

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inclusive, compact cities serviced by public transport, potable water and clean energy, largely due to the relative low-income levels on which urbanisation is taking place and the resulting low level of resources that can potentially be mobilised for urban investments. Power centralisation, inefficient taxation and the absence or low quality of land cadastre are other factors that have made sprawl the default urban form.

Although urban dwellers in the region enjoy significantly higher levels of access to improved sanitation (40% versus 23%) and improved water (87% versus 56%) relative to the rural populations,<sup>12</sup> this lags far behind other regions in the Global South.<sup>13</sup> In 2018, 78.1% of sub-Saharan Africa's urban population had access to electricity. This is lower than the averages for the Middle East and North Africa (99.4%), Latin America and the Caribbean (99.6%), South Asia (99.5%) and the world (97.3%).<sup>14</sup> In that same year, only 44.9% of sub-Saharan Africa's urban dwellers used at least basic sanitation services (compared to 94.1% in the Middle East and North Africa region and 84.4% at the global level).<sup>15</sup>

Thus far, the continent has failed to secure its “urban dividend”—the economic benefits that arise from an alignment of talented jobseekers, livelihood opportunities and services in cities. Unlike in other parts of the world, urban growth is occurring without much in the way of economic transformation.<sup>16</sup> Indeed, urban form has not always evolved in ways that maximise agglomeration benefits. Specifically, sub-Saharan Africa's large cities tend to be characterised by informality and expansive urban sprawl—fragmented, disconnected and costly—both for the inhabitants as well as the administrations, inhibiting productivity and economic growth. A spatial and economic analysis of 64 African cities of different sizes shows that these cities lack physical density and connectivity through planned transport and infrastructure systems, preventing them from offering firms the level of cost efficiencies and job creation advantages that have been possible in other countries. Consequently, cities themselves are trapped in low development pathways with few globally tradable.<sup>17</sup>

Climate change is bringing the urban development deficit into sharper contrast.<sup>18</sup> Africa accounts for less than 2% of current GHG emissions, yet it is the most vulnerable to climate change. Much of the continent is already warming more quickly than the rest of the world. By 2050, mean atmospheric temperatures in Africa will almost certainly be at least 2°C above the long-term average.<sup>19</sup> Consequently, Africa's urban development is likely to confront unprecedented biophysical risks.<sup>20</sup> The low capacity to withstand the impacts of natural disasters costs Africa an estimated US\$832 million every year, with a growing share of this cost being borne by cities.<sup>21</sup> Seventy-nine of the fastest-growing African cities, including 15 African capitals and many of the continent's key commercial hubs, are at “extreme risk” from climate change.<sup>22</sup> These include Abuja, Addis Ababa, Dar es Salaam, Kampala, Lagos and Luanda where the annual population is set to grow by between 3.7 and 5.0% a year on average between 2018 and 2035.<sup>23</sup> As cities grow, however, climate change will place increasing pressures on energy options and will expose government infrastructure deficits. This more insidious and systemic climate change impact where climate change exposes governance and infrastructure deficits



is more difficult to counter.<sup>24</sup> For example, the frequency and intensity of natural disasters will expose the absence of cadastral systems and census data, frustrating the mobilisation of relief efforts and spreading conflicts over boundaries and the allocation of resources. Similarly, the rise in sea level will expose poor coastal planning and injudiciously reclaimed land. Emergency interventions and the replacement of public housing located too near the coast will likely divert funding from other programmes.<sup>25</sup>

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## BOX 1      Impacts of climate-related shocks on African cities – select examples

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- In Kampala, Uganda, near-surface temperature increased between 1979 and 2005, making localised rainfall both more intense and more variable, resulting in increased prevalence of flooding and, in conjunction with longer dry periods, disruption of hydroelectric power generation and distribution of electricity.<sup>26</sup>
- Poor coastal planning and injudiciously reclaimed land in the deltas of Lagos, Dakar and Alexandria will be exposed by sea-level rise.<sup>27</sup> An assessment of the vulnerability in the Egyptian cities of Alexandria, Rosetta and Port Said suggests that a sea-level rise of 0.5 metres (m) could see more than 2 million people abandoning their homes, 214,000 jobs lost and over US\$35 billion lost in property value and tourism income.<sup>28</sup> This cost does not take into account the loss of the globally renowned historic, cultural and archaeological sites in these cities.<sup>29</sup>
- In Cape Town, South Africa, where parts of the city are built on reclaimed land, the cost of sea-level rise has been estimated at US\$49 million–US\$2.01 billion by 2035, depending on the extent of the rise.<sup>30</sup>
- Climate change-induced recurrent flooding has caused severe economic losses in cities in Senegal. The floods of 2009 in Saint Louis, Kaolack, Thies and Dakar resulted in the temporary displacement of more than 200,000 people and caused more than US\$100 million in damages and losses.<sup>31</sup> Floods in 2012 in Saint Louis, Bambey and Dakar displaced more than 5,000 families.<sup>32</sup> According to the World Bank, €40 billion worth of economic assets are vulnerable to flooding in the Dakar region alone.<sup>33</sup>
- An estimated 17% of the area in the city of Mombasa, Kenya, amounting to 4,600 hectares, could be submerged by a sea-level rise of 0.3 metres, with a larger area rendered uninhabitable or unusable for agriculture because of waterlogging and salt stress.<sup>34</sup>
- A sea-level rise in Abidjan, Côte d'Ivoire, is likely to inundate 562 square kilometres along the coastline of the Abidjan region, as lowland marshes and lagoons dominate the coastal zone.<sup>35</sup> Major economic assets including the city's port, which is the largest in Côte d'Ivoire, and much of the international airport are on land less than 1 metre above sea level and are vulnerable.<sup>36</sup>

**Sources:** Cartwright, 2015. *Better Growth, Better Cities: Rethinking and Redirecting Urbanisation in Africa*; Kareem et al., 2020. *Pathways for Resilience to Climate Change in African Studies*; Zermoglio et al., 2015. *Climate Change and Health Risks in Senegal*; C40 Cities Finance Facility, 2020. *Dakar – Improving Resilience to Climate Induced Flooding*.

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The continent's emissions are also increasing, and the choices that national governments make on the form and trajectory of cities will determine not only the carbon intensity of Africa's growth but also the extent to which the world overshoots the 2°C target. If all of Africa's inhabitants in 2100 emit at the current level of the continent's most intense emitter, South Africa, at 8.2 tonnes of CO<sub>2</sub> (tCO<sub>2</sub>) per capita, the global mean temperature would increase by 1°C in 2100.<sup>37</sup> As more and more countries across the continent reach middle-income status, aspirations and consumption of urban dwellers will inevitably put increasing

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**The choices that national governments make on the form and trajectory of cities will determine not only the carbon intensity of Africa's growth but also the extent to which the world overshoots the 2°C target.**

pressure on the environment. As such, the urban development choices adopted in African cities will affect not only urban residents but will have significant global implications.<sup>38</sup>

Additionally, with the urban population estimated to increase dramatically by an additional 950 million by 2050,<sup>39</sup> urban development will continue to pose an immense challenge in the areas of planning, infrastructure, employment, social services, security and the environment. Estimates suggest that 61% of urban Africans live in informal settlements, and 60% engage in informal work that precludes secure housing situations.<sup>40</sup> It is likely that the adverse impacts of climate change on agricultural productivity and livelihoods will exacerbate migration from rural to

urban areas; meaning that the challenge for African cities to provide dynamic growth to create jobs, deliver housing and infrastructure and reduce poverty will only mount over time.<sup>41</sup>

An estimated US\$20–US\$25 billion per year needs to be invested in basic urban infrastructure, and an additional US\$20 billion per year in housing, to respond to urban population growth.<sup>42</sup> Experiences from a range of cities such as Nairobi, Lagos and Kinshasa show that it is not possible to construct a way out of inner-city congestion with roads and flyovers alone.<sup>43</sup> Investments made now have the potential to ensure a better quality of life for future urban dwellers. If African cities are to begin harnessing the opportunities created by this investment, it must be directed towards low-carbon, climate-resilient infrastructure and services.

**Figure 1: Economic costs of unplanned urban development relative to the potential contained in low-carbon, climate-resilient urban development in African cities**

Cost of urbanisation-as-usual in Africa's cities	Benefits of Africa's urban opportunity
<p><b>Urban form – sprawl, divisions and high costs of service delivery</b></p> <ul style="list-style-type: none"> <li>• Unmanaged private-sector finance of infrastructure undermines spatial management and local tax collection, while encouraging sprawl.</li> <li>• Sprawl raises cost of service provision –more than US\$50 per tonne of solid-waste management, untenable grid-extension costs result in household paraffin use at US\$10–US\$100 per kWh and requirements of 5 metres per person of additional water piping.</li> <li>• Splintered urbanism foments urban conflict and crime and segments markets.</li> </ul>	<p><b>Urban form – people and opportunity connect in compact and efficient cities</b></p> <ul style="list-style-type: none"> <li>• Urban densities in excess of 6,000 per km<sup>2</sup> create viable markets for public transport.</li> <li>• Compact form and multi-story residential buildings result in a six-fold saving in community energy and greater disposable income for local economic development.</li> <li>• Use of ecological flood buffers saves infrastructure costs and flood damage.</li> </ul>
<p><b>Transport – congestion, pollution and low mobility</b></p> <ul style="list-style-type: none"> <li>• Road deaths rise as vehicle ownership increases and cost in excess of 3% of GDP.</li> <li>• Congestion undermines the mobility of people and goods and inflates the cost of doing business and finding work.</li> <li>• Fiscal burden of road maintenance increases faster than economic growth.</li> <li>• Inner-city air pollution increases the burden of respiratory disease.</li> </ul>	<p><b>Transport – affordable safe mobility</b></p> <ul style="list-style-type: none"> <li>• Immediate cost savings in the form of discontinued subsidies for parking and heightened revenue from full capture of cost of parking.</li> <li>• Macroeconomic stability from reduced importation of refined crude oil.</li> <li>• Efficient public transport reduces household expenditure on private vehicles.</li> <li>• Normalisation of traffic congestion in, for example, Lagos alone saves US\$1 billion per year. Congestion reduction elsewhere follows suit.</li> <li>• Efficient public transport reduces inner-city pollution.</li> <li>• Vibrant urban economies are supported by safe pedestrian–retailer interaction.</li> </ul>
<p><b>Waste – rising cost of waste management and waste externalities</b></p> <ul style="list-style-type: none"> <li>• Waste increases with consumption and compounds flooding and disease burden.</li> <li>• Landfill sites occupy valuable land, contaminate water and impose a fiscal burden.</li> <li>• Waste management requires expensive logistics.</li> <li>• Waste management contributes to greenhouse gas emissions through logistics and landfill methane.</li> </ul>	<p><b>Waste – new economic opportunities in waste handling</b></p> <ul style="list-style-type: none"> <li>• Waste and landfill gas becomes an energy feedstock for local smart-grids, contributing to local energy security.</li> <li>• Waste and waste-to-energy generates new local work opportunities.</li> <li>• Recycling and up-cycling increases resource efficiency and reduces need for landfills.</li> <li>• Waste to landfill charged at full cost so as to generate a new fiscal revenue stream.</li> </ul>

**Notes:** kWh = Kilowatt-hour; km<sup>2</sup> = Square kilometres.

**Source:** Table adapted from Cartwright, 2015. *Better Growth, Better Cities: Rethinking and Redirecting Urbanisation in Africa*.

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## COMPACT, CONNECTED, CLEAN AND RESILIENT CITIES: THE 3CR MODEL

### Definition

Three pillars will be crucial for low-carbon, climate-resilient urban development: compact urban growth, connected infrastructure and clean technologies. They can drive cost and resource efficiencies while creating jobs through the benefits of economies of scale and agglomeration and foster resilience and productivity.<sup>44</sup> When delivered with the transversal principles of resilience and inclusivity, they have the potential to create long-lasting change for all. This is the case for future cities that will be created following these principles or for already-established cities that are pursuing redensification and modal shift.

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#### BOX 2

#### What does the 3CR model of urban development mean?

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The three pillars of the 3CR model of urban development are overlapping and mutually reinforcing<sup>45</sup>, requiring integrated policy programmes to capture their benefits fully:

- Compact urban growth: through managed expansion and/or urban retrofitting that encourages higher liveable densities; contiguous development; functionally and socially mixed neighbourhoods; walkable and human-scale local urban environments; the redevelopment of existing brownfield sites; and provision of green spaces.<sup>46</sup>
- Connected infrastructure: through investment in innovative urban infrastructure and technology, such as bus rapid transit (BRT); cycling infrastructure; electric vehicles; smart grids; energy-efficient buildings; and efficient essential water, sanitation and waste services.
- Clean technologies and environmentally friendly practices: characterised by the highly efficient use of materials and energy; electrification of heating, cooking and transport; decarbonisation of the electricity supply; large-scale prevention and recycling of municipal solid waste; and use of nature-based solutions wherever possible.
- Resilient planning, governance and finance: cities everywhere are facing a range of shocks and stresses, natural and human-made. Today, cities in Africa are facing amplified challenges because of rapid urbanisation, climate change and political instability. Urban planning and investments need to foster the ability of African cities to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability.

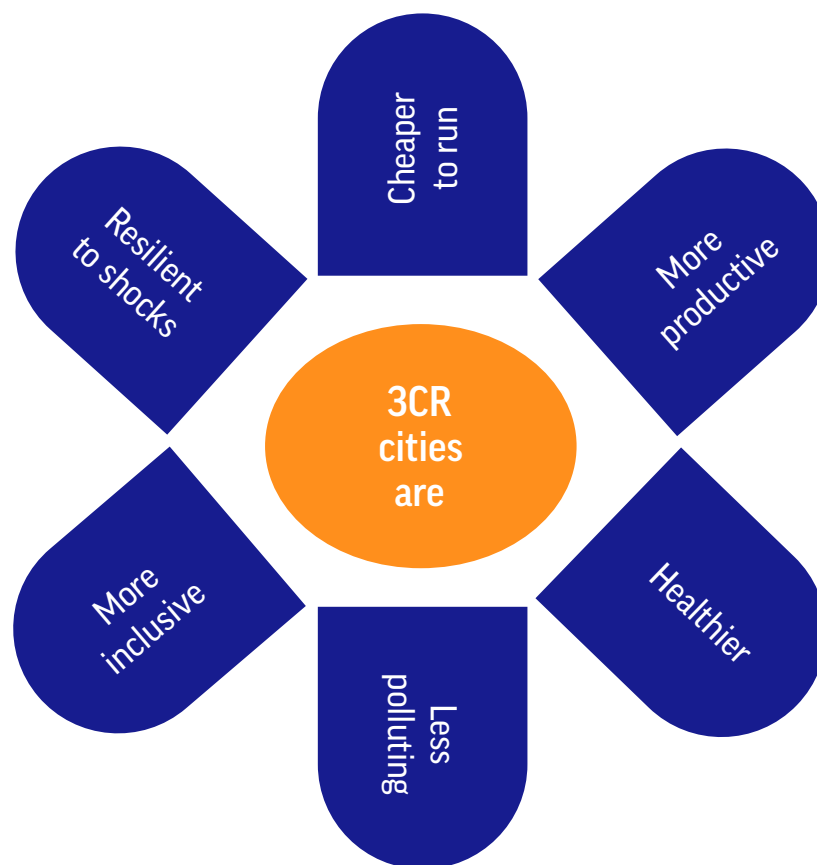
**Sources:** Floater et al., 2017. *Global Review of Finance for Sustainable Urban Infrastructure*; Godfrey & Zhao, 2016. *Financing the Urban Transition for Sustainable Development: Better Finance for Better Cities*.

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## Benefits

**Figure 2: The six benefits of compact, connected, clean and resilient (3CR) cities in Africa**



**Source:** Adapted from Coalition for Urban Transitions, 2019. Climate Emergency, Urban Opportunity.

First, it is cheaper to overcome the deficit of infrastructure and services and build new infrastructure in compact cities. Less land, materials and energy are required to physically connect households and firms when they are closer together than when they are spread out in sprawling developments; moreover, higher densities make infrastructure investments more economically feasible, from roads and electricity grids to telecommunications lines, water supplies and sewage systems. In sub-Saharan Africa, the capital costs of providing piped water, flush toilets, power and landline telephones average US\$325 per person in the highest-density cities, but US\$665 in medium-density cities and up to US\$2,837 in remote rural areas.<sup>47</sup> When delivered through low-carbon infrastructure, cities can ramp up access to basic services while enhancing resilience. For example, decentralised renewable energy systems built within cities can have lower transmission costs and provide more stable power in the face of extreme weather events.

Second, compact, connected cities produce agglomeration effects with great productivity gains and broad economic benefits. Higher-density and good connective infrastructure that enables people to easily reach jobs and services not



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only improves productivity of workers and firms but also fosters higher rates of innovation and clustering of firms, making agglomeration economies attainable. Evidence from South Africa suggests that cities have consistently outperformed the rest of the country in terms of economic growth, largely as a result of agglomeration economies that have allowed for the exploitation of economic assets—including sharing of infrastructure, services, information, well-connected infrastructure and a relatively better educated workforce.<sup>48</sup>

Third, clean cities would be much healthier, thanks to important reductions in waste and pollution of all kinds, as well as improved availability of services. Close to 60% of Ghana's urban households use polluting fuels and technologies such as charcoal and wood as the primary cooking fuel, with the figure being 40% even in the capital city of Accra.<sup>49</sup> The World Health Organization (WHO) estimates respiratory infections, stroke and ischaemic heart disease, which are associated with household air pollution, are three of the top five causes of mortality in Ghana.<sup>50</sup> Clean fuel alternatives would significantly reduce the impacts of polluting household energy fuels on health and livelihoods. Clean distributed energy resources are also a cost-effective and easy-to-deploy option to provide reliable energy supply—one of the biggest challenges facing the continent's health care system.<sup>51</sup> Estimates suggest that polluting diesel generators used for medical facilities range between US\$0.31 and US\$0.42 per kilowatt-hour (kWh) across urban areas on the continent. By comparison, solar photovoltaic (PV)-plus battery systems are cheaper.<sup>52</sup> These are estimated to cost US\$0.14–US\$0.26/kWh in Nigeria, prompting the World Health Organization to advocate greater use of renewable energy for both the economic and environmental benefits.<sup>53</sup>

Fourth, the 3CR model of urban development would reduce greenhouse gas emissions.<sup>54</sup> By focusing urban development on moving people and allowing compact, mixed-use neighbourhoods with safe sidewalks and cycle lanes that allow people to live, work, shop, study and meet one another without having to undertake long trips,<sup>55</sup> the 3CR model would make it possible to reduce emissions from transportation. Driven by the rapidly increasing use of motorcycles over the past two decades, this sector accounts for an average 22% of carbon dioxide (CO<sub>2</sub>) emissions in sub-Saharan Africa.<sup>56</sup>

Fifth, the 3CR model of development would enhance urban resilience.<sup>57</sup> Ambitious climate mitigation is no longer enough to secure national prosperity; investments in urban resilience will be essential to cope with inevitable climate change. African cities will be impacted by climate-induced shocks in different ways. While those in arid regions will face water shortages, the ones along rivers or deltas will be battered by more regular and severe flooding. Yet others will face severe heat waves. Many will face multiple climate hazards that interact and reinforce one another. Urban policies, management and investments must therefore seek to simultaneously reduce emissions and enhance resilience to build cities where people can meet their needs and pursue their aspirations. While the 3CR model would not fully avoid the impacts of climate change for cities, it would enhance the resilience of the poor and marginalised, who are most

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vulnerable to these shocks. Low-income groups are more likely to live in draughty buildings and neighbourhoods with chronic air pollution and depend on public transport, cycling and walking. The 3CR cities would particularly improve the living conditions of the poor as well as their ability to cope with climate shocks and stresses.

Sixth, 3CR cities can reduce inequalities and enable equal access to opportunities for all urban residents. Spatially dispersed cities that lack good public transport infrastructure make jobs inaccessible to those without cars. The average distance between informal settlements and main job centres is estimated at 9.6 kilometres (km) in Addis Ababa and 7.2 km in Nairobi.<sup>58</sup> With nearly three-fourths of the region's urban population residing in urban areas outside the largest city of each country,<sup>59</sup> and lower incomes and the bottom 20% of urban households across sub-Saharan Africa spending 60% of their income on food, the urban poor and unskilled face disproportionately high commuting and job search costs.<sup>60</sup> As a result, the urban poor often end up with daily commuting that involves long treks by foot to inner-city domestic tasks or paid work. Estimates suggest that more than 50% of trips in Bamako, Conakry, Dakar, Douala and Niamey are done by walking.<sup>61</sup> Moreover, poor people are more often affected by natural hazards because they often have to settle in disaster-prone areas, either because they cannot give up on the income opportunities these areas might offer or simply because market effects and housing policies push the poorest to the outskirts of the cities where land is cheaper.<sup>62</sup> This is also true for vulnerable population such as women who are typically more affected as they have homebound activities, and are consequently more often found at home in unstable dwellings when disaster hits.<sup>63 64</sup>

Clearly, compact, connected, clean and resilient urban development would avoid debilitating financial and biophysical risks and generate opportunities that lead to new economic competitiveness. It is the fiscal and practical tenability, combined with new economic opportunities, that make this mode of urban development attractive in Africa's cities. But 3CR cities would also provide significant public benefit by reducing the carbon intensity of the continent's economic growth. Otherwise, total emissions from sub-Saharan Africa's 69 largest cities would increase by an estimated 61% between 2012 and 2030.<sup>65</sup>

### **Alignment with the broader policy agenda**

Compact, connected, clean and resilient cities also have the potential to support core economic and social goals while also enhancing public health, protecting the environment, reducing emissions and enhancing resilience to climate impacts. Deployment of these interventions contribute directly to international development targets that African leaders have shaped and signed up for, including the Sustainable Development Goals (SDGs) and the African Union Agenda 2063. For example, improving the energy efficiency of buildings contributes to SDG 7 (affordable and clean energy), SDG 9 (industry, innovation and infrastructure), SDG 11 (sustainable cities), SDG 12 (responsible consumption) and SDG 13 (climate action), as shown in Table 1.

**Table 1: Compact, connected, clean and resilient cities are closely aligned with the SDGs and Agenda 2063 targets**

	Relevant interventions	SDGs	Agenda 2063
Compact	Reduced motorised travel through mixed land use and increased accessibility	 	    
		 	
Clean	Energy efficient buildings, EVs, rooftop solar, waste efficiency	    	    
Connected	Increased public transit, improved logistics	   	    
Resilient	Flood prevention, ensuring availability of clean water, extreme heat protection	     	     

**Note:** EVs = Electric vehicles.

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions. For the full methodology, see Annex B.





Train in Addis Ababa, Ethiopia. Credit: Hailu Wudineh Tsegaye/Shutterstock.

## 2. The economic benefits of compact, connected and clean cities for African countries

Once the case for pursuing 3CR cities as a means to low-carbon, climate-resilient urban development on the African continent has been recognised, the questions arise: What is the quantum of investment required, and what is the economic case for making this investment? We demonstrate this through three case study countries: Ethiopia, Kenya and South Africa. These countries are relevant because they are economic powerhouses of the continent and collectively represent an increasingly significant and growing share of Africa's urban population (18%).<sup>66</sup>

This section describes results of original economic modelling undertaken by Vivid Economics for this report. This analysis calculated the incremental investments needed from now until 2050 to implement selected decarbonisation measures in urban buildings, transport, waste management and the production of key materials for urban buildings and transport infrastructure, as well as the economic benefits—focusing only on energy and materials savings—and the potential for job creation. The economic analysis builds on the GHG abatement potential analysis previously conducted by the Stockholm Environment Institute<sup>67</sup> and draws on an extensive literature review to define key assumptions made in the modelling.

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Interventions considered in the “compact, clean and connected cities” model are laid out in Table 2 and include deep efficiency retrofits for buildings; the use of efficient lighting, cooking and appliances; rooftop solar PV; improved efficiency and electrification of passenger and freight transport fleets; modal shift to public transportation; reduced motorised travel from urban planning and active transport options; improved logistics system efficiency; landfill gas capture and utilisation; and materials efficiency.

It is important to note that the infrastructure modelled as part of the decarbonisation measures are not specifically designed to be resilient. It is an important limitation of the model and explains why this section refers to the 3C model rather than 3CR. It is crucial that the infrastructure that will make cities reach net-zero emissions is designed in a climate-proof way.

There are profound differences across cities in the three countries, with only 22% of Ethiopia’s population living in cities, compared to 28% in Kenya and 67% in South Africa.<sup>68</sup> The countries are also at different stages of development, with Ethiopia classified as a low-income country (with a GDP per capita of US\$856), while Kenya is lower-middle income, and South Africa is upper-middle-income (with GDP per capita of US\$1,817 and US\$6,001, respectively).<sup>69</sup> As such, the rollout of interventions may look different across the countries. For example, higher growth rates for cities in Ethiopia mean that buildings sector interventions may be more focused on new builds rather than retrofitting existing build stock, creating the opportunity to reduce costs in the long run by building in low-carbon technologies from the start.



**Table 2: Low-carbon interventions considered in this analysis that contribute to compact, connected and clean cities**

Urban mitigation interventions	Description
<b><i>Buildings – residential and commercial</i></b>	
Deep efficiency	Includes both new build at “passive house” levels <sup>1</sup> and deep energy retrofits of existing buildings, as well as heat pump installations in new and retrofitted buildings.
Efficient lighting	Aggressive implementation <sup>2</sup> of efficient lighting in both new and existing buildings.
Efficient appliances	Aggressive implementation of efficient appliances in both new and existing buildings.
Rooftop solar	Decarbonise electricity and increase adoption of rooftop and building-integrated solar PV.
Efficient cooking (residential only)	Aggressive implementation of efficient cooking methods in both new and existing residential buildings.
<b><i>Passenger transport</i></b>	
Efficient and electric vehicles	Improvements in fuel economy and high penetration of electric vehicles (EVs).
Modal shift	Rapid expansion of cycling and public transport.
Reduced motorised transportation	National and local policies to drive reduced passenger travel demand.
<b><i>Freight transport</i></b>	
Efficient and electric vehicles	Improvements in fuel economy and high penetration of electric vehicles (EVs).
Improved logistics	Improving efficiency of freight logistics systems through the deployment of urban consolidation centres.
<b><i>Waste</i></b>	
Landfill gas utilisation	Methane capture efficiency and electricity generation from landfill gas.
Materials efficiency	Reduced demand for building materials and increased efficiency of production of cement, steel and aluminium.

**Note:** PV = Photovoltaic.

The “passive house” standard is a rigorous, energy-efficiency construction standard for new buildings. To be considered a “passive house,” a building must meet a set of requirements, including thermal insulation, energy efficient windows, adequate ventilation and maximum airtightness.

“Aggressive implementation” refers to considerable effort to increase implementation of measures beyond existing levels of uptake to cover a very large share (>80%) of the building stock.

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions. For the full methodology, see Annex B.

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Given the make-up of cities in the three countries, with many small peri-urban areas, this analysis assumes compact, clean and connected interventions are rolled out to urban areas with populations of 250,000 or more.<sup>70</sup> Compared to other regions of the world, the urban landscape in eastern and southern Africa is different, with many peri-urban areas and large villages where the urban climate interventions modelled in this report may not be relevant or feasible to deploy (e.g., deployment of electric vehicles [EVs] or landfill gas [LFG] capture). As such, this report focuses only on major cities that are large enough for these interventions to be relevant, defined as urban areas with at least 250,000 inhabitants. A 250,000-population threshold is commonly used for defining major cities by organisations working on urban statistics, such as the UN Statistical Commission.<sup>71</sup> As smaller urban areas grow in both population and infrastructure, there may be significant opportunities to leapfrog directly to deploying compact, clean and connected city interventions. As such, results for all cities (defined as urban areas with a population of at least 50,000 inhabitants) are included in Appendix B. A full list of the major urban areas, totalling 20 major cities in Ethiopia, four in Kenya and 11 in South Africa, is also included in Table B2 of the appendix.

Across the 35 major cities in Ethiopia, Kenya and South Africa, investment in more compact, clean and connected cities is expected to deliver total benefits equal to US\$1.1 trillion by 2050, or as much as 250% of annual GDP in 2020, supporting hundreds of thousands of additional jobs compared to conventional fossil fuel investment. By 2050, investment in urban climate interventions in major cities in Ethiopia, Kenya and South Africa could deliver US\$240 billion, US\$140 billion and US\$700 billion in benefits, respectively —equivalent to 250% of annual GDP (2020) in Ethiopia, 150% in Kenya and 200% in South Africa. These benefits include energy savings and other avoided costs, such as reduced vehicle costs and lower material costs for construction, with wider economic benefits such as job and gross value added (GVA) creation, discussed below.

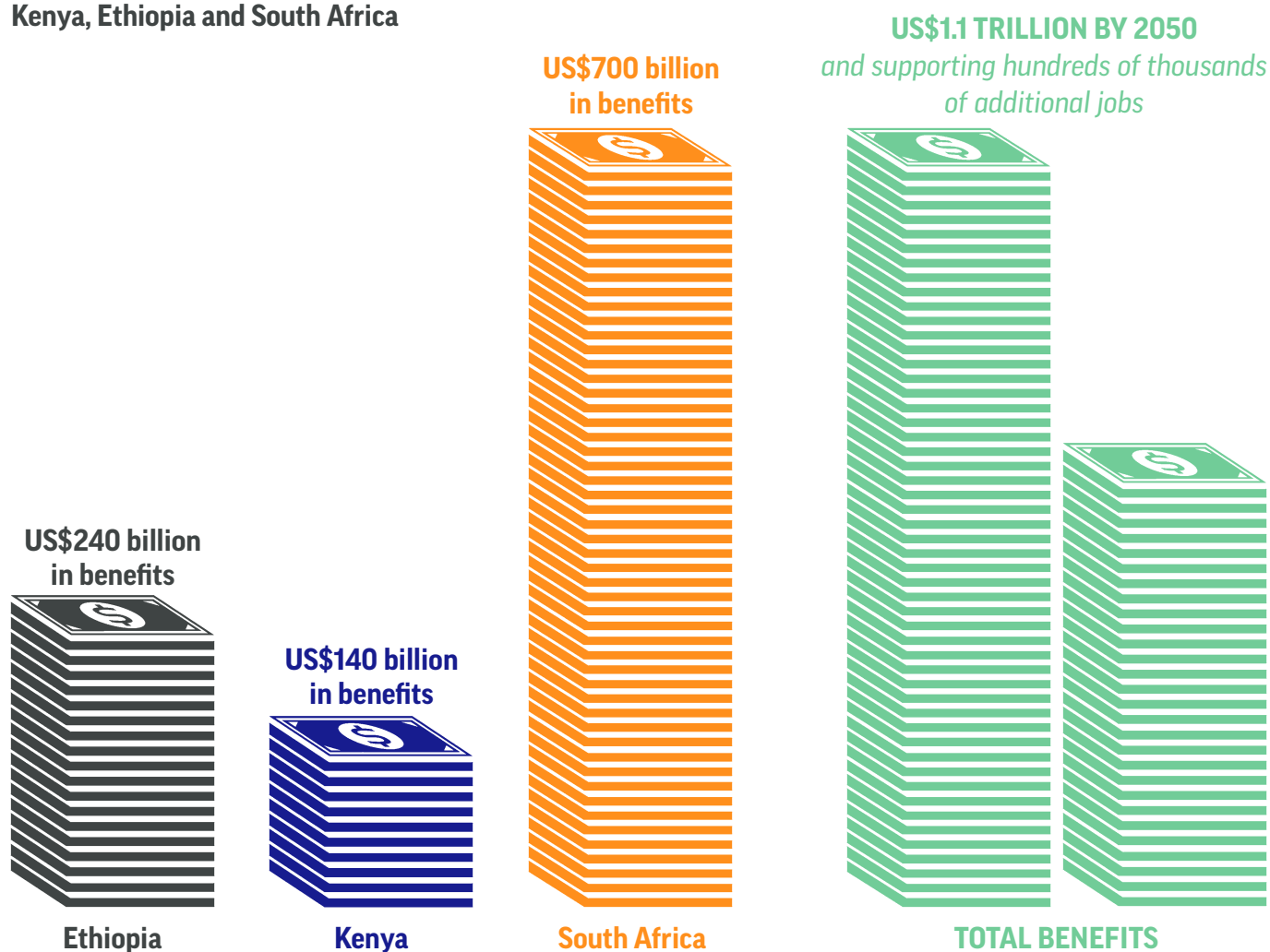
Energy savings, in particular, reflect an important benefit from a fiscal perspective as energy subsidies in these countries are currently a relatively major public expense,<sup>72</sup> meaning that reduced demand for fossil fuel energy would benefit government spending as well as households and firm budgets. New investment in urban climate interventions is also expected to generate significant wider economic benefits, including additional employment compared to traditional fossil fuel energy consumption, which would occur under a counterfactual scenario, resulting in an average of 210,000 net new jobs in Ethiopia, 98,000 in Kenya and 120,000 in South Africa to 2050 (further details on the counterfactual scenario can be found in Appendix B).<sup>i</sup>

The jobs created from investment and operation of climate-aligned urban sectors is significant. In Ethiopia, net new jobs generated by compact, clean and connected city investments are equivalent to 2.1% of the workforce in major cities, presenting an opportunity to address urban unemployment, which is currently 19%.<sup>73</sup> Supported jobs linked to modelled investments represent a significant share of the jobs expected from South Africa's green recovery plan, which is expected to create 800,000 jobs over the

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i Jobs are estimated as average annual jobs across the lifetime of each intervention. Lifetime assumptions and counterfactual investments are set out in Appendix B.

**Figure 3: The impact of investment in urban climate interventions across 35 major cities in Kenya, Ethiopia and South Africa**



next four years.<sup>74</sup> A large share of the jobs created will be supported by investment from now until 2030, which would support 98,000 net jobs in Ethiopia, 47,000 in Kenya and 82,000 in South Africa. However, job creation is not necessarily tied to the modelled deployment timeline and could be brought forward if investment is mobilised at pace. In addition to the overall benefits and employment impacts, investment in urban climate interventions is expected to generate US\$2.5 billion of net additional GVA in Ethiopia, US\$5.2 billion in Kenya and US\$76 billion in South Africa compared to alternative similar investments in fossil fuel technologies. On an average annual basis, this represents 0.9%, 0.5% and 1.5% of the total GDP of all cities in Ethiopia, Kenya and South Africa, respectively.<sup>ii</sup> Scaling up interventions to include smaller cities with populations of at least 50,000 would generate a total of 1,400,000 net jobs and US\$29 billion in net GVA in Ethiopia, 67,000 net jobs and US\$12 billion in net GVA in Kenya and 170,000 net jobs and US\$100 billion in net GVA in South Africa to 2050.

ii GVA represents the value of a sector's outputs minus its inputs and is a measure of a sector or region's contribution to overall GDP.

## At the city level

**Table 3: City-level benefits for capital city and a major regional hub in each country**

Country	City	Total benefits (\$US billion)	NPV (US\$ billion)	Jobs	GVA (US\$ million)
Ethiopia	Addis Ababa	95	33	110,000	9,700
	Bahir Dar	11	4.6	5,600	350
Kenya	Nairobi	100	39	59,000	5,000
	Mombasa	28	8.4	31,000	3,100
South Africa	Johannesburg	260	66	56,000	33,000
	Durban/eThekweni	110	30	19,000	12,000

**Note:** Results assume a 3.5% discount rate, a 2.5% annual increase in energy prices and a 5% annual learning rate (1.5% in buildings efficiency projects). Additional data sources and rationale for the choice of rates can be found in Appendix B.

NPV = Net present value; GVA = Gross value added.

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions. For the full methodology, see Annex B.

Table 3 presents the city-level economic benefits of investment in compact, clean and connected cities for two major cities (the capital city and a major regional hub) in Ethiopia, Kenya and South Africa. Estimates indicate that major cities would account for a significant share of total country-level benefits of investment in urban climate interventions—with major cities representing 44%, 91% and 53% of total country-level benefits in Ethiopia, Kenya and South Africa, respectively.





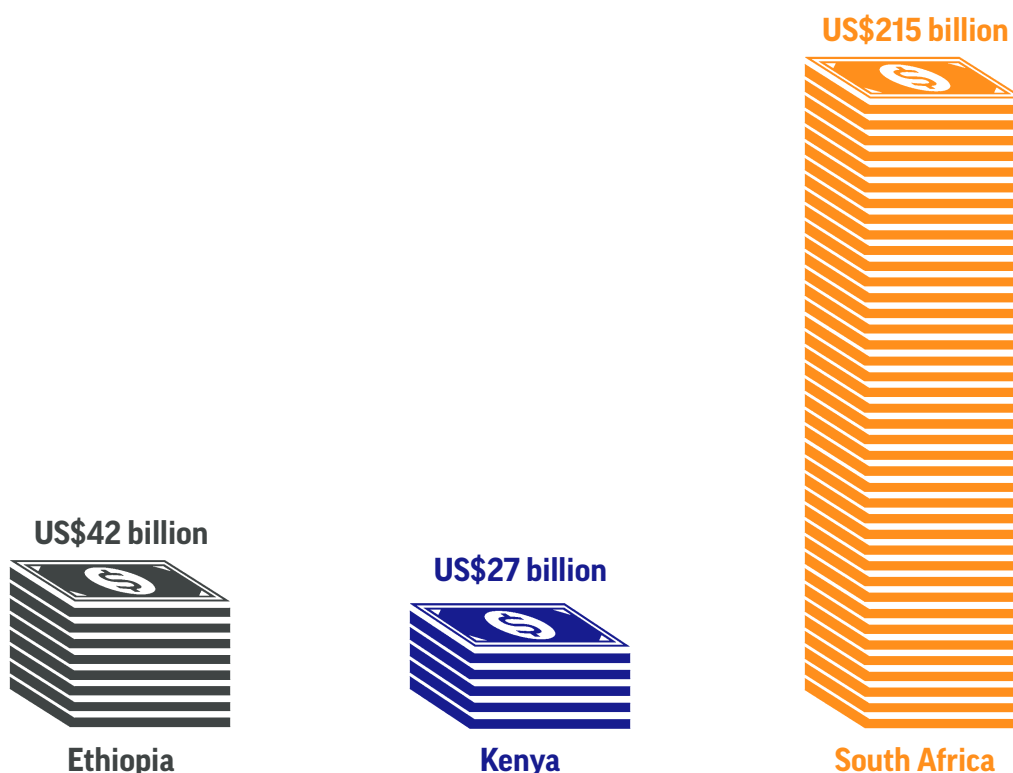
Solar panels on roofs in Enkanini neighborhood of Stellenbosch, South Africa. Credit: MrNovel/Shutterstock.

### 3. What is the scale of investment needed?

For the 35 major cities in Ethiopia, Kenya and South Africa, delivering compact, connected and clean cities will require US\$280 billion of incremental investment by 2050—a significant level of investment when compared to forecasted spending to deliver national climate targets across the three countries.<sup>iii</sup> Delivering these benefits requires mobilising significant investment at pace—in line with calls for urgent and massive investment in Africa following the adoption of the SDGs and passage of the Paris Agreement. Incremental investment represents investment beyond baseline levels (e.g., the additional cost to build an energy-efficient home or purchase an electric vehicle, compared to a less efficient option). In Ethiopia, Kenya and South Africa, the total incremental investment required by 2050 to deliver low-carbon interventions is US\$42 billion, US\$27 billion and US\$215 billion, respectively.

<sup>iii</sup> Analysis conducted for this report assessed the investment associated with deployment of interventions in line with a below-2°C scenario for all cities, whereas national climate targets (i.e., nationally determined contributions [NDCs]) reflect national priorities that may or may not align with deployment associated with the below-2°C scenario. As such, the estimated additional investment required may overlap with existing national climate targets or may be additional to such targets.

**Figure 4: Total incremental investment required by 2050 to deliver low-carbon interventions**



To provide an indication of the magnitude this represents, Table 4 shows required incremental investment compared to other relevant metrics of climate finance for each country, as average annual values. While some countries will have different time frames for climate-relevant spending (especially in the context of increased near-term spending to support green recoveries), assuming metrics are distributed equally across years allows for straightforward comparison to other policy-relevant financial and economic metrics, which occur over different time frames. As shown in the table, annual average incremental investment required represents 40%, 88% and 15% of current annual governmental spending (domestic and international) on climate in Ethiopia, Kenya and South Africa, respectively. Table 4 also shows that required investment is significant when compared to average annual nationally determined contribution (NDC) costings for Ethiopia, Kenya and South Africa—representing 14%, 43% and 13% of average annual NDC costing for each country, respectively.<sup>iv</sup>

<sup>iv</sup> It should be noted that assuming NDC costing is spread equally across years is a rule of thumb for simplifying comparisons and does not reflect the bottom-up detailed analysis for incremental NDC costings. NDCs are also likely to include a wider set of sectors than those directly relevant for urban transitions, and this comparison implies that NDC costs will be focused on urban sectors.

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In Ethiopia, current annual governmental spending on climate change is US\$2 billion per year (as shown in Table 4) and is mostly directed through a national climate fund—Climate Resilient Green Economy (CRGE).<sup>75</sup> The CRGE combines public, private, domestic and international sources of climate finance, with some additional finance administered on an ad hoc basis. CRGE finance is administered by individual ministries, with 37% going to water, irrigation and energy; 28% to agriculture; 15% to environment and forestry; 13% to transport; 6% to urban development; and 2% to industry.<sup>76</sup> However, CRGE spending amounts to only 20% of the scale of spending required for existing NDC commitments, meaning that significant additional finance will be required.

In Kenya, roughly half of climate finance from public sources is directed through subnational climate funds—the County Climate Change Funds (CCCFs)—which provide counties with grants for climate mitigation and resilience projects. To date, CCCF-funded projects have been concentrated in the water and agriculture sectors.<sup>77</sup> Together with other public climate-related finance, average public expenditure on climate change amounts to US\$750 million per year.<sup>78</sup> However, this accounts for only 35% of the scale of spending required for existing NDC commitments, meaning that significant additional finance will be required.

While South Africa does not have a dedicated climate fund, the government has committed to invest 10% of GDP (US\$35 billion based on 2020 GDP) into three key sectors—transport, energy and water—over the next ten years.<sup>79</sup> Together with the Green Climate Fund, the Development Bank of South Africa has launched an innovative climate finance facility, committing US\$56 million to drive investment into climate mitigation.<sup>80</sup> In South Africa, NDC spending (averaging US\$55 billion per year to 2030) is expected to be concentrated in the energy sector (with 48% needed for renewable energy, energy decarbonisation, carbon capture and storage infrastructure) as well as the transport sector (with 52% needed for EVs and hybrid electric vehicles).<sup>81</sup> Together, national government spending targets and spending through the climate finance facility amount to 85% of the scale of spending required for existing NDC costing. While the financing shortfall is less stark than in Ethiopia and Kenya, additional finance will still be required. Cities in South Africa have been working to increase climate finance through the issuance of municipal green bonds, with one in Cape Town (US\$76 million) funding water and low-carbon transport projects and another in Johannesburg (US\$143 million) supporting biogas energy and low-carbon transport projects.<sup>82</sup>



**Table 4: Average annual investment required and comparators for major cities in Ethiopia, Kenya and South Africa**

Average annual (US\$, billions)	Ethiopia	Kenya	South Africa
Incremental investment required to 2050 (major cities)	1.4	0.9	7.2
National government spending on climate change (2018 [Kenya], 2020 [Ethiopia, South Africa]) <sup>83</sup>	2.0	0.3	47.0
NDC implementation costs to 2030 <sup>84</sup>	9.8	2.1	55.0
International climate finance inflow (2018) <sup>85</sup>	1.5	0.7	2.5
Total government budget (2020) <sup>86</sup>	15.0	24	118.0
FDI inflow (net, 2019) <sup>87</sup>	2.5	1.3	4.6
GDP (2020) <sup>88</sup>	97.0	96.0	350.0
Investment required to 2050 (all cities)	6.1	1.4	9.9
GDP per capita (US\$/person)	860	1,800	6,000

**Notes:** NDC = Nationally determined contribution; FDI = Foreign direct investment.

Cities defined as contiguous areas with population density of at least 1,500 inhabitants/km and with a collective population of at least 50,000 inhabitants.

Major cities defined as all urban areas in (a) with a total population of at least 250,000.

It should be noted that assuming NDC costs are spread equally across time does not reflect the bottom-up detailed analysis for incremental NDC costings. NDCs are also likely to include a wider set of sectors than those directly relevant for urban transitions; this comparison implies that NDC costs will be focused on urban sectors.

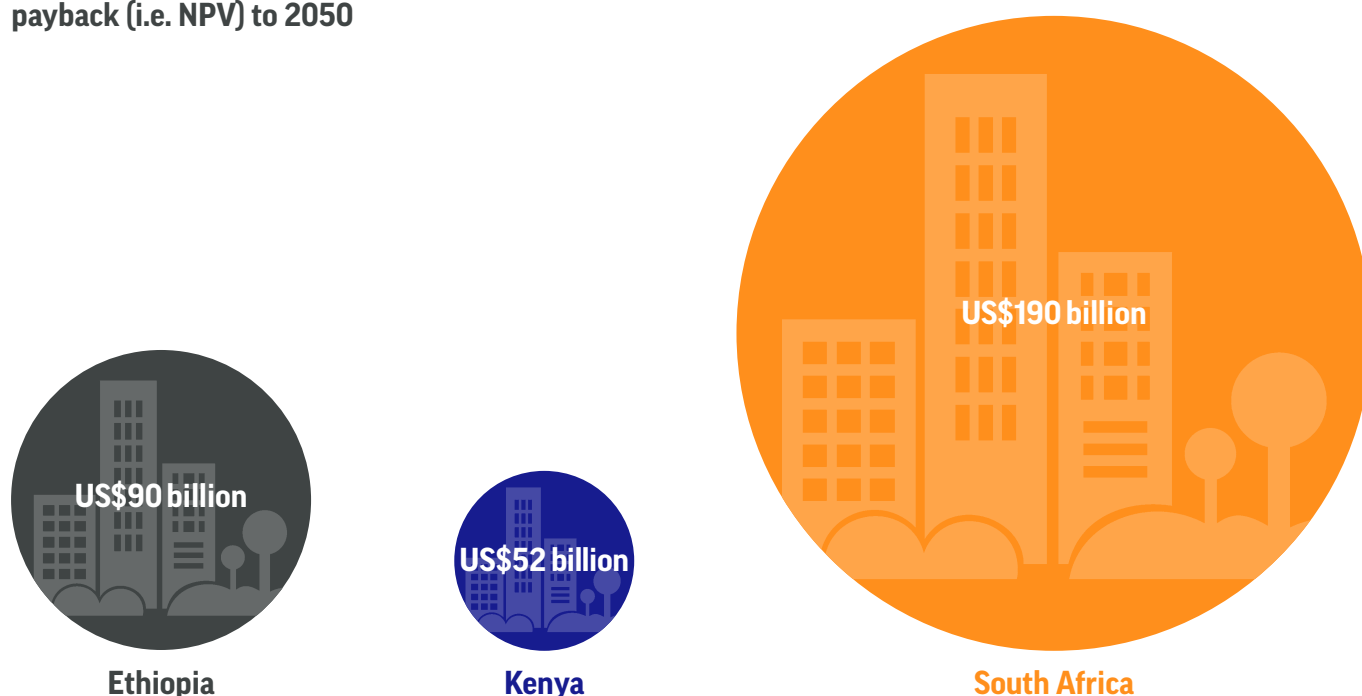
**Source:** Vivid Economics analysis for the Coalition for Urban Transitions. For the full methodology, see Annex B.

While a significant amount of investment is required to deliver compact, clean and connected cities in Africa, the case for investment rests on robust returns. Across all countries, while the investment required is substantial, the estimates, as shown in terms of net present value (NPV) or the extent to which benefits exceed costs over the period to 2050, yield very significant positive net returns—these estimates are discounted at 3.5% per year, assuming a 2.5% annual increase in real energy prices



from 2020 levels and annual cost reductions of 5% (1.5% for buildings efficiency projects), reflecting technology learning rates. Further discussion around these assumptions is included in Appendix B). For major cities in Ethiopia, Kenya and South Africa, the returns of investment in compact, clean and connected city interventions after payback (i.e., NPV) to 2050 are expected to be US\$90 billion, US\$52 billion and US\$190 billion, respectively.<sup>v</sup>

**Figure 5: Expected returns on investment in compact, clean and connected city interventions after payback (i.e. NPV) to 2050**



By 2050, all interventions are NPV positive except for deep efficiency measures in building stock and efficient appliance deployment, both of which have longer payoff periods not wholly captured in the model. These results are robust to sensitivities placed on the rate of energy price increases and technology learning rates, with NPV results ranging from US\$78–US\$110 billion in Ethiopia, US\$44–US\$64 billion in Kenya and US\$150–US\$260 billion in South Africa. For deployment across all cities (with population 50,000 or more), NPV ranges are US\$560–US\$730 billion in Ethiopia, US\$75–US\$110 billion in Kenya and US\$220–US\$360 billion in South Africa.

<sup>v</sup> Net present value (NPV) is the difference between the present value of the total benefits of an intervention and the present value of the total costs of an intervention over a period of time, in this case to 2050. If the NPV of an intervention is greater than zero, that means the benefits of that intervention are greater than the costs in present value terms. For the analysis in this report, benefits include energy savings and other avoided costs such as reduced vehicle costs and material costs for construction. Other economic stimulus benefits in the form of additional GVA are included separately.

## At the city level

**Table 5: City-level incremental investment requirement for the capital city and a major regional hub in each country**

Country	City	Incremental investment to 2050 (US\$ billion)
Ethiopia	Addis Ababa	20
	Bahir Dar	1.5
Kenya	Nairobi	17
	Mombasa	6.9
South Africa	Johannesburg	89
	Durban/eThekweni	34

**Note:** Results assume a 3.5% discount rate, a 2.5% annual increase in energy prices and a 5% annual learning rate (1.5% in buildings efficiency projects). Additional data sources can be found in Appendix B.

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions. For the full methodology, see Annex B.

Table 5 shows the incremental investment required at city level to 2050 for two major cities (the capital city and a major regional hub) in Ethiopia, Kenya and South Africa. Estimates indicate that a significant share of the total investment required to deliver compact, clean and connected cities would need to be directed towards major cities—with major cities representing 51%, 89% and 57% of the total country-level investment required in Ethiopia, Kenya and South Africa, respectively.

The following case studies provide a deeper look at relevant initiatives that demonstrate an existing commitment to compact, clean and connected interventions in one major city in each country. These case studies demonstrate the relevance of the modelled interventions. The results of the modelling, including key assumptions and the relevance of modelled interventions, were tested with in-country experts in Ethiopia, Kenya and South Africa to ensure their validity and alignment within local contexts.

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## CASE STUDY 1

### Addis Ababa's Strategic Comprehensive Transport Development Plan

Addis Ababa is experiencing rapid population growth (over 4% annually), putting increasing demand on the city's public transport systems. Modelling results suggest that deploying low-carbon passenger transport interventions supporting modal shift to public transport in Addis Ababa would require US\$6.5 billion in incremental investment to 2050, delivering US\$56 billion in total benefits and creating 30,000 net jobs, compared to traditional fossil fuel energy investment.

Improving the city's transport systems is already a key priority for the city government, with 26% of its capital investment budget in 2017 dedicated to transport.<sup>89</sup> Since 2010, the city has worked with development partners to expand its transport systems, including the addition of seven bus rapid transport lines, 34 kilometres of light rail transit, three new public transport terminals, three bus depots and dedicated bus lanes, two bike-sharing systems and the development of an intelligent transport system to improve traffic safety and flow.<sup>90</sup>

Despite increasing accessibility and capacity, the majority of Addis's population still relies on walking or crowded minibuses to travel throughout the city (54% travelled by walking in 2020).<sup>91</sup> Combined with increasing car ownership, this is driving increased congestion and air pollution across the capital city.

To improve Addis's transport system for its growing population, the Addis Ababa City Road Authority is currently developing a Strategic Comprehensive Transport Development Plan (SCTDP).<sup>92</sup> The plan is funded by the World Bank as part of its US\$300 million Transport Systems Improvement Project (TRANSIP) to improve transport in Ethiopia's capital city through capacity-building and direct investment in infrastructure.<sup>93</sup> Once developed, the plan will guide transport investments in the city to 2030 through sector-specific strategies.

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions, based on references detailed above.

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## CASE STUDY 2

### Electric vehicle-sharing in Nairobi

Increasing population growth and economic development across Kenya has spurred an increase in the number of passenger vehicles, which are expected to more than triple by 2050.<sup>94</sup> According to Kenya's Green Economy Strategy and Implementation Plan, Kenya's transport-related emissions have doubled over the last ten years, with passenger vehicles accounting for 33% of all emissions from the sector.<sup>95</sup> However, Kenya is one of the few countries in Africa with a sector-specific mitigation target for the transport sector, aiming to reduce transport emissions by 16% (representing 8% of its total emissions target).<sup>96</sup>

In the capital city of Nairobi, the growing vehicle fleet has generated increased emissions as well as higher congestion, driving up transport costs and travel times and contributing to adverse health impacts, especially among the vulnerable urban poor. The city serves as a regional economic hub, accounting for two-thirds of Kenya's economic output; traffic jams in Nairobi have significant impact on economic activity, reducing productivity at an estimated cost of US\$1 billion annually.<sup>97</sup> As such, decarbonising passenger transport in Nairobi (through reduced vehicle miles and reduced emissions intensity of travel) has become a priority across the city.

The electrification of Nairobi's passenger vehicle fleet is a key way of achieving this decarbonisation. Modelling results suggest that deploying more efficient and electric passenger vehicles in Nairobi would require US\$400 million in incremental investment to 2050, delivering US\$10 billion in total benefits. However, in the short term, the shift may lead to fewer additional jobs (-3,400) compared to making similar new investments in traditional fossil fuel energy production.

In the past two years, several start-ups have launched with the aim of solving this problem. Finnish company Nopea Ride aims to offer affordable taxi services in a 100% electric fleet and is installing charging stations at malls across Nairobi. The company allows taxi drivers to charge cars for free, meaning they make 30-50% more than with other ride-sharing services.<sup>98</sup> Nairobi-based Kiri EV launched a pilot for its electric motorcycles in 2020, targeting motorcycle taxi drivers, commonly known as "boda bodas," but also opened up sales to the wider public. Both companies have seen rapid growth in demand in the short time since their launch.<sup>99</sup>

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions, based on references detailed above.

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### CASE STUDY 3

#### Rooftop solar power in Durban/eThekweni

Rooftop solar is a particularly relevant intervention for the city of Durban, in the municipality of eThekweni, which has a significant solar resource. Modelling results suggest that deploying rooftop solar on residential and commercial buildings in Durban would require US\$1.3 billion in incremental investment to 2050, delivering US\$2.8 billion in total benefits. While, in the short term the shift to rooftop solar may lead to fewer additional jobs compared to traditional fossil fuel energy investment, the net job losses are estimated to be marginal (-170) compared to overall employment in the city (1.3 million).

Compared to its peers, the city of Durban has been ahead of the curve in its efforts to accommodate and promote rooftop solar photovoltaic (PV) across the municipality. In 2013, the city developed its Solar City Framework to guide its promotion of solar through six strategic steps, including an analysis of market barriers, a regulatory review and a mapping of the city's solar resources. The Durban Solar Map was launched in 2015 as a consumer-focussed tool that assists in high-level planning for rooftop solar, including estimates of system costs and electricity savings.

Following the Solar City Framework and Durban's Climate Change Strategy (approved in 2015), the city launched the Energy Office Solar (EOS) project with the aim of contributing to Durban's goal of having 40% of its electricity supplied from renewable energy by 2030 by increasing the adoption of rooftop solar.<sup>100</sup> The project resulted in the installation of 500 kilowatts (kW) of rooftop solar PV across the city.

Continued regulatory reforms and support from the city have also enabled large-scale commercial rooftop solar investment at the city's international airport and a vehicle manufacturing plant.<sup>101</sup> Durban is also home to South Africa's only domestically owned solar manufacturer, ARTsolar, capable of manufacturing 300 megawatts (MW) of solar PV capacity annually.<sup>102</sup>

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions, based on references detailed above.

**Note:** The modelling done for this report compares the investment scenario of household-level rooftop solar PV with a counterfactual scenario of utility-scale coal energy. The counterfactual was selected as an energy-based counterfactual of the energy that would be used without the intervention. In this case, without investing in household-scale rooftop solar PV, households would demand power from the grid, modelled as utility-scale coal. For this reason, the net impact of investment in rooftop solar PV is marginal, which may not be the case when comparing utility-scale solar with a similar utility-scale counterfactual.

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While decarbonising cities can generate significant economic value overall, the payback periods on investment may be longer for certain sectors compared to conventional capital-intensive fossil fuel investments. For some sectors, a transition period may temporarily produce lower levels of economic value and adverse employment impacts from new investments in the short term (0–5 years), compared to a similar fossil fuel investment. For example, employment impacts are expected to be slower to take off for solar PV and transport mode shift. As the stock of climate-smart interventions grows in the long term (5+ years), short-term lags are offset by large net gains in terms of both jobs and GVA. In Ethiopia, Kenya and South Africa, this results in greater employment impacts in the long term, with 94,000 short-term versus 116,000 long-term net jobs in Ethiopia, 39,000 short-term versus 59,000 long-term net jobs in Kenya and 29,000 short-term

versus 101,000 long-term net jobs in South Africa. GVA generation is also expected to grow to significant levels only in the long-term, with US\$0.6/1.9 billion in short-/long-term net GVA in Ethiopia, US\$1.7/3.5 billion in Kenya and US\$14/61 billion in South Africa. While large net jobs and GVA increases are expected from deep efficiency and improved logistics, the transition will be particularly acute for efficient and electric passenger transport, where short-term GVA losses are expected, compared to continued equivalent investment in fossil fuels.

Shifting investment from fossil fuels to renewables is an imperative, not only for the global climate, but also for the health and productivity of citizens in African cities and the resilience of these areas to climate impacts. In addition to the long-term job gains and GVA benefits of shifting investment away from fossil fuels, the

development of compact, clean and connected cities also mitigates against the risk of stranded assets as the world more broadly makes the transition, ensuring the economic benefits of investments can be realised over their full lifetime.

However, beyond the economic benefits of urban climate mitigation, the shift from fossil fuels to renewables is critical for securing the health and well-being of current and future populations in African cities. Ambitious climate action also creates opportunities to develop innovation hotbeds in urban areas, helping to advance sustainable development.

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**Shifting investment from fossil fuels to renewables is an imperative, not only for the global climate, but also for the health and productivity of citizens in African cities and the resilience of these areas to climate impacts.**



Construction in Pretoria, South Africa. Credit: Sopotnicki/Shutterstock.

## 4. Barriers to realising these investments

As seen from the previous section, delivering 3C interventions in the major cities of Ethiopia, Kenya and South Africa will require incremental investment of US\$280 billion by 2050. This provides a sense of the magnitude of investment that will be required to transform cities in these countries into compact, connected, clean and resilient urban areas and scale up this transformation to all countries across the continent. Realising these investments is a difficult task for cities and local authorities on the continent, the vast majority of which face budgetary constraints (see Table 6), high debt levels and poor creditworthiness. This lack of creditworthiness often stems from a dearth of reliable and meaningful revenue streams, along with overreliance on transfers from national and regional governments. There are, however, notable exceptions, such as in some cities in Ethiopia, Kenya and South Africa.

Multilevel governance-related constraints mean that municipal financing systems on the continent tend to rest on central government transfers and shared local and related tax receipts and fees. For example, in Tanzania, intergovernmental transfers account for 71%, 88% and 91% of the revenue of Dar es Salaam, secondary cities and other local government authorities, respectively. These transfers are often delayed so that local authorities receive funding at the end of the fiscal year, making

it difficult for local governments to budget and operate effectively. More generally, nationally collected commodity revenue is sparingly allocated to address urban priorities, especially where cities are the locus of political opposition, as is often the case in national capitals and other economically important urban areas.<sup>103</sup> Municipal debt ceilings and state or national requirements for infrastructure project approval, which are generally intended to serve as safeguards against irresponsible financial management at the local level, are in actuality often used to punish jurisdictions that do not align with the political priorities or spending plans of national politicians.<sup>104</sup>

The fiscal challenges facing cities are compounded by the fact that by 2050, almost half of Africa's urban population is expected to live in cities with fewer than 300,000 people; these cities will be too small and insufficiently resourced to deliver the market agglomeration effects and economies of scale in the provision of infrastructure enjoyed by larger urban areas.<sup>105</sup> For example, in 2015, Niger had 143 rural villages ranging from 5,000 to 10,000 inhabitants, of which a total of 29, or roughly 6 per year, are expected to have crossed the threshold of 10,000 inhabitants by 2020, effectively becoming urban agglomerations.<sup>106</sup> Local authorities in such nascent urban agglomerations also lack the financial and institutional capacities to mobilise finance at scale.

**Table 6: Estimated per capita municipal budgets in select African cities**

City	Per capita annual budget (US\$)
Addis Ababa, Ethiopia	91.0
Kigali, Rwanda	39.8
Dar es Salaam, Tanzania	29.4
Kampala, Uganda	29.2
Ouagadougou, Burkina Faso	22.5
Dakar, Senegal	22.4
Yaoundé, Cameroon	16.0
Accra, Ghana	12.5
Abidjan, Côte d'Ivoire	0.02

**Source:** Cartwright et al., 2018. Developing Prosperous and Inclusive Cities in Africa—National Urban Policies to the Rescue?

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Weak fiscal regimes and thin economic bases at the city level make urban infrastructure in Africa a relatively unattractive proposition for private investors. The lack of creditworthiness and fiscal decentralisation also prevents many cities from issuing green bonds. Additionally, cities face a diverse array of barriers that

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**Realising these investments is a difficult task for cities and local authorities on the continent, the vast majority of which face budgetary constraints, high debt levels and poor creditworthiness.**

restrict or entirely prevent large-scale deployment of 3CR infrastructure specifically—many of these barriers are common to all types of urban infrastructure. For example, sustainable urban infrastructure projects tend to have a cost premium ranging from 9% to 27% and carry more financial and technological risks than comparable, conventional projects.<sup>107</sup>

These investment barriers include those that are best addressed by concerted national action and those better addressed through specific financial instruments or funding mechanisms, as well as several for which both types of solutions are required (see Table 7).

In terms of resilience, there are additional barriers to investment. One of the primary barriers is the fact that risk is often understated, meaning that resilience itself becomes fundamentally undervalued. Additionally, it is difficult to identify funding, or revenue streams that must be generated to pay back financing of projects, because cities are unable to make convincing arguments about the overall value of resilience benefits, and thus unable to provide a return on investment for funders.



**Table 7: Barriers to investing in compact, connected, clean and resilient cities**

Barrier	Summary	Manifestations of barriers	Barrier addressed by:	
			National action	Financial instrument solutions
<b>Jurisdictional barriers</b>	Overly restrictive laws or regulations limit the financial and/or operational autonomy of cities.	<ul style="list-style-type: none"> <li>• Proliferation of local government entities and parastatal agencies leads to overlapping or conflicting organisational mandates.</li> <li>• National government restrictions limit the ability of cities to raise revenue through taxation on income, sales or land value.</li> <li>• Poorly coordinated elements of the subnational fiscal system are unable to fill gaps in funding and capacity when different departments within the national finance ministry have responsibilities for different functions (budget, local revenues, transfers and lending) and compete to control policy agendas and funding.</li> <li>• Requirements to obtain state or national government approvals slow or prevent development of locally funded and developed infrastructure projects.</li> <li>• Most large-scale urban infrastructure in urban areas is provided by state-owned enterprises, meaning that central government approval is necessary, and that projects may not be compatible with local plans and priorities.</li> </ul>	✓	
<b>Political economy and governance</b>	Political realities often discourage or prevent cities from pursuing long-term, large-scale infrastructure projects.	<ul style="list-style-type: none"> <li>• Cities themselves are often reluctant to take on the responsibility of making politically unpopular decisions to raise their own taxes or to monetise public services.</li> <li>• Fluctuation in priorities of city leadership means constant changes in which projects are prioritised.</li> <li>• Rapid turnover of officials, often driven by political parties and interests, makes it difficult to plan and implement projects, especially partnerships with the private sector.</li> <li>• Lack of political will to implement low-carbon projects that have longer payoff periods and may not enter operation or provide meaningful benefits during the current electoral cycle.</li> <li>• Where urban areas are controlled by opposition parties, national governments are often reluctant to empower municipal authorities or relinquish control over visible public services.</li> </ul>	✓	
<b>Organisational barriers</b>	Internal limitations on the ability and willingness of city governments to finance climate projects arise from capacity constraints and risk aversion.	<ul style="list-style-type: none"> <li>• Institutional lack of knowledge and skills, financing mechanisms, emerging low-carbon technologies and co-benefit investments (i.e. projects that address mitigation and adaptation simultaneously).</li> <li>• Cities have project ideas and wish lists, but these are rarely well-structured or designed in terms of bankability due to analytical and technical capacity constraints.</li> <li>• Structuring procurement and financing approaches, such as public-private partnerships or green bonds, takes several years.</li> <li>• Lack of experience and knowledge implementing complex financial structures and/or gaps in sectoral or industry expertise prevent cities from being able to implement specific types of financing structures.</li> </ul>	✓	✓



<b>Inability to access capital markets</b>	Cities have little to no access to public (bond) or private (commercial bank) debt markets.	<ul style="list-style-type: none"> <li>Subnational borrowing is heavily regulated in many countries with cities not allowed to borrow from foreign banks, and domestic credit may be constrained due to financial repression policies.</li> <li>Cities lack authority to raise municipal debt ceilings, which are often set at arbitrarily low levels.</li> <li>Subnational governments struggle to service debt due to heavy dependence on budgetary appropriations from state and national governments, poor financial planning and inadequate levels of own revenues.</li> <li>Banks need to charge higher interest rates to offset elevated default risk from subnational governments, resulting in prohibitively high borrowing costs.</li> </ul>	✓	✓
<b>Difficulty monetising social benefits</b>	Cities cannot collect the revenue required to offset the costs of constructing and maintaining public goods and services.	<ul style="list-style-type: none"> <li>Cities often provide certain socially beneficial services for free or at rates that reflect a heavy discount from the true cost to provide the service, such as parking, water supply or waste disposal; this underpricing compromises cities' financial health and ability to fund improvements to public infrastructure.</li> <li>This barrier is exacerbated by the free-rider problem: When cities invest in "intangible" outcomes like cleaner air, reduced emissions and more resilient infrastructure, all residents benefit regardless of their willingness or ability to pay, so the city's "return" on investment does not include cashflows to pay back initial expenditures.</li> </ul>	✓	✓
<b>Lack of upfront capital</b>	Cities lack the upfront capital to fund their investment priorities.	<ul style="list-style-type: none"> <li>Subnational governments often struggle with high debt ratios, low capital reserves, limited revenue sources, inadequate revenue collection from municipal services and fees and/or restricted revenue-raising powers, insufficient or inaccessible collateral, etc, limiting their ability to directly fund infrastructure projects.</li> <li>Technologies that contribute to 3CR development, including solar energy, battery-electric buses and energy-efficient buildings often have higher upfront costs than "conventional" alternatives, discouraging cities from investing despite clear long-term savings opportunities from construction of low-carbon, climate-resilient infrastructure.</li> </ul>		✓
<b>Insufficient project pipeline</b>	Cities lack a deep pool of high-quality, bankable infrastructure projects.	<ul style="list-style-type: none"> <li>Subnational governments lack financial resources to conduct the rigorous project preparation that is key to bringing forward bankable projects for financing and development.</li> <li>Few projects are fully evaluated for implementation due to exceptionally high costs of pre-feasibility and feasibility studies relative to other regions due to the underdeveloped academic and consulting sphere in most African countries</li> <li>Absence of local capacity means feasibility studies are often produced by consultants from outside the continent using unrealistic templates that are not relevant to African cities, reducing investor confidence and willingness to commit capital.</li> </ul>		✓
<b>Foreign exchange and interest rate risks</b>	Fluctuations in foreign exchange and interest rates can threaten cities' ability to finance critical projects.	<ul style="list-style-type: none"> <li>Foreign exchange rates and interest rates fluctuate in response to many macro factors, including foreign and domestic monetary policy, business cycles, political events and other outcomes that impact the costs of currency or debt, which can in turn adversely impact borrowers' ability to repay loans, especially over the course of a costly, long-lived infrastructure project.</li> <li>This barrier is especially prevalent for cities in nations with both high inflation rates and limited local currency capital available through financial institutions or public exchanges, two characteristics that are especially common in low- and lower-middle-income countries in sub-Saharan Africa.</li> </ul>		✓

**Source:** Author elaboration based on expert interviews; Floater et al., 2017. *Global Review of Finance for Sustainable Urban Infrastructure*.

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These barriers are compounded by the lack of maturity of African financial markets.<sup>vi</sup> African countries' domestic financial systems remain small in terms of absolute value, relative to economic activity, and— except for those of Mauritius and South Africa—relative to other financial systems in the world. In addition, financial markets in the region are characterised by fragmentation and shallow financial intermediation. Furthermore, African banks are overly liquid, a problem compounded by the crowding-out effect of aggressive central banks: tax-free government bonds generally offer comparable or higher interest rates than commercial debt interest rates, meaning that banks have no incentive to lend to assets that may have any level of risk.<sup>108</sup> As a result, banks are under-leveraged, tending to invest their own funds in short-term government bonds or to increase their reserves with central banks, while loaning out only a small fraction of their assets. However, this is not to say that Africa's banks are not tapping new opportunities, as they have been innovative in the face of significant challenges facing many African nations, such as low-income levels, widespread use of cash and poor credit bureau coverage.<sup>109</sup> For example, they are harnessing the continent's widespread mobile phone coverage to create low-price loan offerings and innovative distribution models.<sup>110</sup> The problem is that innovation has tended to centre on retail banking rather than wholesale banking, and therefore does not address the key barriers to financing critical urban infrastructure.

Private equity, venture capital, hedge fund and mutual fund investors are beginning to fill this space in many countries. However, fund managers' low awareness of green investment opportunities and lack of technical capacity to structure and execute complex project financing pose challenges in mobilising investments for low-carbon infrastructure.<sup>111</sup> Where investors do have such capacity, cities lack either creditworthiness, a pipeline of bankable projects that can offer attractive returns to private investors or both.<sup>112</sup>

Pension funds are another potential source of funding, albeit limited to a handful of countries such as Botswana, Kenya, Namibia, Nigeria and South Africa, where pension assets as a share of GDP are sizeable.<sup>113</sup> However, regulatory barriers tend to prevent African pension funds from investing in infrastructure. In South Africa, the National Treasury drew up proposals to allow pension funds to invest in infrastructure as recently as May 2021. Even when pension reform has been implemented, as in Nigeria, pension fund administrators can invest pension assets for infrastructure development through infrastructure bonds and funds only up to a maximum of 15% and 5% of assets under management (AuM), respectively.<sup>114</sup> However, as of March 2021, only 0.10% of AuM was invested in green bonds and 0.54% in infrastructure funds, according to the country's National Pension Commission.<sup>115</sup> As with other investors, the challenges for these funds remain the availability of bankable projects for investment, weak governance and lack of adequate financial instruments to facilitate investments into infrastructure.

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vi The discussion on African financial systems follows from interviews conducted with FSD Africa.

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Private sector investment is also constrained by the absence of critical basic infrastructure necessary to support further investments in 3CR cities.<sup>116</sup> For example, while constructing and operating a utility-scale solar farm is a relatively low-risk proposition in most developed countries, many nations in sub-Saharan Africa lack a robust central electricity grid.<sup>117</sup> This means that massive additional investments in electricity transmission and distribution infrastructure would be required to build and operate the poles and wires necessary to connect output from a solar plant with demand from grid-connected residential, commercial

and industrial customers.<sup>118</sup> Similarly, significant capital expenditure is needed to build functional, reliable waste and water systems in many African cities before implementing climate-friendly infrastructure upgrades aimed at increasing the sustainability of waste and water usage.<sup>119</sup>

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**Climate finance providers increasingly provide a range of instruments for urban development. However, not enough resources are yet being allocated to urban climate projects.**

Climate finance providers, especially multilateral sources of finance, are also failing to meet cities' 3CR investment needs. Multilateral development banks (MDBs) and bilateral donor funds are important sources of infrastructure capital investment but have historically focused on transnational road, rail and port, agriculture and energy infrastructure at the expense of engagement with and investment in urban areas.<sup>120</sup> They increasingly provide a range of instruments for urban development, project preparation technical assistance, structuring abilities, direct investments, loans

and guarantees—a range that is unique in the institutional sector. However, not enough resources and funding are yet being allocated to identifying, financing and developing urban climate projects.

While multilateral climate funds have a more focused mandate than general development financial institutions (DFIs), they have also fallen short in financing 3CR urban development. Globally, from 2010 through 2014, multilateral climate funds provided about US\$842 million in approved climate finance for explicitly urban projects, accounting for just over one in every ten dollars spent on urban climate finance during that period. During this time, these funds only approved five projects targeting urban climate resilience, equating to just 5% of the US\$1.8 billion that the climate funds provided for all adaptation projects across the five-year period.<sup>121</sup>

While specific data on the current state of climate finance for African cities could not be obtained, selected figures from CPI's *Updated View on the Global Landscape of Climate Finance*<sup>122</sup> and Cities Climate Finance Leadership Alliance's (CCFLA's) *2021 State of Cities Climate Finance* report suggest that despite an increase in the overall funding to climate-relevant projects in Africa, urban infrastructure remains largely ignored as a percentage of total investment (see Box 3). In absolute terms, urban climate finance flows to SSA stood at only US\$3 billion on average annually in 2017–2018.<sup>123</sup>

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To fill this gap, the World Bank and the European Investment Bank have launched a City Climate Finance Gap Fund, which will provide at least US\$120 million in targeted preparatory finance in addition to donor support and technical assistance programmes. This funding is expected to mobilise a total investment of around US\$5 billion to support green, inclusive, resilient, creative and competitive cities in developing countries. Similarly, the African Development Bank has recently launched its Urban and Municipal Development Fund, which supports cities across the continent to identify, prepare and finance urban infrastructure investments.<sup>124</sup> The first round of technical assistance grants, announced in April 2021, includes three African cities: Kinshasa, Democratic Republic of the Congo; Addis Ababa, Ethiopia; and Fez, Morocco.<sup>125</sup>

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**BOX 3**

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**Current climate finance commitments are insufficient to achieve 3CR cities in Africa**

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Of US\$34.7 billion in total climate finance tracked in sub-Saharan Africa during 2017 and 2018, 58% funded mitigation projects, with 31% of investment flowing to adaptation and resilience activities, and the remaining 11% directed to projects with dual benefits (both mitigation and adaptation). Broken down by sector, 39% of climate finance in the region was directed to renewable energy generation, with 59% of this coming from private investors. By contrast, water and waste management, critical aspects of urban climate infrastructure needs, received just over 7% of total finance, while low-carbon transport, another category largely oriented towards urban needs, received slightly less than 4%.

Public funders were responsible for all financing tracked in these two sectors, underlining the importance of governments and development financial institutions (DFIs) in the current urban infrastructure funding picture. However, the dataset does not include complete information on domestic investment from private sector entities, and therefore does not capture the growing importance of private investment and public-private partnerships in funding and building urban climate infrastructure.<sup>126</sup>

**Source:** Climate Policy Initiative analysis for the Coalition for Urban Transitions, based on references detailed above.

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It is interesting to note here that most activity around urban climate finance mechanisms in sub-Saharan Africa, in terms of both monetary commitments and number of discrete projects, currently focuses on near- and medium-term interventions lasting between one and ten years. Near-term projects last up to five years and are often funded using grants from philanthropies or development aid agencies. These interventions tend to focus on improving the enabling environment for financing of urban infrastructure through initiatives targeted at strengthening municipal revenue generation, establishing intergovernmental transfers for public-private partnerships (PPPs).<sup>127</sup>

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Medium-term interventions, which occur on a five-to-ten-year time horizon, are generally supported by development financial institutions or multilateral climate funds. These programmes empower cities to implement best practices in project design and preparation, financial management and measurement and reporting and verification (MRV) systems. Some medium-term interventions may also help municipalities create and capitalise special purpose vehicles or revolving funds for climate action, water infrastructure, municipal development and other targeted uses.

Historically, long-term interventions of ten years or more have been attempted far less frequently in sub-Saharan Africa, compared with short- and medium-term programmes and instruments. The notable exception to this is South Africa, the only country in the region in which cities can effectively access credit markets.<sup>128</sup> For example, in 2014 the city of Johannesburg issued a 10-year, R1.5 billion (US\$136 million) green bond to fund low-carbon infrastructure projects,<sup>129</sup> quickly followed by a 10-year, R1 billion (US\$76 million) green bond from Cape Town in 2017 to fund water and low-carbon transport projects.<sup>130</sup>

Public-private partnerships, often presented as the solution to overcoming the continent's infrastructure<sup>131</sup> challenges, have also largely failed to deliver on this promise. While PPP investment in sub-Saharan Africa has grown rapidly over the past three decades, with total financing for infrastructure PPPs increasing from US\$40 million in 1990 to US\$175 billion in 2017, PPPs have been limited to a handful of countries. South Africa and Nigeria have historically received the greatest number of deals and volume of total PPP finance, followed by Kenya, Rwanda, Tanzania and Uganda, with all other countries lagging far behind.<sup>132</sup> In any case, the replicability of PPP arrangements in other countries in the region depends on local laws and regulations that dictate the extent to which governments and public agencies are allowed to partner with private actors. These rules are often especially restrictive for municipal governments, especially in countries where national governments hold extensive authority over city-level revenue collection and budgeting.





Nairobi, Kenya Central Business District. Credit: Anna K. Mueller/Shutterstock.

## 5. National action to overcome barriers to investing in cities

The complex, diverse and unevenly developed landscape in which sub-Saharan cities operate makes for a challenging environment to attract and deploy urban investment. The majority of cities in SSA remain deficient in creditworthiness, capacity, accountability, organisational structure and governance. Unless these barriers are addressed, finance is unlikely to flow at the scale necessary. In particular, without sound financial management, subnational governments will continue to lack the ability to generate meaningful own-source revenues or to attain the required creditworthiness or market access to attract financing from capital markets.

Addressing these barriers is not something that subnational governments can manage alone. This will require significant leadership from and collaboration with national governments. National governments play a strong enabling role in setting market conditions that draw in private sector capital for sustainable infrastructure programmes through a mix of non-financial actions such as enacting supportive policies, standards and regulations, as well as providing pricing signals and improving information flows. Four instruments that fall under the control or influence of national governments stand out here. They have potential for financing at scale, there is evidence of previous effectiveness, and they can be pursued simultaneously.

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## National Urban Policies

The enabling environment for investments in cities can be greatly enhanced when national governments have clearly articulated their strategies for 3CR urban infrastructure development through national-level regulatory frameworks and broader discourse about urban development and urban areas. National governments control many policies and incentives that can influence the ability of cities to raise finance. They can use their powers to design, implement and enforce regulations that directly or indirectly affect urban development. They can organise and coordinate activities within different agencies and among different levels of government. In particular, well-defined National Urban Policies (NUPs) are critical to overcome these barriers and facilitate investments in cities.

Key elements of NUPs that can enable sustainable urban development include the following:<sup>133, 134</sup>

- Identifying and delegating tasks and responsibilities to the various levels and departments of government and establishing cross-sectoral institutional arrangements necessary for urban development;
- Delineating the potential contribution of the private sector and the mechanisms by which public-private initiatives are fostered;
- Linking spatial planning to tenure strategy reform to integrate informal settlements into formal property and land markets, which can facilitate compact and connected urban form while avoiding spatial exclusion;
- Developing a national urban infrastructure plan with an emphasis on sustainable and inclusive infrastructure design to ensure that planned infrastructure investments reinforce the spatial plan;
- Creating a finance plan that outlines processes and mechanisms by which national governments can guide and mobilise finance to deliver the 3CR model. This includes support to city governments to improve local revenue collection, develop pipelines of bankable projects and access capital markets; and
- Effectively regulating state-owned enterprises to align their activities with the infrastructure requirements and plans of cities.

NUPs can also reconcile existing industrial and climate strategies at the city scale. These strategies typically tend to be disparate at the national level. For example, NUPs have a crucial role to play in aligning energy policies with industrial strategies and nationally determined contributions (NDCs) under the Paris Agreement by requiring power producers to prioritise renewable energy technologies while recognising the importance of affordable and reliable energy supply and energy security.

NUPs can also create opportunities for partnerships with the private sector and civil society to enhance knowledge-sharing, promote capacity-building and contribute to service and infrastructure delivery: for example, by encouraging the development of businesses selling decentralised renewables or the work of community-based organisations supporting upgrading of informal settlements.



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## Fiscal decentralisation

To raise finance for urban infrastructure, national governments can support national and local tax reforms, increase the size and effectiveness of fiscal transfers to cities and enact and support fiscal decentralisation policies. While each of these approaches requires effective coordination between layers of government, there are particularly strong reasons to promote decentralisation. These reasons include both allocative efficiency, since the costs and benefits of public services are fully internalised when local governments hold fiscal authority, as well as preference matching, as local governments are better positioned to gather specific, actionable information on local needs and preferences. Granting appropriate fiscal powers to local authorities therefore enables a more targeted or tailored approach to development of 3CR infrastructure in line with the needs of individual cities and empowers cities to recover the true costs of providing adequate service from residents who are willing to pay for these services.

Fiscal decentralisation can be a particularly effective tool to deal with climate change challenges; because impacts are felt locally, support for mitigation or adaptation actions can be easier to mobilise. However, decentralisation will need to take into account the capacity of cities. It will also have to be accompanied by measures that ensure transparency and appropriate accountability and that balance own-source revenue-raising, intergovernmental transfers and spending obligations among levels of government.

For example, in 2010, Kenya reformed its constitution and introduced greater decentralisation of powers to lower levels of government. The country established 47 autonomous counties with executive and legislative branches. The primary objective of decentralisation was to devolve power, resources and representation down to the local level. Counties have been empowered to make policies, plan and collect revenue and execute budget, accounting, auditing and monitoring and evaluation, along with provision for citizen participation in decision-making.<sup>135</sup> The Kenyan Constitution also recognised the rights of communities to manage their own affairs and to further their development.

Kenya's 47 county governments came into operation in 2013. As new entities, county governments lacked the capacity, knowledge and resources to effectively deliver the devolution dividend, enhance delivery of vital services and improve management of public resources. The county governments received support from a World Bank-managed multi-donor trust fund to build their capability to better plan, deliver and monitor the delivery of public services, including support to strengthen public financial management systems to ensure that public money is effectively spent and accounted for.<sup>136</sup>

Fiscal decentralisation can allow cities to utilise a wide variety of taxes (income, property, sales or value-added tax), fees and transfers to promote widespread sustainable measures and support future investment in 3CR infrastructure in urban areas. For example, revenues raised by taxing vehicles based on emissions can be invested in charging stations to promote vehicle electrification. Similarly, land value capture (LVC) or property

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taxation could be used by subnational governments as revenue-raising instruments. As city investments in utilities, schools, transit systems and parks raise property values, this appreciation can be captured by a progressive property tax physically tied to the benefitting area. This type of taxation is relatively easy to collect compared to other forms of taxation, although the changes in value are difficult to capture in developing countries or in localities where property ownership is not clearly defined.

For example, under Ethiopian law, the national government is the sole landowner, and individuals and businesses lease rather than purchase land, complicating the task of imposing property taxes to pay for infrastructure in Addis Ababa and other major Ethiopian cities.<sup>137</sup> While taxing immobile assets is less likely to exacerbate regional inequalities, problems can arise when high-income condominium construction forces lower-income families out, and few efforts are made to ensure equitable housing in the area.

### Improving city creditworthiness

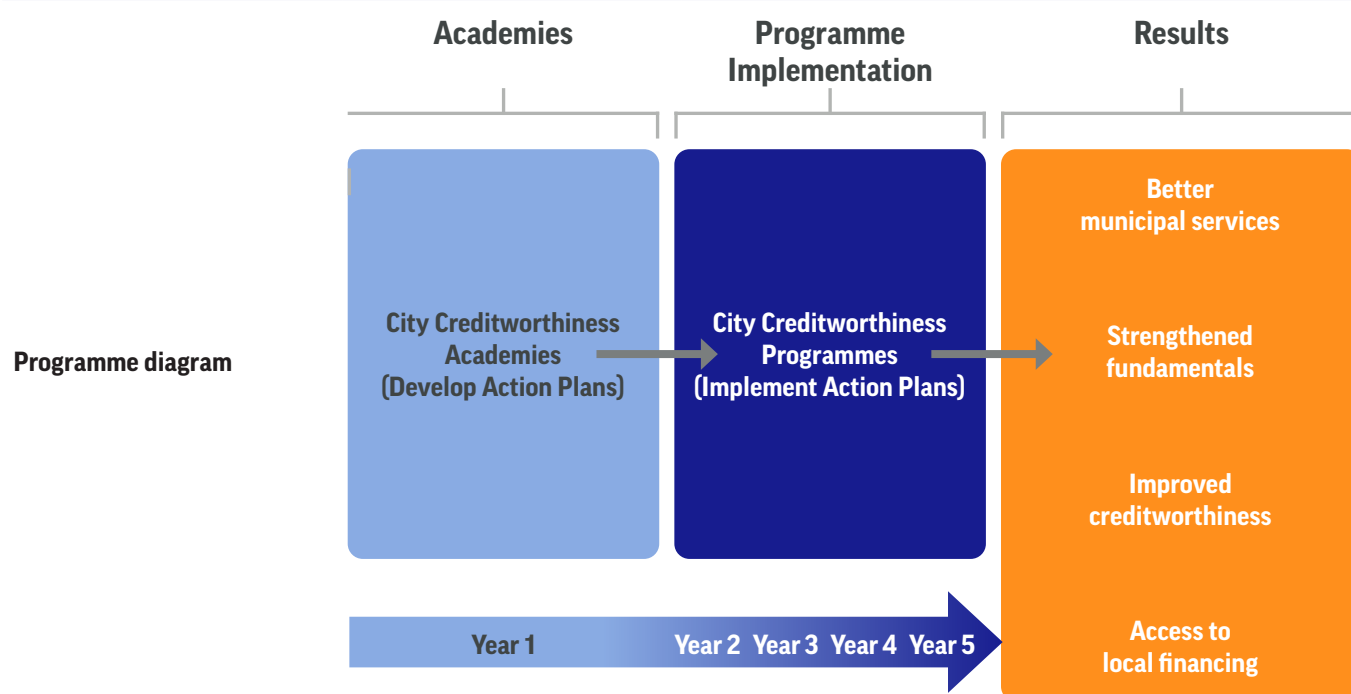
Creditworthiness is a prerequisite to attract both public and private finance, including from multilateral agencies. Investors will be drawn to public infrastructure investments where forecasted project cash flows provide a sufficient risk-adjusted return on investment, or where governments can issue low-risk debt backed by a broader range of municipal revenue streams. The lack of creditworthiness is therefore one of the main factors preventing cities from accessing capital markets and obtaining loans or issuing municipal bonds. Even when a city has achieved an investment-grade credit rating, sound financial management is essential to minimise the risk of future default and to provide headroom for future investments while debt repayments of older projects are still ongoing.

Creditworthiness programmes such as the World Bank's former City Creditworthiness Initiative can be crucial in addressing these concerns. The initiative offered targeted long-term technical assistance to educate participating cities on the importance of credit ratings and creditworthiness as well as to execute five-year action plans to boost municipal creditworthiness. In the first year, cities participated in a "creditworthiness academy," combining basic financial management education with support to develop municipal action plans for financing climate infrastructure. The following four years were spent refining and implementing these action plans with the World Bank's support, resulting in improved municipal services, stronger financial fundamentals and better access to affordable local financing by the end of the programme. Cities that can afford to borrow to fund infrastructure projects have increased flexibility to prioritise long-term needs, including climate mitigation and adaptation priorities, through instruments like green bonds and public-private partnerships. The initiative made this goal a reality for city officials from 261 local jurisdictions across 30 countries and exemplifies the importance of technical assistance programming to promote a strong enabling environment for urban climate finance.<sup>138</sup>

However, as mentioned earlier, the creditworthiness of cities necessitates revenue streams, reliable (apolitical) transfers from central fiscal authorities and balance sheets that properly account for the public assets belonging to the state, including ecological infrastructure and carbon sinks. Most cities in SSA do not have such asset registries at present.

**Figure 6: Case Study—City Creditworthiness Initiative**

INTERVENTION TYPE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<i>Financial planning and management</i>	World Bank, municipal governments	Cities in low- and middle-income countries	Programme concluded after serving 261 local authorities in 30 countries
<b>Summary</b>	For each partner city, the initiative conducts a creditworthiness academy in the first year to strengthen local leaders' financial management skills. Then from years two to five, cities receive targeted technical assistance to develop and implement an action plan for financing climate-smart infrastructure projects.		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>• Creditworthiness academies unite multiple local governments from the same area, helping official build connections with peers while receiving critical training.</li> <li>• Multi-year TA programme provides customised support and education to improve city financial management and planning.</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>• Five-year follow-through period for TA support is critical to support full implementation of initial action plans.</li> </ul>		
<b>Implications for cities' ability to mobilise finance</b>	<ul style="list-style-type: none"> <li>• Improved financial management capacity and ability to implement long-term city financial plans strengthen municipal creditworthiness, unlocking public borrowing to fund climate infrastructure projects.</li> </ul>		



**Note:** TA = Technical assistance.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.



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## Land value capture

Land value capture (LVC) relies on government investment, usually improvements in transport infrastructure, to increase the value of land, converting the benefits into public revenue through a variety of taxes and fees. LVC is an ideal tool that rapidly growing cities with few resources at their disposal can use to provide basic infrastructure for a growing population. At the same time, LVC can be used to drive more compact urban development by incentivising density and efficiently allocating infrastructure funding to where it is most needed. Strategies to extract the uplift in value, or realise and capture existing value, include land value taxation, negotiated extractions, tax increment financing, special assessments, joint development, betterment levies, transportation utility fees, impact fees and air rights. LVC strategies specifically targeted at capturing new value generated through real estate appreciation generally require creation of a special precinct or district in which revenue is to be collected for infrastructure improvements. By contrast, broader efforts to capture existing value, like property tax reforms, can be applied to the entire geographic area of a city or municipal region. In either of these forms, LVC can be used to partially finance infrastructure in combination with other public funds or private debt or equity capital.

While revenue for LVC is locally derived, national legislation and frameworks are critical enablers for creating the revenue stream. In Latin America, for example, multiple countries (Bolivia, Ecuador, Paraguay and Uruguay)<sup>139</sup> have passed legislation that directly supports LVC policies, while in North America, property taxes, impact fees and development charges have been utilised for decades. Constitutional, statutory and policy frameworks created by national governments can incentivise LVC financing of sustainable infrastructure by regional and municipal governments, with variation in the type of LVC tool employed, based on the specific enabling conditions and policies in place in a given jurisdiction. Regardless of the policy environment, cities seeking to employ LVC strategies should establish a clearly defined objective, ensure transparency around how funds are spent and engage the public in the overall decision-making processes as the LVC approach is developed and implemented.

One example of successful land value capture using property tax reform can be found in the Sierra Leonean capital city, Freetown. With Sierra Leone having created the conditions for LVC by implementing fiscal decentralisation reforms that empower cities to take command of their own revenue capture strategies, Freetown pursued a bold campaign to “Transform Freetown,” when it became clear that the city’s outdated and inefficient property tax system could not collect sufficient revenue to fund critical urban infrastructure projects. Mayor Yvonne Aki-Sawyer identified this challenge as a key priority and set an ambitious target to increase tax revenue fivefold by 2020.<sup>140</sup> To achieve this goal, the city government partnered with the International Centre for Tax and Development

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and the UK government to develop a simplified points-based system, identifying and measuring all properties in the city using satellite imaging technology and collecting field observations on the quality of building walls, roofs and windows. These observations were combined with existing rental value data to construct a simple model and calculate the taxable value of each property.<sup>141</sup>

Virtually all buildings and residences in Freetown have been registered under the new system—almost doubling the tax base from 57,000 to 110,000 properties. In addition, the new system has ended the systematic under-taxation of valuable properties by incorporating elements of property valuation beyond raw surface area into the assessment process. This ensures that property taxes more accurately reflect residents' ability to pay, as well as the benefit their property derives from local infrastructure improvements.<sup>142</sup> The latter is a key driver of successful property tax reform, as citizens are more likely to register and pay their taxes when the local government has a transparent system to show them the infrastructure benefits funded by their tax dollars. Since implementation, Freetown's property tax receipts have grown by even more than the targeted fivefold increase, with collection efficiency aided by a new information technology (IT) system to manage the entire process, from data collection to assessment to payment and enforcement.

While the tax reform itself is not strictly tied to climate infrastructure projects, the increased revenues from the reform will enable the Freetown municipal government to commit more funding to key sustainable development priorities in the years to come, including for critical adaptation and ecosystem services needs such as waterway management and restoration, flood prevention and reforestation. For example, the city took advantage of its stronger tax revenues to begin implementing a Flood Mitigation programme in 2020.<sup>143</sup>

**Figure 7: Case Study: Freetown property tax reform**

INTERVENTION TYPE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<b>Revenue collection</b> (land value capture)	Freetown city government, UK FCDO, ICTD	Sierra Leone	Fully implemented
<b>Summary</b>	Data-driven reform of city property tax regime to register all properties and more accurately estimate their value, enabling increased tax receipts to support city budget.		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>• City used satellite imagery to collect detailed information on all properties and developed a simple, transparent model to calculate taxable value of each property.</li> <li>• City council developed new IT system to manage entire process, including data collection, valuation, billing, revenue collection and enforcement.</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>• Strong political commitment and leadership were critical in designing and implementing the property tax reform.</li> <li>• Effective combination of local leadership and international technical assistance support enabled development of a technically sound system tailored to local needs.</li> </ul>		
<b>Implications for city's ability to mobilise climate investment</b>	<ul style="list-style-type: none"> <li>• Expected to increase city property tax revenue significantly, up to fivefold over previous system.</li> <li>• Increased tax revenues create stable cash flows into city budget, strengthening municipal balance sheet and enabling either direct city investment or lower-cost borrowing to fund urban climate infrastructure projects.</li> <li>• City officials anticipate reform will reduce reliance upon funding from central government and international development partners to deliver basic services.</li> </ul>		

**Notes:** FCDO = Foreign, Commonwealth & Development Office (UK); ICTD = International Centre for Tax and Development; IT = Information technology.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.



Pedestrian crossing in Kinshasa, Democratic Republic of the Congo. Credit: Alexandra Tyukavina/Shutterstock.

## 6. Financing mechanisms for investing in compact, connected, clean and resilient cities

While national governments must establish and execute comprehensive, actionable development strategies to enhance investment flows for sustainable urban infrastructure, cities can deploy a wide variety of financial instruments to implement the range of 3CR interventions highlighted earlier. Of course, the exact instruments that cities consider will continue to be determined by their fiscal, financial and administrative capacities as well as their legal authority.

For example, smaller cities will likely continue to depend heavily on resources transferred from national governments and are unlikely to be able to collect taxes or set tariffs and issue debt obligations. By contrast, midsize or large cities may theoretically have access to commercial debt through bond markets or commercial or public banks, but often lack credit ratings due to weak or mismanaged municipal finances, driving up borrowing costs and often requiring concessional guarantees to borrow. These cities may have some independent authority to levy taxes and set prices for public services like electricity and transportation, but resulting tax and service revenues may continue to be insufficient to cover their 3CR investment

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needs. Basic financial instruments such as those that involve repayment arrangements tied to project cash flows<sup>144</sup> are likely to be the best solution for such cities—especially those with constrained balance sheets and limited financial management capacity—since they enable cities and financiers to devote more creative energy to engineering and management innovations for projects rather than financial engineering.

Therefore, the report reviews a range of financing mechanisms that have been or could potentially be used for investing in urban infrastructure projects and programmes depending on city characteristics (see Box 4).

- First, the review examined both proven instruments and models with a history of successful implementation in Africa or elsewhere and innovative new approaches that have yet to be scaled up but show strong potential to address the financing barriers to urban infrastructure in Africa.
- Second, the review considered the ability of these instruments and models to attract private sector capital. Given the sheer scale of investment requirements, public finance alone will not be sufficient to meet urban 3CR investment needs on the continent. Cities will need to use public funds to leverage and crowd in private finance. This catalytic element of financial instruments is crucial since instruments that enable blending of public and private sector capital also enable cities to access and benefit from the technical and implementation skills of a range of actors, including civil society organisations, philanthropic institutions, development banks and private for-profit entities.<sup>145</sup>
- Third, the review mapped the instruments and models to the degree of subnational government autonomy required for implementation and the resulting roles that subnational governments themselves play in each instrument. Given that the success of any financial instrument depends on the circumstances under which it is implemented, no single approach will be appropriate across the array of cities on the continent. Rather, the appropriate strategy for a given city will depend on the city's financial health and institutional capacity; its own level of authority or influence over regulatory policy, budgeting and municipal service delivery; and its specific sectoral investment needs to enable 3CR development outcomes.
- Finally, the review mapped instruments by way of their contribution to the 3CR model of urban development.



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**BOX 4**

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**Types of cities based on the lowest to highest degree of municipal government involvement**

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- **Mobiliser:** The city is minimally or moderately involved in the instrument's design, mobilising private investment by contracting with private sector firms for municipal services provision, taking a supporting role in a public or public-private partnership, serving as a matchmaker between providers and recipients of finance or otherwise engaging with private investors to attract investment in 3CR infrastructure.
- **Partner:** The city is directly involved in the instrument's design and execution, taking a leading or co-equal role in a partnership with public and/or private actors, including development financial institutions (DFIs), national governments, banks and project developers, to finance, build and operate urban climate infrastructure.
- **Leader:** The city is directly involved in the instrument's design and execution as the primary (or only) actor developing and implementing major aspects of the instrument, from project sourcing to fundraising to project construction and operation.

Source: Climate Policy Initiative for the Coalition for Urban Transitions.

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These categories represent various degrees of city involvement in financing climate and sustainable infrastructure projects, allowing municipal governments to target specific actions they can take based on their financial strength and legal authority. For example, a city that lacks budgetary autonomy or revenue-collection powers will not be able to deploy financial instruments that fall under the Partner or Leader categories but can act as a Mobiliser by serving as a matchmaker between private investors and projects in need of financing. Depending on its specific authority to award services contracts or enter into public-private partnership agreements, this city could also potentially contract with private investors for the development and operation of high-priority climate and infrastructure projects.

The review identified six key finance mechanisms that cities could select and deploy in line with their own unique characteristics, circumstances and investment needs. Table 8 provides an overview of these mechanisms and their applications in greater detail, summarising how these instruments specifically contribute to one or more of the value streams for 3CR cities. Each of these mechanisms addresses a different combination of barriers, sectors and geographies, providing a robust cross-section of the spectrum of financing mechanisms available to both governments and private sector actors. While these six instruments and models have been prioritised following the review, many of the others are also likely to be effective in overcoming financing barriers to 3CR infrastructure. The relative effectiveness of different instruments will depend on city-specific circumstances, and, as such, deployments or pilots should be open to exploring not just these instruments but other potential mechanisms as well. The full case studies for the six financing mechanisms are explored in the following sections.

**Table 8: Six instrument case studies by city role and contributions to 3CR objectives**

City Role	Instrument	Contribution to 3CR cities			
		COMPACT urban Growth	CONNECTED infrastructure	CLEAN technologies and environmentally friendly practices	RESILIENT planning, governance and finance
City as Mobiliser	<i>Philippines City Disaster Insurance Pool</i>	Cities incentivised to limit urban sprawl and development in environmentally sensitive areas to reduce insurance premiums	Parametric insurance pays out quickly, funding repairs to critical transportation, sanitation and communication infrastructure		Affordable insurance to enable fast recovery from extreme weather events
	<i>Cooling as a Service</i>			Incentivises deployment of energy-efficient cooling equipment	Affordable cooling services improve urban residents' productivity, health and safety during extreme heat events
City as Partner	<i>Pay As You Save for Clean Transport (PAYS)</i>	Improved public transport encourages dense, mixed-use development and walkable neighbourhoods	Stronger, higher performing public transport networks connect urban residents to employment, social services and other amenities	Increases affordability of battery-electric buses, which reduce carbon emissions and local air pollution	
	<i>Nagpur Water Supply Public-Private Partnership (PPP)</i>		Water supply contract includes provisions for maintenance and improvement of city-owned infrastructure		PPP employs private sector partners to manage infrastructure and service delivery, freeing up city personnel to tackle other important city planning and governance challenges
City as Leader	<i>Breathe Better Bond (BBB)</i>			Helps cities raise funds for projects to address local air pollution and reduce GHG emissions	
	<i>Kenyan Country Climate Funds</i>		Local citizens' councils identify and prioritise critical local infrastructure projects based on community needs		Government funds allocated at city level based on citizens' input, enabling targeted investment in local resilience

**Note:** GHG = Greenhouse gas.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.

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## Parametric insurance pools

Many financial approaches to addressing cities' climate needs are led by regional or national governments rather than the cities themselves. This may occur because cities have limited budgetary and operational autonomy, as outlined in Section 5, or because national authorities are farther along in their consideration of urban climate needs and in the development of appropriate solutions. This is especially true for adaptation and resilience finance, for which a lack of commercially viable projects presents a challenge to cities' efforts to prepare for stronger storms, extreme heat and longer droughts caused by climate change.<sup>vii</sup> Cities therefore must seek to mobilise adaptation and resilience financing by collaborating with national and regional governments that have both the authority and the expertise required to drive meaningful investment into urban areas.<sup>146</sup>



One such adaptation and resilience instrument led not by cities, but by a national actor, comes from the Philippines—a country that is vulnerable to earthquakes, volcanic eruptions and typhoons due to its location on the Pacific Rim, as well as to floods, droughts and landslides. This baseline disaster risk is amplified by increased incidence of extreme weather events driven by climate change, and Philippine cities face especially elevated risk given their high proportion of the nation's population, economic activity and critical infrastructure. In response, the Philippine Department of Finance has collaborated with the Asian Development Bank to design the Philippines City Disaster Insurance Pool (PCDIP) to provide rapid post-disaster recovery funding for cities. The instrument is a parametric insurance pool, meaning that payouts are based not on actual losses suffered, but rather on a disaster event's physical features, such as wind speed or earthquake magnitude, which closely correlate with actual losses and are easier to measure and verify.<sup>147</sup> Parametric coverage will initially insure against earthquakes and typhoons, with eventual planned expansion to offer flood insurance.

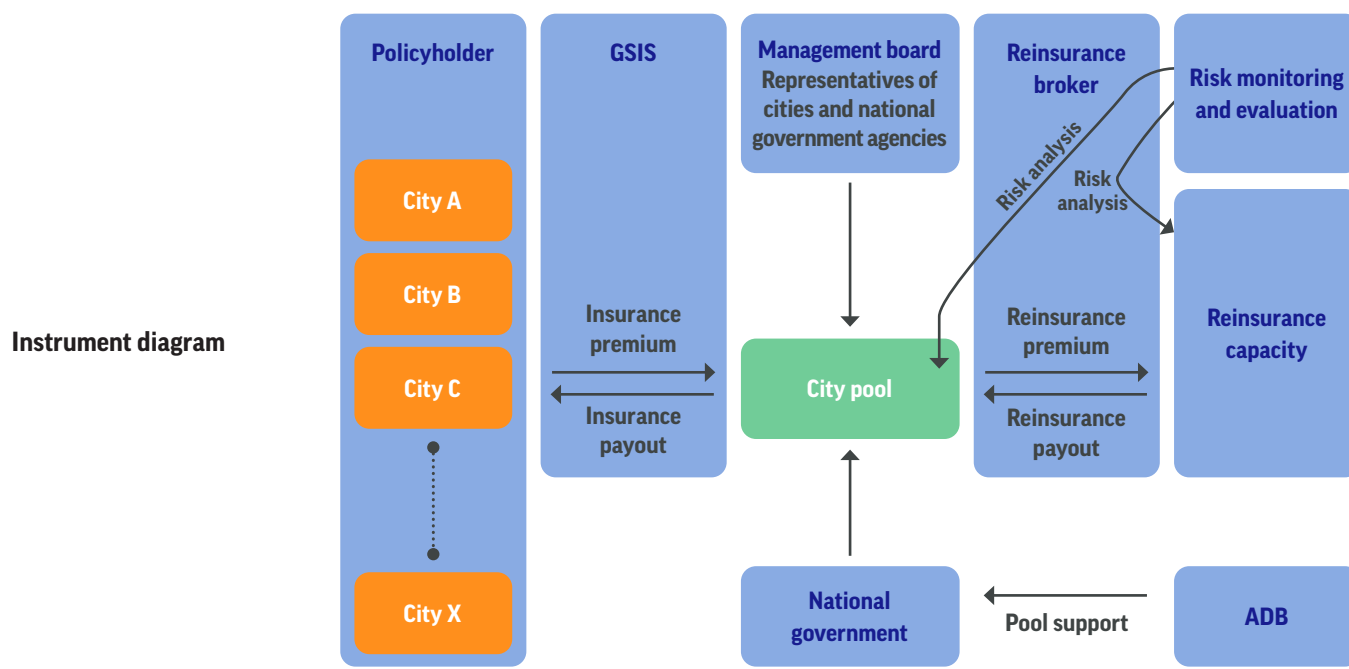
While cities did not participate directly in the design of the instrument, ten cities from across the country were engaged in exposure data collection, needs assessment and capacity-building to support the design process. The planned pool would allow cities to buy parametric insurance policies from the Government Service Insurance System (GSIS), a state-owned social insurance agency, with premiums set for each city's policy, based on risk-modelling services from an external provider. GSIS would take a small fee for acting as the policy and payout issuer, passing on the remaining premium to the PCDIP pool, which will seek reinsurance from domestic and international providers.<sup>148</sup> This parametric pooling system enables cities to receive payouts channelled from PCDIP through GSIS within 15 business days, aiding cities in recovering more quickly and effectively than would be possible under traditional indemnity insurance policies that require detailed loss assessments.<sup>149</sup>

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vii Analysis based on expert interviews.

**Figure 8: Case Study—Philippines City Disaster Insurance Pool**

CITY'S ROLE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<b>Mobiliser</b>	Asian Development Bank, Philippine Department of Finance	Philippines	Seeking approval to launch 10-city pilot insurance pool
<b>Summary</b>	ADB subsidises disaster insurance pool allowing Philippines cities to purchase parametric disaster insurance		
<b>Barrier(s) addressed</b>	 Capital markets access  Lack of capacity		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>Parametric insurance based on physical characteristics of disaster rather than damage assessment, enabling rapid payouts for recovery after extreme weather events</li> <li>City-specific risk modelling enables custom premiums and policies for each participating city</li> <li>Pool structure diversifies and derisks each policy, reducing costs and unlocking access to reinsurers</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>Effective insurance instruments require rigorous risk modelling, which can be provided or supported by DFI technical assistance programming</li> </ul>		



**Note:** ADB = Asian Development Bank; DFI = Development financial institutions.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.

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## Servitisation instruments



While service- or subscription-based business models, such as enterprise software and digital media, have long dominated in capital-light sectors, these approaches have only recently been applied to capital-intensive infrastructure. Servitisation can be an especially powerful solution when up-front costs pose a substantial barrier to infrastructure investment, whether in a public, private or blended context.

Cooling as a Service (CaaS), developed by the Basel Agency for Sustainable Energy and the Kigali Cooling Efficiency Programme, is a prime example of how servitisation instruments can drive increased investment in climate-friendly urban infrastructure. Demand for cooling is growing in African cities, where the size and purchasing power of the middle class are increasing rapidly. The Cooling as a Service instrument helps fulfil these urban cooling needs efficiently and sustainably, contributing to both climate mitigation, by reducing energy use for cooling, and adaptation, by meeting cooling needs in the areas of health care, food and nutrition, and human comfort and safety. Under CaaS, a cooling equipment manufacturer owns and maintains cooling assets like air conditioners, refrigerators and cold storage units, earning revenue by charging customers per unit of cooling used. This provides a clear incentive for customers to reduce cooling consumption, while also ensuring that the cooling equipment owner-operator receives steady operating cash flows throughout the life of the assets to fund operations and maintenance. If desired, the equipment provider can also recapitalise via a sale-leaseback arrangement with a bank or other investor, selling the equipment and leasing it back using the cooling services contracts as additional collateral to obtain favourable financing terms. This innovative, affordable and transparent pay-per-service model incentivises large-scale deployment of clean cooling technologies in urban areas.<sup>150</sup> The proponents of this instrument will require local fiscal capacity as well as capable partners to implement the business model, which will involve the sustained engagement of a variety of stakeholders including technology providers, cooling customers and financiers. It will also require changes in traditional business operations including how owners think about cash flows and payment structures.

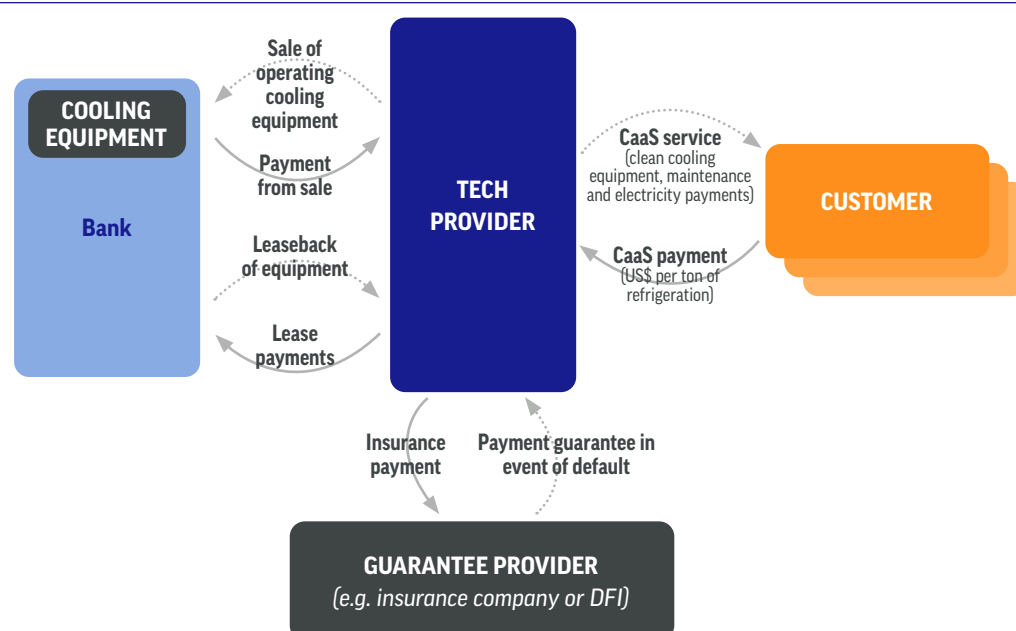
CaaS pilots are currently underway in India, Nigeria, Singapore and South Africa, and the concept has the potential to be applied to many more markets in which high up-front costs prevent commercial customers from purchasing badly needed cooling equipment.<sup>151</sup> In addition, the instrument's service-based approach could potentially be applied to other capital-intensive sectors including energy efficiency, industrial equipment and transport. While current pilot projects generally focus on private markets, the instrument design is flexible enough to be adapted to the needs and procurement processes of city governments. By signing CaaS contracts with equipment providers, cities can procure cost-effective, long-term cooling services for schools, hospitals, government buildings and other public facilities while actively driving deployment of climate-friendly infrastructure that provides both mitigation and adaptation benefits to local residents.



**Figure 9: Case Study—Cooling as a Service**

CITY'S ROLE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<b>Mobiliser</b>	BASE, K-CEP, technology providers, banks	Africa, Asia, Central/South America	Pilots underway in India, Nigeria, Singapore and South Africa
<b>Summary</b>	Pay-per-service model for clean cooling systems		
<b>Barrier(s) addressed</b>	 High up-front costs  Monetising social benefits (secondary)		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>Cooling provider or financier owns cooling assets, eliminating upfront equipment costs to customers</li> <li>Customers sign cooling services contracts with all-in fees charged per unit of refrigeration used (e.g., \$/ton-hour)</li> <li>Customers are incentivised to minimise cooling consumption by only paying for the amount of cooling services they need</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>A small amount of targeted technical assistance funding for capacity building and instrument design can attract investor interest and mobilise capital at scale</li> </ul>		

**Instrument diagram**



**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.

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## Public agency partnerships



City, state and national governments are only part of the infrastructure investment picture. Investment in municipal or regional transportation, energy, waste and water infrastructure may be partially or entirely controlled by independent public agencies, such as electric utilities and metropolitan transportation commissions. While government officials may have some degree of oversight or management authority over these agencies, the agencies themselves generally have independent mandates, balance sheets and investment strategies. Cities attempting to mobilise finance for 3CR development should therefore leverage the financial and technical capabilities of these agencies by bringing them together in investment partnerships, as in the Pay As You Save for Clean Transport (PAYS) financial instrument.

PAYS offers cities a compelling opportunity to electrify public transport fleets, reducing carbon emissions and local air pollution while taking advantage of the life-cycle cost savings of replacing petrol-powered buses with battery-electric buses. PAYS is a financial structure in which a creditworthy utility leverages its access to low-cost capital to purchase batteries and charging infrastructure for electric buses. The utility then leases these assets to a city transportation authority, recovering capital costs through per-use payments as the transport agency utilises the new batteries and charging facilities. This approach mirrors pay-as-you-go financing approaches used in other sectors, like energy access, enabling public transport providers to modernise and electrify urban bus systems without needing to borrow at high interest rates against a constrained municipal balance sheet.<sup>152</sup>

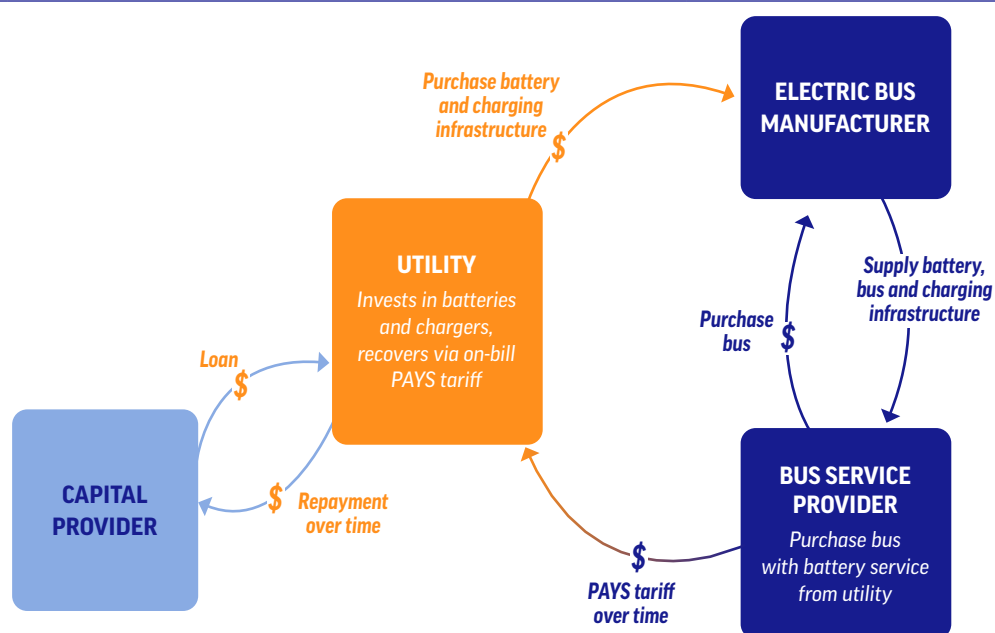
Initial conversations around piloting the PAYS concept in Lima, Peru, have revealed challenges in coordinating the actions and incentives of all four partners—the utility, the transport agency, the lender and the electric bus manufacturer. This is where cities can play a critical role, engaging with the idea and helping to form partnerships that enable implementation. Many municipal governments in Africa control local electricity supply, mass transit systems or both, either directly as a function of city government or in a supervisory role providing guidance to separate public utilities and transit agencies. By prioritising collaboration between these public or quasi-public entities, lenders and bus manufacturers, municipal governments have the opportunity to unlock the full potential of a financial approach that enables transport providers (often cities themselves) to avoid high borrowing costs and instead finance climate-friendly infrastructure by leasing capital assets from a creditworthy partner.

However, cities pursuing PAYS or similar public agency partnerships should also note that the viability of this strategy depends on the creditworthiness of the local utility, which, while often stronger than that of the city itself, may still be insufficient to enable the type of low-cost borrowing required to launch this instrument.

**Figure 10: Case Study—Pay As You Save for Clean Transport**

CITY'S ROLE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<b>Mobiliser or Partner</b>	Clean Energy Works	Central/South America	Exploring potential pilot in Lima, Peru
<b>Summary</b>	Transit agencies partner with utilities to adopt electric buses and build out supporting infrastructure		
<b>Barrier(s) addressed</b>	<div>  Capital markets access         </div> <div>  High up-front costs         </div>		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>Local transit agency acquires electric buses</li> <li>Utility acquires bus batteries and builds charging infrastructure, taking advantage of creditworthiness to obtain lower borrowing costs</li> <li>Transit agency leases bus batteries from utility and pays subscription fee to use charging infrastructure</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>Ensure that instrument design properly aligns incentives for all partners (i.e., utilities, transit agencies, lenders)</li> </ul>		

**Instrument diagram**



**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.

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## Public-private partnerships

Many cities use public-private partnerships (PPPs) as a mechanism to deliver 3CR infrastructure through a wide variety of models, from limited-scope construction contracts to turnkey build-finance-own-operate arrangements. These partnerships enable cities to obtain from private partners the technical expertise, financing support and management capacity required to develop and manage critical urban infrastructure, which cities themselves may not possess. One example of a PPP in which a municipal government acted as a true partner in mobilising financing for resilient infrastructure occurred in the Indian city of Nagpur. The city used a PPP to overcome a lack of technical capacity and insufficient service revenues by partnering with both national government and private service providers to finance improvements to the infrastructure and operations of its water system, providing immediate economic and climate resilience benefits to local residents whose quality of life depends on a reliable, affordable water supply.



The city of Nagpur became responsible for providing water supply services in the early 2000s when the state government of Maharashtra devolved this authority to the local level. At this time, the city began to outsource water supply functions via a series of small maintenance and operations arrangements but struggled to manage multiple fragmented contracts over time. To ensure a single point of accountability and improve service quality, the city's elected officials and employees of the Nagpur Municipal Corporation agreed to pursue a PPP arrangement and formed a subsidiary called Nagpur Environmental Services Limited (NESL) to manage the process, taking responsibility for procurement of water supply services.<sup>viii</sup>

The 2011 PPP contract between NESL and private operators Veolia and Vishvaraj is a 25-year performance improvement agreement, under which the private operators must implement initial performance improvement projects within five years. The operator will collect user charges in an escrow account, to be used for payment of obligations for raw water purchases, as well as payments back to the operator, with any shortfall in collections to be provided from the city's general budget. Of a total US\$70.5 million in initial required capital expenditures, 70% was provided by a grant from the government of India's Jawaharlal Nehru National Urban Renewal Mission, which makes public funds available to enable PPP projects. The remaining 30% was provided by the contracted private operator, with this investment to be repaid via revenues for water users. In this case, the city overcame a lack of technical capacity and insufficient service revenues by partnering with both national government and private entities to finance improvements to the infrastructure and operations of its water system, providing immediate economic and climate resilience benefits to local residents whose quality of life depends on a reliable, affordable water supply.

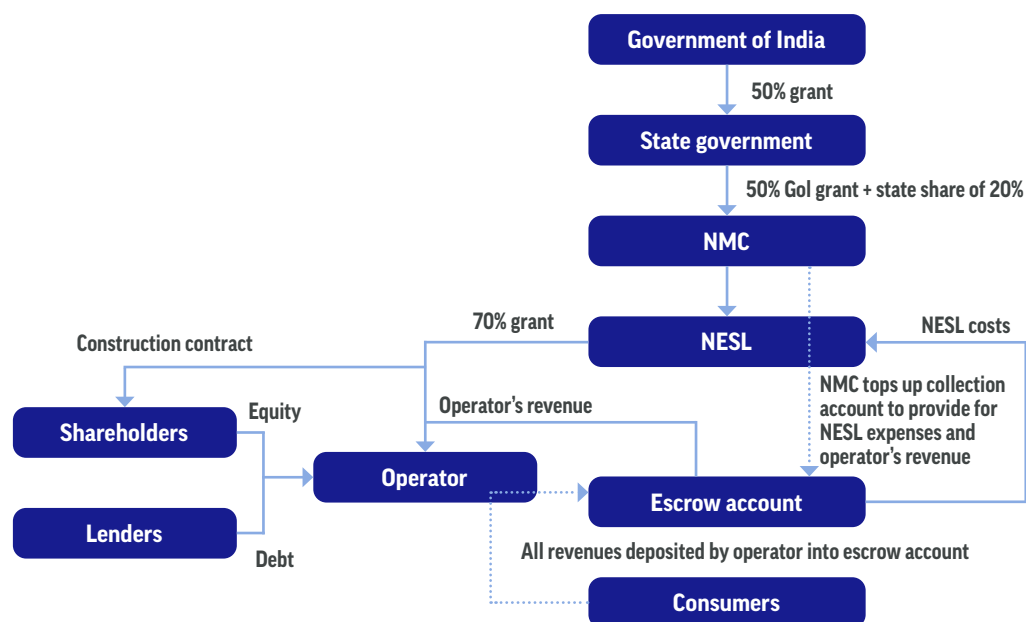
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viii World Bank Water and Sanitation Program: World Bank, 2014, *Running Water in India's Cities: A Review of Five Recent Public-Private Partnership Initiatives*, <https://www.wsp.org/sites/wsp.org/files/publications/Running-Water-in-India-Public-Private-Partnership-Initiatives.pdf>.

**Figure 11: Case Study – Nagpur Water Supply PPP**

CITY'S ROLE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<b>Partner</b>	Nagpur Municipal Corporation, Indian government, Vishvaraj-Veolia	India	Fully implemented
<b>Summary</b>	Nagpur city government combined federal and state grants with 25-year private performance contract to rehabilitate, operate and manage the municipal water supply system		
<b>Barrier(s) addressed</b>	 High up-front costs  Lack of capacity		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>City established fully-owned company, NESL, tasked with water supply contracting and management</li> <li>Federal and state government grants covered 70% of project costs: rehabilitation of water treatment and distribution assets</li> <li>Remaining 30% of costs (operating expenses) paid from city budget to private operator offering stronger operational capacity and single point of accountability</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>Maintain close communication and collaboration between municipal, state and federal governments to enable smooth PPP structuring, funding and implementation</li> </ul>		

**Instrument diagram**



**Notes:** NESL = Nagpur Environmental Services Limited; PPP = Public-private partnership.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.



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## Green bonds

Green bonds take advantage of public debt capital markets to fund climate solutions. Under the standard green bond structure, the issuer earmarks proceeds for use on green projects, which must comply with a green bond taxonomy of acceptable project types. This debt is issued “on-balance sheet,” meaning it carries the same credit rating as the issuer’s other bonds, and purchasers have recourse to the issuer’s assets in the case of default. Other green bonds may be issued through a special purpose vehicle (SPV), meaning lenders have recourse only to the specific assets and projects funded by the bond proceeds; however, this approach can

increase structuring and borrowing costs due to the need to incorporate and operate an SPV separately from the borrower’s balance sheet and the desire of lenders for significant collateral as protection against default.

One green bond structure especially well-suited to the 3CR development needs of African cities is the International Finance Corporation’s (IFC’s) proposed Breathe Better Bond (BBB), a bond issued by a city, state or special purpose vehicle to raise dedicated financing for projects that reduce both air pollution and greenhouse gas emissions. The bond portion of the BBB is a blended financial instrument, using concessional funding to provide credit enhancements and attract private institutional capital, with bond proceeds used to fund climate-critical infrastructure projects across the waste, water, energy and transport sectors. The BBB will repay its obligations using revenue generated from these projects once they are operational, with a wide variety of projects that address air pollution while also providing steady cash flows. Examples of project types that can be

funded by BBB proceeds and ring-fenced for debt service include municipal solid waste to energy plants, bus rapid transit systems, solar PV (both utility-scale and rooftop), electric bus conversion and waste remediation.

The BBB initiative combines this bond offering with a donor-funded technical assistance facility that provides capacity-building support to help cities identify sources of air pollution, prepare a strong project pipeline and improve the enabling environment for investment. In addition, a proposed results-based payment mechanism funded by DFIs or philanthropies would reward tangible emissions reductions and air quality improvements achieved by projects funded by the bond, lowering the effective cost of borrowing and incentivising deployment of funds to impactful projects.<sup>153</sup>

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**The Breathe Better Bond initiative combines this bond offering with a donor-funded technical assistance facility that provides capacity-building support to help cities identify sources of air pollution, prepare a strong project pipeline and improve the enabling environment for investment.**

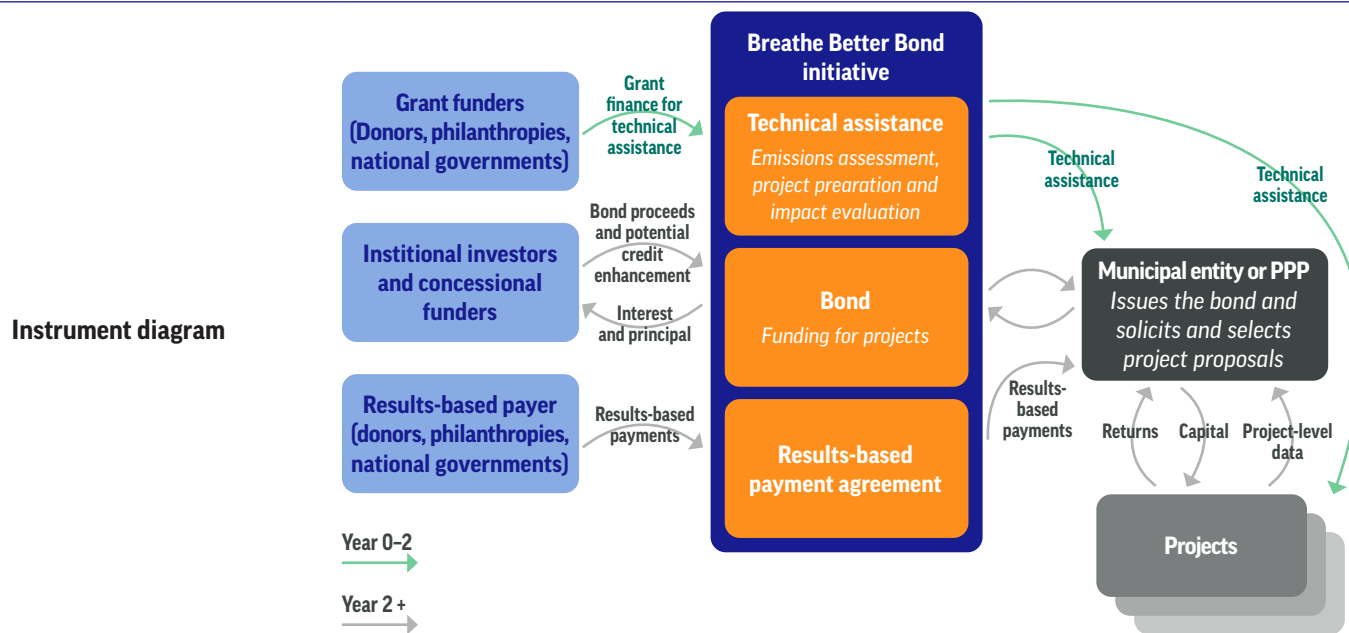
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Because the idea depends on cities themselves to issue the green bond, the Breathe Better Bond's replicability is restricted to cities that have both the financial autonomy to independently issue debt and adequate creditworthiness to achieve reasonable borrowing costs based on overall municipal revenues. While the technical assistance package can assist in mitigating risks associated with these two requirements, the instrument depends on strong local government institutions and functional domestic capital markets, which only exist in a few cities on the continent, such as Cape Town or Lagos. In the past, the city of Johannesburg has used municipal green bonds to raise funds to expedite the implementation of its climate change mitigation strategy and to invest in low-carbon urban infrastructure. Issued in June 2014 and worth R1.5 billion (approximately US\$143 million), the green bond is funding projects across a range of sectors including 150 new dual fuel buses and converting 30 buses to biogas.<sup>154</sup> In case a city cannot issue a green bond directly, there are options such as using local government funding agencies or utilities as proxies to issue bonds for low-carbon and resilience projects.

The IFC is currently in preliminary talks with several municipal and national governments in Africa to explore potential collaboration on a BBB pilot project, with the understanding that any city chosen for the pilot must be capable of taking a leading role in driving the instrument's success. It is important to note that the risk of greenwashing must be addressed with high priority in the case of green bonds. Greenwashing is defined as the attempt to make a project or investment appear more climate-friendly or environmentally beneficial than it is. The absence of common definitions or industry standards for what constitutes a green project or investment has led to a proliferation of meaningless labels and a lack of consistency and professionalism in the verification market, creating the risk of greenwashing.<sup>155</sup>

**Figure 12: Case Study—Breathe Better Bond**

CITY'S ROLE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<i>Leader</i>	International Finance Corporation	Africa, Asia, Central/South America	Exploring possible city partners for pilot(s)
<b>Summary</b>	City, state or SPV-issued bond to finance projects reducing both air pollution and greenhouse gas emissions		
<b>Barrier(s) addressed</b>	 Lack of capacity  Insufficient project pipeline  Monetising social benefits		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>Grant financing funds TA facility to identify local air pollution/emissions sources, develop bankable projects in response and structure bond issue</li> <li>Potential for add-on, results-based mechanism, which would reduce effective municipal borrowing costs by offering payments when the borrower city meets preset emissions reduction and air quality improvement targets</li> </ul>		
<b>Lessons learned/ Takeaways</b>	<ul style="list-style-type: none"> <li>Imperative to achieve full alignment among borrowers (cities) and credit enhancement providers (DFIs) on specific target sectors and projects before launching pilot</li> </ul>		



**Notes:** SPV = Special purpose vehicle; TA = Technical assistance; DFIs = Development financial institutions.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.

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## Municipal climate change funds



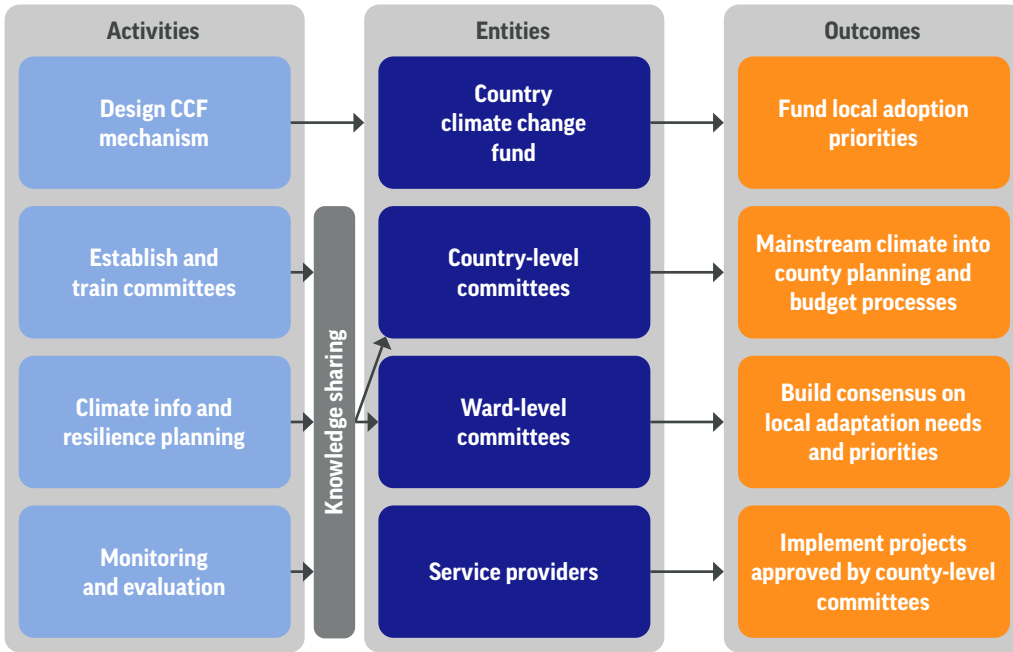
Municipal climate change funds are devolved finance mechanisms that can be used by subnational governments to mainstream climate investment into local planning and budgeting systems.<sup>156</sup> They are structured to blend financial resources from international climate finance, multilateral development banks, the private sector, the national government and municipalities' own budgets, providing dedicated funding for local climate adaptation and mitigation projects.

The most successful example of this type of fund comes from Kenya, whose County Climate Funds are among the clearest instances available of a local government taking a leading role in the development and implementation of a successful financial instrument to fund climate projects. The County Climate Fund model, developed with the support of the United Kingdom's Foreign, Commonwealth and Development Office (FCDO), earmarks 1% of participating counties' development budgets to be spent on climate projects. In addition, grant-funded technical assistance programming is used to establish and train community investment committees, which source a pipeline of local climate adaptation projects and approve the strongest projects to receive funding.

This system has succeeded in democratising local climate investment and emphasises the importance of involving residents in the investment process, as they are often more aware than central county or national authorities of their municipality's specific climate adaptation needs and priorities. As of 2020, the County Climate Funds had made more than 100 public goods investments across five pilot counties, ranging from water infrastructure to livestock health care, with many communities prioritising adaptation projects in the water and waste sectors. The County Climate Fund model is currently being expanded to several additional counties, with the programme expected to encompass all 47 Kenyan county governments in the future.<sup>157</sup>

However, the County Climate Fund model requires that counties or other subnational government entities be given a certain degree of budgetary autonomy, and this instrument would therefore be less viable in countries that restrict subnational entities' ability to collect revenue and manage their finances independently.

**Figure 13: Case Study—Kenyan County Climate Funds**

MUNICIPALITY'S ROLE	GROUP(S) INVOLVED	LOCATION(S)	CURRENT STATUS
<i>Leader</i>	Five Kenyan counties, UK FCDO	Kenya	Full deployment and replication
<b>Summary</b>	County governments earmark 1% of annual development budget for climate adaptation and resilience projects, with TA funding supporting capacity building for community committees to identify and evaluate projects to be funded		
<b>Barrier(s) addressed</b>	 Lack of capacity  Insufficient project pipeline		
<b>Unique feature(s)</b>	<ul style="list-style-type: none"> <li>Empowers local communities to act on their knowledge of climate adaptation and resilience needs</li> <li>Establishes and trains citizens' committees on governance, climate, project development and finance</li> </ul>		
<b>Lessons learned Takeaways</b>	<ul style="list-style-type: none"> <li>Importance of establishing a dedicated, regular funding stream for public climate financing efforts</li> <li>Local residents are often better able to articulate climate adaptation priorities than central authorities</li> </ul>		
<b>Instrument diagram</b>	 <pre> graph LR     subgraph Activities         A1[Design CCF mechanism]         A2[Establish and train committees]         A3[Climate info and resilience planning]         A4[Monitoring and evaluation]     end     subgraph Entities         E1[Country climate change fund]         E2[Country-level committees]         E3[Ward-level committees]         E4[Service providers]     end     subgraph Outcomes         O1[Fund local adoption priorities]         O2[Mainstream climate into county planning and budget processes]         O3[Build consensus on local adaptation needs and priorities]         O4[Implement projects approved by county-level committees]     end     A1 --&gt; E1     A2 --&gt; E2     A3 --&gt; E3     A4 --&gt; E4     E1 --&gt; O1     E2 --&gt; O2     E3 --&gt; O3     E4 --&gt; O4     E2 &lt;--&gt; E3     E3 &lt;--&gt; E4     </pre>		

**Notes:** FCDO = Foreign, Commonwealth & Development Office (UK); TA = Technical assistance.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.





Tuk tuk drivers in Lagos, Nigeria. Credit: UnsulliedBokeh/Shutterstock.

## Conclusion

The challenge faced by Africa's rapidly growing cities is a balancing act, as cities must address priorities around development and economic growth alongside urgent action to address the climate emergency and adapt to climate impacts. African cities are not alone in facing these challenges, but these challenges are especially pronounced in Africa due to a variety of factors. Urbanisation on the continent is taking place not only in the context of poverty and human development deficits that are higher than in many other regions, but it is also occurring faster, at lower levels of income and without access to the industrial development pathways used by Europe, North America and some Asian economies. As African countries focus on alleviating poverty through economic growth and urban development, they can turn the climate crisis into an opportunity by supporting the development of a new urban economy while locking in resilience against future climate risks.

Unlike cities in developed countries, African cities have an immense opportunity because they can build new infrastructure from the ground up, rather than having to replace carbon-intensive legacy infrastructure. They are taking long-term infrastructure

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decisions with full knowledge of climate change; there are significant energy and digital innovations taking place that they can harness; and sources of green financing such as development banks and private investors are ready to contribute to this vision under the right conditions. The benefits of 3CR investment go beyond reducing emissions: African cities are on the front lines of the climate emergency

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**African cities are on the front lines of the climate emergency. Besides reducing emissions and enhancing resilience to climate impacts, the compact, connected, clean and resilient model of urban development can also deliver on core economic and social goals.**

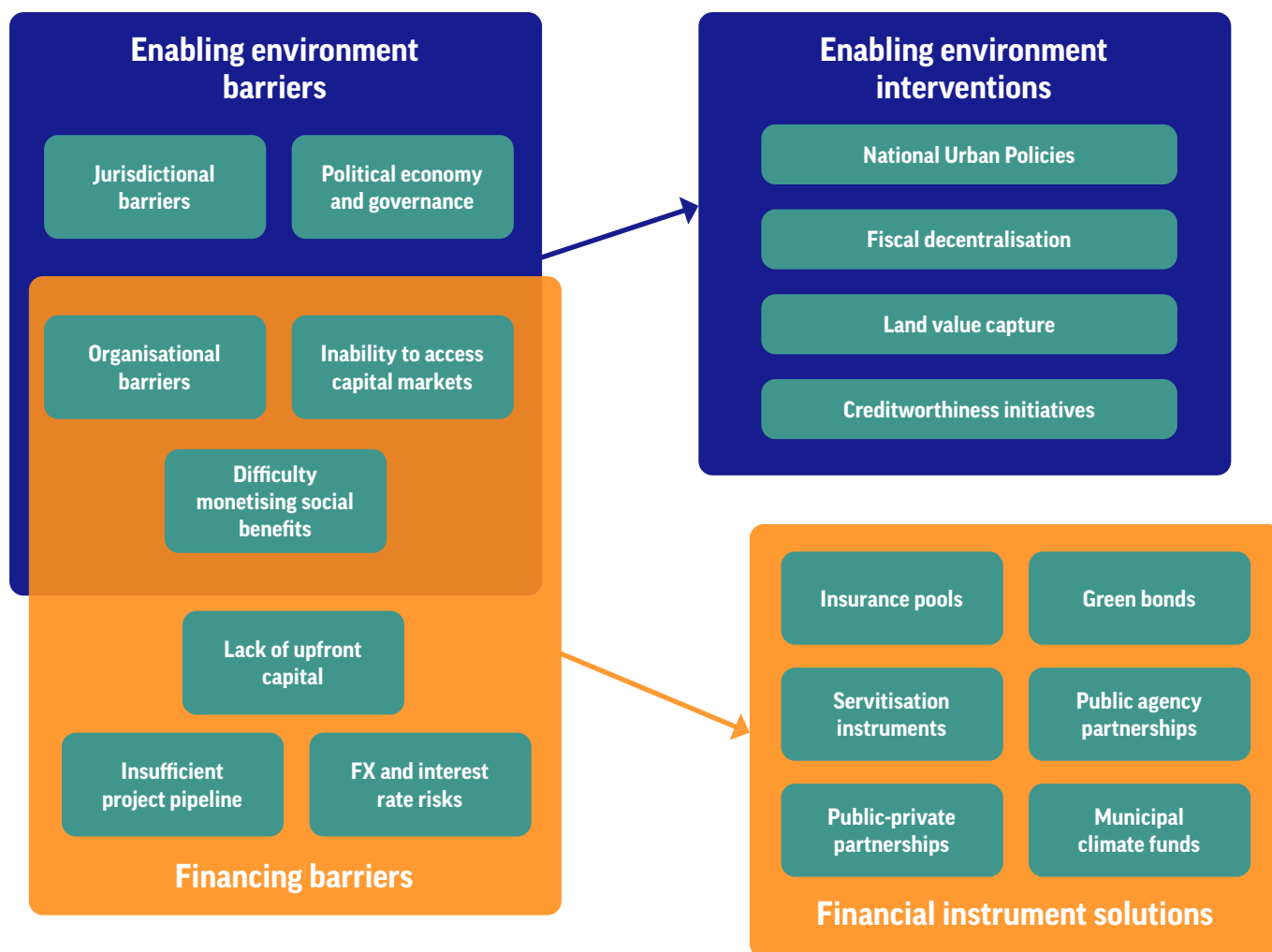
and are particularly vulnerable to impacts such as rising sea levels and rising temperatures. Besides reducing emissions and enhancing resilience to climate impacts, the compact, connected, clean and resilient model of urban development can also deliver on core economic and social goals.<sup>158</sup>

As demonstrated by this report, while the required investment is significant, the benefits are even greater. For major cities in Ethiopia, Kenya and South Africa, the returns of investment in compact, clean and connected city interventions after payback (i.e., NPV) to 2050 are expected to be US\$90 billion, US\$52 billion and US\$190 billion, respectively. Scaling this model of urban development across the continent will require trillions of dollars of investment—investment that will be hard to mobilise given constraints such as the high up-front costs of sustainable infrastructure, weak municipal

creditworthiness and inefficient revenue-collection mechanisms for the provision of municipal services and other public goods. Other hurdles include legal restrictions on the financial autonomy of cities, which often force municipal governments to rely upon the budgeting and policy priorities of state or national governments, as well as a lack of internal capacity among city governments and constituent public agencies to implement best practices for financial management and analysis.

Consequently, mobilising finance at scale will necessitate that the regulatory and financial frameworks and policies are reformed rapidly to unlock investment in cities. As national action overcomes barriers to investment in cities, cities can utilise financial instruments aimed at mobilising investment in urban infrastructure. The report identifies four interventions that can enhance the enabling environment for investing in cities and six mechanisms that are capable of mobilising finance for 3CR infrastructure (see Figure 14).

**Figure 14: Instruments to enable investments in compact, connected, clean and resilient cities**



**Note:** FX = Foreign exchange.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.

While these six financing mechanisms have been prioritised in this report, many other instruments are also likely to be effective in overcoming financing barriers to 3CR infrastructure. It is recommended that financing of 3CR infrastructure be based on the following broad principles:

### Use the right tool for the right task

Financial instruments vary in their ability to address different barriers and the needs of different sectors, actors and geographies. They must be carefully selected based on the specific markets in which they are to be implemented. Cities attempting to replicate the successful approaches used elsewhere need to thoroughly investigate the potential and feasibility of each instrument for their own context and needs and adapt them as necessary.

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### Seek technical assistance opportunities

National governments, development banks and philanthropic organisations offer a wide variety of financial partnerships and technical support programmes for cities. Subnational governments must proactively seek out these opportunities to maximise success in mobilising urban climate finance.

### Embrace private sector investments where city financial or jurisdictional flexibility is limited

Commercial investors have the required capital and investment mandates to contribute significantly to developing critical urban climate infrastructure. Subnational governments must seek to be enablers and mobilisers for private sector investment by identifying and sharing potential project opportunities and by streamlining regulatory and permitting processes to enable smoother deployment of private capital into projects.

The COVID-19 pandemic has shown that building national- and city-scale resilience will be decisive to climate-proof our future. African leaders have the ability to boost national economies' resilience to a wide range of economic, health and environmental shocks by getting cities right.

Although a rapid transition to 3CR cities is challenging, it is both feasible and attractive. Investing in cities offers the most promising opportunities to accelerate the transition to a resilient and low-carbon future. Urban areas in Africa already concentrate most of the people, activity and assets. City and national leaders should seek to attract public and private capital to finance major urban infrastructure projects that have the potential to unleash new economic activity, create local jobs, increase public health outcomes and set cities on a path of prosperity and sustainable long-term development. However, financing is not a silver bullet. Strong local and national policies need to pave the way to create a strong enabling environment.



## Appendix A: Inventory of financial instruments and funding models

We reviewed several financial instruments and funding models that have been used or could potentially be used for investing in urban infrastructure projects that facilitate 3CR cities. These instruments vary widely in terms of both the role of city governments in implementation and the primary investment barriers they address.

**Table A1: Financial instruments and funding models for investing in urban infrastructure**

NAME	CITY ROLE	GEOGRAPHY	IN 10 WORDS	ENTITIES	High upfront costs	Capital markets access	Monetising social benefits	Insufficient project pipeline	Organisational barriers	FX/Interest rate risk
<b>Pay As You Save for Clean Transport</b>	Mobiliser	Africa, Asia, C/S America	Per-per-service model to deploy affordable, clean cooling equipment	Basel Agency for Sustainable Energy, Kigali Cooling Efficient Prog	✓		✓			
<b>Philippines City Disaster Insurance pool</b>	Mobiliser	Philippines	Parametric insurance pool enabling quick disaster recovery payouts to cities	Asian Development Bank, Philippine Department of Finance		✓			✓	
Long-term FX Risk Management	Mobiliser	Africa	Inflation-linked currency/interest rate swaps to hedge climate project risks	The Currency Exchange Fund, International Finance Corporation					✓	✓
Water Finance Facility	Mobiliser	Global	Mobilises domestic private investment to fund critical utility water projects	Dutch FMO		✓	✓	✓		
The ACT Fund	Mobiliser	West Africa	Blended-currency infrastructure fund for urban climate projects	ARM-Harith Infrastructure Investment			✓	✓	✓	✓
<b>Pay As You Save for Clean Transport</b>	Partner	C/S America	Utilities fund battery and charging infrastructure purchase; lease to transit agencies	Clean Every Works	✓	✓				
<b>Nagpur Water Supply PPP</b>	Partner	India	City government contracts private firms to repair, operate water infrastructure	Nagpur Municipal Corporation, Indian government, Vishvaraj-Veolia	✓				✓	
Proterra electricity bus battery service agreements	Partner	North America, Europe	Transit agencies purchase electric buses; lease batteries with maintenance guarantees	Proterra	✓					
<b>Breathe Better Brand</b>	Leader	Africa, Asia, C/S America	Municipal bonds + TA to finance air pollution and climate solutions	International Finance Corp			✓		✓	✓
<b>Kenyan County Climate Funds</b>	Leader	Kenya	County governments commit development funding to community-identified adaptation projects	Kenyan Counties, UK FCDO				✓	✓	
Cape Town Green Bond	Leader	South Africa	Revenue-backed loan to fund climate mitigation and adaptation projects	City of Cape Town		✓				
Ghana Infrastructure Investment Bond	Leader	Ghana	PPP, public funding to attract global investments in infrastructure projects	GIIF, DACF (District Assemblies Common Fund), SSNIT (pension fund)	✓	✓		✓		

**Notes:** Detailed case studies contained in this report are in bold in table.

FX = Foreign exchange; PPP = Public-private partnership; C/S America = Central/South America; TA = Technical assistance; FCDO = Foreign, Commonwealth & Development Office (UK); GIIF = Ghana Infrastructure Investment Fund.

**Source:** Climate Policy Initiative for the Coalition for Urban Transitions.



## Appendix B: Economic modelling methodology

The model used for this report is based on the model developed for the Urban Opportunity, Climate Emergency report. The full methodology is available at <https://urbantransitions.global/wp-content/uploads/2020/04/Climate-Emergency-Urban-Opportunity-Methodological-Annexes.pdf>.

### Specific assumptions and sources for this study:

#### 1. Relevance of interventions

The analysis covers a bundle of urban climate action interventions based on the International Energy Agency's (IEA's) Below-2°C/Sustainable Development Scenario,<sup>ix</sup> combined with sector-specific scenarios including the Institute for Transport and Development Policy (ITDP) Global High Shift<sup>x</sup> and Global Buildings Performance Network (GBPN) Deep Efficiency deployment.<sup>xi</sup> For all interventions, deployment is assumed in major African cities with metro populations above 250,000.

**Table B1: List of interventions modelled**

Model	Intervention	Justification
Residential buildings	Deep efficiency	All models interventions were deemed relevant for major urban areas in Africa- defined as those with populations of at least 250,000 inhabitants (a commonly used threshold for defining major cities by organisations working on urban statistics, such as the UN Statistical Commission). <sup>15</sup> For example, interventions such as landfill gas utilisation and electric vehicles are not as relevant for urban areas in Africa with populations closer to 50,000 (which constitute a large portion of total urban areas in countries such as Ethiopia). To ensure model results are relevant to this context, we have limited results across all interventions to include only major cities. Results for all cities over 50,000 are included as a sensitivity of the modelling, representing an upper bound if interventions were to be deployed beyond just the 35 major cities modelled.
	Efficient lighting	
	Efficient appliances	
	Efficient cooking	
	Rooftop solar	
Commercial buildings	Deep efficiency	
	Efficient lighting	
	Efficient appliances	
	Rooftop solar	
Passenger transport	Efficient & electric vehicles	
	Mode shift to mass transit	
	Reduced motorised transport	
Freight transport	Efficient & electric vehicles	
	Improved logistics	
Waste	LFG utilisation	
	Materials efficiency	

**Source:** Vivid Economics for Coalition for Urban Transitions.

<sup>ix</sup> IEA (2020) Sustainable Development Scenario, [www.iea.org/reports/world-energy-model/sustainable-development-scenario](http://www.iea.org/reports/world-energy-model/sustainable-development-scenario).

<sup>x</sup> ITDP (2014), A Global High Shift Scenario, <https://www.itdp.org/publication/a-global-high-shift-scenario/>.

<sup>xi</sup> GBPN (2015), Monetary Benefits of Ambition Building Energy Policies.

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**Table B2: List of major cities included**

<b>Ethiopia</b>	<b>Kenya</b>	<b>South Africa</b>
Addis Ababa	Nairobi	Johannesburg
Bahir Dar	Mombasa	Cape Town
Adama	Kisumu	Durban
Dire Dawa	Nakuru	Pretoria
Shashamane		Klipgat
Hawassa		Port Elizabeth
Jijiga		Evaton
Dessie		Tsakane
Arsi Negelle		Bloemfontein
Alaba Kulito		Daveyton
Yirgalem		Edendale
Merawi		
Bule Hora		
Gonder		
Bonsa Bota		
Darechera		
Wereta		
Bishoftu		
Kombolcha		
Chiro		

**Note:** Major cities are defined as those with a population of at least 250,000 inhabitants.

**Source:** Vivid Economics for Coalition for Urban Transitions.

## **2. Data**

Table B3 below details cost parameter assumptions for Ethiopia, Kenya and South Africa. Where available, country-level cost estimations were used; otherwise, regional cost data or regional averages were used, with countries used in regional averages listed in the table. For the urban planning cost index, data exist for only a subset of cities in Africa. As such, city-level data were used for Kenya and South Africa and averaged for Ethiopia. Estimations of benefits for African cities include country-level data for jobs and gross value added (GVA) multipliers, energy prices<sup>xii</sup> and some transportation costs. For each country, the analysis tested modelled outputs with in-country case studies; experts validated the relevance of results.<sup>xiii</sup>

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<sup>xii</sup> Based on national data reported in the IEA energy prices database.

<sup>xiii</sup> Experts engaged in quality assurance review included urban experts from WRI Africa and the African Centre for Cities.

**Table B3: Cost parameter assumptions for Ethiopia, Kenya and South Africa**

Cost variable	Source(s)	Region used			Value		
		Ethiopia	Kenya	South Africa	Ethiopia	Kenya	South Africa
Construction cost index	Arcadis (2021) <sup>159</sup>	All of Africa average, including: Johannesburg and Nairobi	Nairobi	Johannesburg	41%	40%	42%
Average energy price (US\$/MWh)	IEA (2020) <sup>160</sup>	All of Africa average, including: Algeria, Benin, Botswana, Egypt, Kenya, Malawi, Morocco, Senegal, Tunisia	Kenya	South Africa	103.99	188.22	80.66
Passenger car purchase cost (US\$)	NUMBEO (n.d.) <sup>161</sup>	Ethiopia	Kenya	South Africa	44,320	14,051	21,157
Passenger bus purchase (US\$)	NAP (2010) <sup>162</sup>	South Africa	South Africa	South Africa	120,873	120,873	120,873
Passenger rail purchase (US\$)	NAP (2010) <sup>163</sup>	South Africa	South Africa	South Africa	1,208,735	1,208,735	1,208,735
Transport cost index	Littman (2021) <sup>164</sup>	All of Africa average, including: Algeria, Egypt, Morocco, Tunisia	All of Africa average, including: Algeria, Egypt, Morocco, Tunisia	South Africa	64.6%	64.6%	61.5%
Average travel time cost (US\$ per passenger km)	VTPI (2020) <sup>165</sup>	Ethiopia	Kenya	South Africa	0.003	0.01	0.02
Cost of residential deep efficiency retrofit (US\$)	GBPN (2015)	Africa	Africa	Africa	367	367	367
Cost of commercial deep efficiency retrofit (US\$)	GBPN (2015) <sup>166</sup>	Africa	Africa	Africa	883	883	883
Appliance and lighting cost index	University of Leeds (2014); COMBI (2018) <sup>167</sup>	Africa	Africa	Africa	0.68	0.68	0.68
Cost of rooftop PV (US\$/kWh)	IRENA (2017) <sup>168</sup>	South Africa	South Africa	South Africa	0.10	0.10	0.10

**Source:** Vivid Economics analysis for the Coalition for Urban Transitions.

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### 3. Limitations

A major limitation of the analysis that is particularly important for policymakers to take into account is that the economic benefits calculated do not include broader benefits beyond energy and materials cost savings, which are likely to be significant. These benefits include, for example, the value of time saved through avoided traffic congestion and more efficient transport options, including public transport and non-motorised options; health benefits from improved air quality, increased physical activity (e.g., walking and biking), improved waste infrastructure and upgraded buildings; additional productivity benefits related to more efficient buildings; increased appeal to businesses and individuals due to higher quality of life; improved access to jobs, public services and urban amenities for lower-income people who are now isolated in peri-urban areas; and the extensive benefits associated with avoided carbon emissions—that is, less severe climate change impacts in the medium and long terms.

Auxiliary infrastructure costs were not considered for electric vehicle charging or increased use of buses for public transport. In both cases, the assumption is that required infrastructure would be developed in the reference case, but this may warrant further research. An important finding is that some interventions generate significant benefits (e.g., in transport), while others (e.g., deep retrofit in buildings) typically do not within the period of the analysis. This finding reflects the design of the analysis: significant capital investments are projected to 2050, but the analysis only accounts for economic savings to 2050. Investments in deep building efficiency would pay for themselves in all countries by 2089, if not sooner, and they continue to generate a stream of energy savings throughout the buildings' life spans.

As shown in Table B3, country-level data are not available for all key cost variables across Ethiopia, Kenya and South Africa. For these variables, regional averages were used, which may not reflect local costs most accurately. However, countries selected for regional averages were selected to maximise comparability.

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