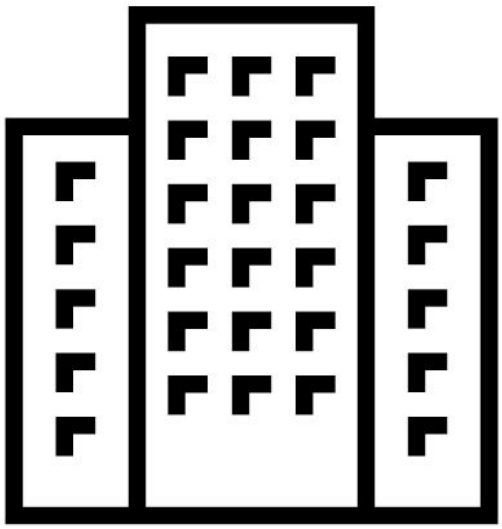

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Cities, buildings and urban systems

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Abbreviations

5R	Rethink, Refuse, Reduce, Reuse, Recycle
ACliFF	Asian Climate Finance Facility
ADB	Asian Development Bank
AE	Accredited Entity
AfD	French Development Agency
ASI	Avoid-Shift-Improve
BEIS	UK Department of Business, Energy and Industrial Strategy
BMU	German Ministry of the Environment
BMZ	German Ministry of Development Cooperation
BOT	Build Operate Transfer
BOOT	Build-Operate-Own-Transfer
BRT	Bus Rapid Transit
C40	C40 Cities Climate Leadership Group
CALPERS	Californian Public Employees Retirement System
CBO	Community-based organization
CCFLA	City Climate Finance Leadership Alliance
CDIA	Cities Development Initiative for Asia
CFF	C40 Cities Finance Facility; CFLI – Climate Finance Leadership Alliance
CHP	Combined Heat and Power
CIF	Climate Investment Funds
CN	Concept Note
CO2	Carbon Dioxide
CRP	City Resilience Program
DAC	Development Assistance Committee of the OECD
DBLVC	Developed Based Land Value Capture
DBSA	Development Bank of Southern Africa
DFI	Development Finance Institution
DfID	UK Department for International Development
EBA	Ecosystem Based Approach
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EFI	European Financial Institution
EIB	European Investment Bank
ESCO	Energy Service Company
FP	Funding Proposal
EU	European Union
FX	Foreign Exchange
GCF	Green Climate Fund
GCoM	Global Covenant of Mayors
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GIF	Global Infrastructure Facility
GIZ	German Development Cooperation Agency (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GPRBA	Global Partnership for Results-Based Approaches
HVAC	Heating Ventilation and Air Conditioning
IBRD	International Bank for Reconstruction and Development
ICT	Information and Communications Technology
IDB	Inter-American Development Bank
IDFC	International Development Finance Club

IFC	International Finance Corp
IFI	International Financial Institution (includes bilateral banks as well as MDBs)
ILN	Institutional Leadership Network
IRENA	International Renewable Energy Agency
IPCC	International Panel on Climate Change
IRM	Initial Resource Mobilization
KfW	German Development Bank (Kreditanstalt für Wiederaufbau)
LDC	Less Developed Country
LECR	Low-Emission, Climate-Resilient
LED	Light-Emitting Diode
LUCI	Leadership in Urban Climate Investment initiative
LVC	Land Value Capture
MDB	Multilateral Development Bank
NAP	National Adaptation Plan
NDA	Nationally Designated Agency
NDB	National development Bank
NDCs	Nationally Determined Contributions
NGO	Non-Government Organisation
OECD	Organization for Economic Cooperation and Development
PAYG	Pay-as-you-go
PDF	Project Development Facility
PIC	Private Institutional and Commercial finance
PIDG	Private Sector Infrastructure Group
PPA	Power Purchase Agreement
PPF	Project Preparation Facility
PPIAF	Public private Infrastructure Advisory Facility
PPP	Public-Private Partnerships
PSPs	Paradigm-shifting pathways
PV	Photo-Voltaic
SCI	Sustainable Cities Initiative
SECO	Swiss economic Cooperation Organisation
Sida	Swedish International Development Agency
SIDS	Small Island Developing States
SIF	Sustainable Infrastructure Foundation
tCO2e	tonne of Carbon Dioxide equivalent
TNAs	Technology Needs Assessments
ToD	Transit-oriented Development
UCIG	Urban Climate Investors Group
UN	United Nations;
UNEP	United Nations Environment Programme
UN-Habitat	United Nations Human Settlements Programme
UN IDO	United Nations Industrial Development Organization
USD	US Dollars
UNDP	UN Development Programme;
WB	World Bank
WBGU	German Advisory Council on Global Change

1 Executive summary

1.1 Purpose of the Cities, Building and Urban System (Urban) Sectoral Guide

This guide seeks to provide an overview of country needs and evidence-based programming experiences in the cities, building and urban system (urban) sector. It aims to support proposal development for the GCF in line with its investment criteria during its first replenishment period 2020-2023. The objective of the guide is to provide a set of 'how to' tools to National Designated Authorities and Accredited Entities to support the development of high quality and impactful funding proposals for consideration by the GCF Board.

1.2 The importance of the Urban Sector in climate mitigation and adaptation efforts

With more than two thirds of the global population expected to reside in cities[1] by the 2050 (UN, 2018), urbanisation offers both unprecedented risks and opportunities with respect to the global response to climate change. The IPCC has concluded that cities and urban infrastructure are one of four critical global systems that are key to reducing global greenhouse gas emissions (GHG) and limiting long-term global warming levels to less than 1.5°C above pre-industrial levels. (Bazaz et al., 2018). Cities represent at least 58% of direct global emissions and constitute at least 21% of the potential for direct global emissions reduction (Godfrey and Zhao 2016). Given that in 2017 it was estimated that 18% of all global emissions come from just 100 cities (Moran et al, 2018), climate action in mega-cities and in large and rapidly growing secondary cities has the potential to meaningfully reduce carbon emissions. While mega and large cities constitute an immediate potential for reduction in emissions, secondary cities are vital to breaking dependency on high-carbon development as they grow to large cities.

Cities also require the implementation of adaptation measures to enhance resilience. Eight-five per cent of cities, with hundreds of millions of the most vulnerable, have already experienced major climate effects. Globally, of all the infrastructure expected to be in place by 2050, nearly 75% will be in cities yet to be built (Coalition for the Urban Transitions, 2019).

This situation presents an unprecedented investment opportunity for governments, private financiers, and the international climate finance community (UN-Habitat, 2016). Deploying technologically feasible low emission measures in urban buildings, materials, transport, water and waste consistent with current Nationally Determined Contributions (NDCs) and keeping global warming below 2°C by 2100, could generate an economic return valued conservatively at USD 23.9 trillion in 2018 USD (New Climate Economy, 2018).

However, governments are unable to access the finance needed to invest in low-emission, climate resilient urbanisation. Less than 10% of available global climate funds disbursed has been for locally focused climate investments (Soanes et al, 2017). The urgent challenge is thus to avoid path dependencies that will firmly embed highly GHG emission reliant and fragile urban development – especially across the construction, infrastructure, household and enterprise sectors.

1.3 Paradigm-shifting pathways

Comparative research has yielded a set of four paradigm-shifting pathways (PSPs) in both mega/ large and secondary cities, which have strong potential to deliver high-impact, cost-effective climate benefits at scale, with local benefits (Kučan, 2018, GCF & UN-Habitat, 2019a & 2019b):

- ***Decarbonisation of urban energy systems –*** *Scaling up distributed renewable energy.* Given that 56% of energy is used in cities, every one quarter of the total global abatement potential comes from decarbonising the energy supply servicing those cities. Developing world cities have great potential to achieve reductions through distributed renewables. Scaling up distributed

[1] In this document the words "cities" and "urban areas" are used interchangeably and connote a contiguous urban area.

renewable energy in 60 countries with carbon intensive power systems by tripling the current installed capacity of solar PV would reduce GHG emissions by 108 Mt CO2e, an amount equivalent to the total annual emissions of Belgium in 2012.

- ***Energy efficiency in building stock*** – *Retrofits of existing buildings, and construction of new, green buildings, with more energy-conscious constructions using Ecosystems Based Approaches (EBAs) where appropriate*. Improving the energy efficiency of building stock and related infrastructure would help cities contribute to the emission reduction needed for the 1.5°C target. Potential savings in total energy are significant: 37 per cent (low-income large city), 33 per cent (low-income megacity), 21 per cent (middle income large city), 35 per cent (middle-income megacity). Adoption of low emissions building codes that include cool and green roofs as well as local, low-carbon building materials can reduce temperatures and also help to reduce energy demand as well as CO2 emissions in cities by 3.3 Gt (plus or minus 0.5 Gt) over the summer months (GCF and UNHabitat 2019a). There is a need to ensure that incentives are in place to minimize embodied energy and the use of appropriate local, low-carbon materials for urban building stocks, particularly public and residential buidlings.

- ***Compact and resilient urban development*** – *Provisions for compact urban growth, transit-oriented development to avoid or reduce transporatin demand and integrate ecosystems based approaches to urban planning.* The form and management of urban areas can have a profound impact on both energy used and on adaptation/ resilience options. In respect of energy, transport investments are particularly shaped by urban development and planning policy. In large, middle-income semi-dense cities transit-oriented development could attain 5 per cent of the required 2030 emissions reduction for the 1.5°C targets assuming a 6 per cent increase in average density. Adaption/ resilience considerations and investments relating to all sectors need to be integrated into planning for urban areas. Particular attention should be paid to the use of EBA and on ecosystems serving urban areas, which provide important benefits by transforming resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services, such as clean air, water, and food.

- ***Circular urban economy –*** *shifting away from our current take-make-waste urban economies.* In so called 'linear systems', cities consume over 75% of natural resources, produce over 50% of global waste, and are responsible, directly and indirectly for emitting between 60-80% of greenhouse gases. A circular urban economy aims to keep resources in use for as long as possible, to extract maximum economic value from them while in use, to keep materials out of landfills and incinerators, and to minimise waste by recovering and regenerating products and materials at the end of their service life[2].

In the context of the COVID-19 pandemic, these PSPs focus on priority investments that will contribute effectively to a climate-resilient recovery, yielding green cities, green jobs and a green transformation.

1.4 Barriers to achieving these paradigm-shifting pathways in the Urban Sector

There are a range of barriers across city types that limit implementation of these paradigm-shifting pathways. While their significance varies between cities depending on size and the depth of local capital markets, these barriers generally include the following:

- Lack of enabling policy frameworks, integrated policy and planning systems, and institutional and technical capacities at all levels of government.
- Limited support for fostering new business models, institutions, technologies and financing structures.
- Lack of upfront financing and structures to cover pre-feasibility studies and project design in order to create a pipeline of bankable LECR urban projects.
- Higher upfront costs and longer payback periods of LECR urban investments, increasing their

[2] https://www.city2city.network/thematic-area/Urban-circular-economy

perceived risk/reward profile.

- Limited access to long-term finance at affordable rates and with appropriate repayment schedules due to shallow domestic capital markets and financing systems.
- Lack of common standards, taxonomies and project assessment methodologies for LECR infrastructure investments to channel PIC resources into viable urban climate investments.
- Limited information on best practice and performance data associated with LECR urban infrastructure, which creates barriers to replicating successful practices.

1.5 Role of the Green Climate Fund (GCF) in financing the paradigm-shifting pathways

As the world's largest climate fund mandated to promote a paradigm shift towards low-emission and climate-resilient pathways in developing countries, the GCF is well placed to support developing countries raise and realise their climate ambition in the urban sector. The Cities Climate Finance Leadership Alliance (CCFLA) states that urban infrastructure investment needs have been estimated at USD 4.5 – 5.4 trillion per annum from 2015-2030 and estimates (CPI 2021) that aggregate climate finance flows for cities reached an estimated USD 384 billion in 2017/2018, far short of urban climate finance needs and with flows heavily concentrated in OECD countries and China. Through its country-driven approach, the GCF helps countries design, finance and implement innovative climate initiatives that can be replicated, scaled up and sustained after project completion to achieve transformational change. Through its country-driven approach, the GCF helps countries strengthen capacities and enabling environments relating to policy, planning and implementing institutions relevant to maximizing delivery of climate investment. The GCF offers a range of financing instruments (including grants, loans, guarantees, and equity) and works with diverse groups of partners in order to share risk and catalyse larger financial flows towards transformative climate investments. More details on the GCF's programming can be found in its Programming Manual.

Based on its mandate and comparative advantages, the GCF offers a four-pronged approach for both mega/ large and secondary cities to drive implementation of the PSPs at scale (Figure 1). While business models, project development systems, financing structures and ability to attract PIC finance differ significantly between mega/large and secondary cities, these approaches can support developing countries' efforts towards sustainable urbanisation. The four drivers are:

- ***Transformational planning & programming:*** Demand-side measures focused on strengthening the capacity of urban institutions to foster policy integration and enabling policy frameworks, as well as to plan, programme and build a pipeline of climate investments and improve skills in green procurement.

- ***Catalysing innovation in the urban sector:*** Invest in policy, institutional, business model, financial and technological innovations in each of the PSPs, with the potential to break existing trends and dramatically scale-up climate and resilience impact.

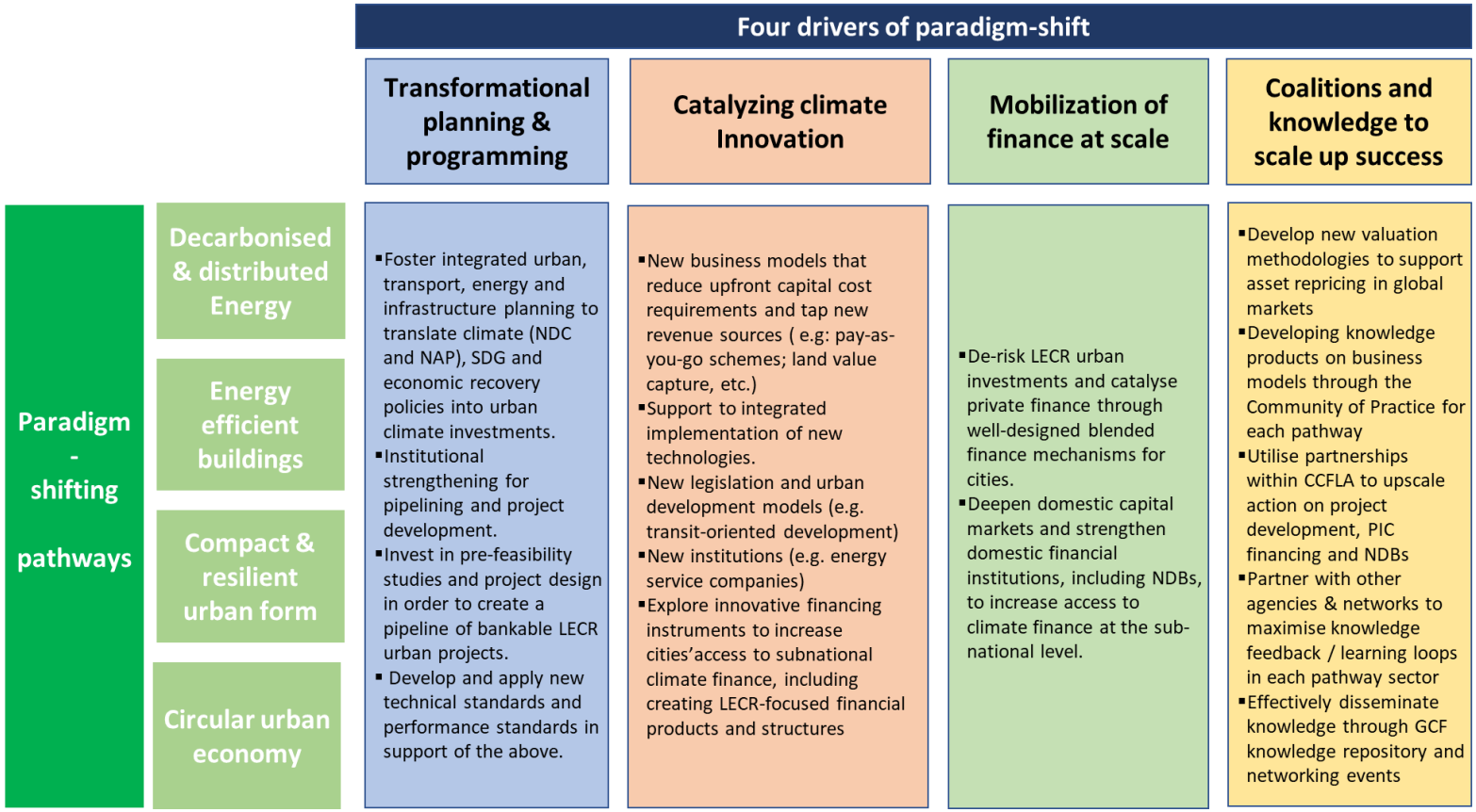
- ***Mobilising finance at scale:*** Leverage GCF financing instruments to catalyse Private, Institutional and Commercial (PIC) financing for PSPs. This includes de-risking a pipeline of low emission climate resilient urban investments through blended finance and improving cities' access to international and domestic capital markets.

- ***Coalitions and knowledge exchange to scale up success***: Generate and disseminate knowledge across the GCF urban sector project portfolio, leverage partnerships with urban networks and coalitions to share lessons learned and replicate good practices in order to reach scale.

Proposals to the GCF are assessed based on six GCF Board approved investment criteria.[3] This guide provides some examples of how these criteria could pertain to the urban sector paradigm-shifting pathways.

[3] https://www.greenclimate.fund/projects/criteria

Figure 1: Drivers of change across paradigm-shifting urban action pathways



Notes: CCFLA=Cities Climate Finance Leadership Alliance, LECR=Low Emissions and Climate Resilient, NAP=National Adaptation Plan, NDB=National Development Bank, NDC=Nationally Determined Contribution, PIC=Private, Institutional and Commercial, SDG=Sustainable Development Goal,

2 Introduction

2.1 Urban Sector context

With more than two thirds of the global population expected to reside in cities by the 2050 (UN, 2018), urbanisation offers both opportunities and risks to the global response to climate change. The IPCC have concluded that cities and urban infrastructure are one of four critical global systems that are key to reducing global greenhouse gas emissions (GHG) and limiting long-term global warming levels to less than 1.5°C above pre-industrial levels. (Bazaz et al., 2018). Urban areas, which contribute to about 80% of global GDP, represent at least 58% of direct global emissions and constitute at least 21% of the potential for direct global emissions reduction (Godfrey and Zhao 2016). Given that in 2017 it was estimated that 18% of all global emissions come from just 100 cities (Moran et al, 2018), climate action in mega-cities and in large and rapidly growing secondary cities has the potential to meaningfully reduce carbon pollution. Hence, while mega and large cities constitute and immediate potential for reduction in emissions, secondary cities are vital to breaking dependency on high-carbon development as they grow to large cities.[4]

The building and construction sector is particular relevant for decarbonizing urban areas as it accounts for 35% of final energy use and 38% of energy and process-related carbon dioxide (CO2) emissions, globally (GlobalABC, 2020). According to the Global Status Report for Buildings and Construction 2020, CO2 emissions from the sector reached a record high in 2019, while at the same time annual decarbonization progress was slowing down. This trend is also reflected in investment figures: for every $1 spent on energy efficiency, $37 is spent onconventional construction approaches. Thus, much more effort is needed to shift investments towards decarbonizing buildings. And this shift is urgent: To be on track to achieving a net-zero carbon building stock by 2050, the IEA estimates that direct building CO2 emissions would need to decrease by 50% and indirect building sector emissions decline through a reduction of 60% in power generation emissions by 2030.

Cities also require the implementation of adaptation measures to enhance resilience. Eight-five per cent of cities, containing hundreds of millions of the most vulnerable - often living in informal areas highly exposed to climate impacts – have already experienced major climate effects, including extreme temperatures and sea level rise, especially in the absence of resilient infrastructure and planning. In 2015, over 710 million people lived in coastal urban centers and quasi-urban clusters less than 10 meters above sea level. Storm surges and sea level rise are now overwhelming urban threats. In the absence of comprehensive measures to advance low-emission resilient urban systems, in the business as usual scenario (BAU), these trends are expected to escalate. Globally, of all the infrastructure expected to be in place by 2050, nearly 75% will be in cities yet to be built (Coalition for the Urban Transitions, 2019). More than half of the urban area to be built by then has yet to be planned and developed, mainly in Africa and Asia.

Climate investments in urban areas can also have significant co-benefits. Economic benefits from urban mitigation and adaptation climate projects can be quantified in terms of jobs created, reduced healthcare costs, efficiency gains in transport of people and goods, and costs avoided relating to flooding, among others. Social co-benefits are also usually large and include improved access to education, cultural preservation, and improved health and safety. Environmental co-benefits include improved air quality, water and soil quality, and biodiversity. Climate efforts in the urban space can also address market failures such as urban sprawl, congestion, and negative externalities of environmental pollution, air

[4] Typically, mega-cities have a population of over 10 million people, but large scale cities share many of their characteristics and the C40 Cities network – addressing climate issues in major cities – effectively includes cities of over about 3 million inhabitants in the total urban area (the actual administrative area of the city may be much smaller). Secondary cities have typically over 250,000 people but at one end of the spectrum, cities of 3 million are secondary (or even tertiary) cities in China, and at the other end of the spectrum in the Pacific, such a city would be bigger than the capital and indeed the entire urban population. The critical distinction for the GCF is made the large, existing cities, and the smaller cities which a) may grow into large cities or b) have major adaptation issues.

quality and emissions.

Urban areas are therefore central to the achievement of almost all of the Sustainable Development Goals (SDGs). Climate-related investments in cities have particular relevance for 11 of the SDGs, including: Goal 6. Ensure availability and sustainable management of water and sanitation for all; Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all; Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation; Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable; Goal 12. Ensure sustainable consumption and production patterns; and, of course, Goal 13. Take urgent action to combat climate change and its impacts.

This situation presents an unprecedented investment opportunity for governments, private financiers, and the international climate finance community (UN-Habitat, 2016). Deploying technologically feasible low emission measures in urban buildings, materials, transport, water and waste consistent with current Nationally Determined Contributions (NDCs) and maintaining global warming below 2°C through 2100, could generate an economic return valued conservatively at 2018 USD 23.9 trillion in (New Climate Economy, 2018).

However, governments – and especially local governments – are often unable to access the finance needed to invest in low-emission, climate resilient urbanisation. Less than 10% of available global climate fund architecture disbursed were prioritised for locally focused climate investments (Soanes et al, 2017).

The urgent challenge is thus to avoid business as usual path dependencies, including in construction and infrastructure, that will lock in substantial GHG emissions and climate vulnerability in urban planning and development. In other words, conventional urbanisation with its implications for levels of transport-related emissions and energy demand must shift across all regions towards pathways that promote sustainable cities, buildings and urban systems.

2.2 Purpose of the GCF Cities, Buildings and Urban System Sectoral Guide

The Green Climate Fund (GCF) is the world's largest dedicated fund and its mandate is to promote a paradigm shift towards low-emission and climate-resilient pathways in developing countries. It was set up by the United Nations Framework Convention on Climate Change (UNFCCC) in 2010 and has a crucial role in upholding the Paris Agreement, supporting the goal of keeping the increase in average global temperature to well below 2° C above pre-industrial levels.

Through its country-driven approach, the GCF helps countries build enabling frameworks to formulate more effective policies and build capacities to design, finance and implement innovative climate initiatives that can be replicated, scaled up and sustained after project completion to achieve transformational change. The GCF offers a range of financing instruments (including grants, loans, guarantees, and equity) and works with diverse groups of partners in order to share risk and catalyse larger financial flows towards transformative climate investments. More details on the GCF's programming can be found in its Programming Manual.

GCF seeks to have an impact within eight mitigation and adaptation results areas as shown in Table 1

Table 1: GCF eight mitigation and adaptation results areas

Mitigation results areas	Adaptation results areas
Low-emission energy access and power generation	Enhanced livelihoods of the most vulnerable people, communities and regions
Zero and low-emission transport	Increased health and well-being, and food and water security
Buildings, cities, industries and appliances	Resilient infrastructure and built environment to climate change threats
Sustainable land use and forest management	Resilient ecosystems

These result areas guide GCF and its stakeholders to take a strategic approach when developing programmes and projects, while ensuring that all programmes and projects are country driven, meeting the needs and priorities of individual developing countries.

This guide seeks to provide an accurate, concise and targeted approach to addressing climate issues in urban areas in the context of an overview of country needs and evidence-based programming experiences in the cities, building and urban system (urban) sector. It aims to guide proposal development for the GCF in line with its investment criteria during its first replenishment period 2020-2023. GCF's investment in the urban sector at the end of 2019 totaled USD 1.96 billion, contributing to an investment volume of USD 8.54 billion.[5] This investment is spread across all regions and is focused, to date, in the Energy Efficiency, Renewable Energy and Urban Adaptation fields (see Section 3 for detail).

At the same time, GCF is preparing sectoral guides across other results areas and recognises the importance of a complementary approach. Table 2 highlights the relationship of topics covered by this urban sectoral guide, with topics covered in the other sectoral guides. For example, the Urban sectoral guide focuses on the potential of renewable distributed energy, while the Energy Generation and Access sectoral guide covers low-carbon on-grid energy for cities. Similarly, the Urban sectoral guide focuses on synergies between transport systems, while the Transport sectoral guide will cover green transport modalities.

Table 2: Relationship between topics covered by the Urban Sectoral Guide vis a vis other GCF sectoral guides

	Some cross-sectoral topics in Cities, Buildings and Urban Systems Contribution by Urban sectoral guideline/ Covered by other sectoral guides
Cities, Buildings and Urban Systems Sectoral Guide:	Identify opportunities to reduce emissions and vulnerability in developing country cities by advancing 4 paradigm-shifting pathways (PSPs) in the urban sector through climate investments across both mega/ large and secondary cities
Forest and Land Use	Forest protection at the urban boundary and city greening for resilience – especially for water and heat island impact (PSP 3)/ energy efficiency of cities bolstered by sustainable construction materials and biofuel for renewable energy
Agriculture and Food Security	Pollution control & reduction of pressure on agriculture (urban agriculture in green spaces – PSP 3 & 4)/ resilience of cities bolstered by sustainable food supply and energy efficiency supported by shorter supply chains
Ecosystem Services	Using urban governance systems to link ecosystem services to urban management and funding systems (PSP 3)/ resilience of cities fostered by access to green and blue infrastructure and by supply of water and other essential inputs
Energy	Supplementing generation with support to distributed generation and urban micro-grids (PSP 1)/ low carbon energy for cities by grid renewable energy
Energy Efficiency	Using urban governance systems to implement new and retrofit building energy efficiency (PSP 2)/ energy efficiency of cities bolstered by industry/ producer regulation and incentives
Transport	Fostering integration and thus synergies between transport and energy efficient development (PSP 3)/ low carbon transition for cities supported by greening transport modalities (low carbon vehicles, NMT etc)
Infrastructure	Using urban governance systems to link resilience investments (sponge cities etc) to urban management and funding systems (PSP 3)/ low carbon cities supported by national and regional energy efficient infrastructure and incentive systems
Water	Minimising pollution & pressure on water resources through water recycling, capture, & waste water treatment investments (PSP 3 & 4)/ resilience of cities supported by sustainable water resource management at regional and national levels
Health	City greening reduces heat island effects reducing pressure on health systems and provides recreational spaces, again providing an accessible healthy environment and increased resilience reduces casualties during an incident (PSP 3)/ health infrastructure strongly supports resilience of cities

[5] These figures will be updated to the end of 2020.

2.3 Organisation of the document

The sectoral guide has five sections. Section 1 provides an overview of the sector within the global context of climate action. Section 2 highlights key paradigm pathways in the urban sector, as well as the GCF drivers to realise these pathways. Section 3 describes financing trends and models to scale up and catalyse public and private investment, including GCF financing structures. Section 4 provides examples of country experiences. Section 5 provides guidance for developing proposals aligned with the GCF investment criteria and programming framework.

3 Global Context

3.1 The scientific basis: why is the urban sector relevant to climate action

This section sets out the science underlying the need and potential for climate actions that span mitigation and adaptation in the urban sector.

Mitigation potential: Cities are central to global efforts to curb emissions, particularly as the world experiences rapid urbanisation. Urban areas in 2021 accommodate over half of the global population and generate approximately 82% of global GDP. Over the next 15 years, the urban population will increase by over 1 billion, reaching 60% of the total global population. A New Climate Economy study (Godfrey and Zhao 2016) predicts that the share of global economic output attributable to cities will reach 88% well before 2030 and the 750 largest cities are likely to account for up to 60% of global GDP growth between 2012 and 2030. The implication is that cities are at the center of economic activity, determining how economies grow and how resources are allocated. The same study estimates that city economies and urban infrastructure are directly and indirectly responsible for around 70% of global energy consumption and over 70% of GHG emissions are associated with urban areas.

The expected future growth in population, economic output, energy consumption and GHG emissions will be predominantly in emerging and developing countries, led by urban areas in China, India, south east Asia and sub-Saharan Africa (Oliver & Peters 2019). Asia and Africa now account for 90% of the world's rural population, but by 2050 around 6 in 10 people in Asia (64%) and Africa (56%) will live in cities. Most advanced economies and some emerging countries in Latin America are already highly urbanised, hence their contributions to urban growth are expected to be relatively modest (UN 2018).

While disaggregated data on emissions performance at the specific urban level are difficult to establish, the United Nations Environment Programme (UNEP 2019) *Emissions Gap Report* highlights that the gap between where emissions need to be to keep warming below the 2°C goal and actual performance is wide. In 2030, annual emissions need to be 15 GtCO2e lower than current unconditional Nationally Determined Contributions (NDCs) or national climate action strategies and plans imply for the 2°C goal, and 32 GtCO2e lower for the 1.5°C goal. Countries must increase their NDC ambitions threefold to achieve the well below 2°C goal and more than fivefold to achieve the 1.5°C goal. The report focuses on the need to invest in renewable energy electricity expansion and coal phase out; decarbonising transport and industry; and avoiding future emissions (energy efficiency) while increasing energy access (climate justice). Cities play a major, if not predominant, role in making all of these investments happen.

The only existing detailed urban-focused study on establishing actual goals for urban emissions reduction is the C40 and Arup (2016) study covering C40 cities, representing 650 million people and 25% of the world's GDP. To deliver individual emission trajectories consistent with limiting the increase in global temperature to 1.5°C, the study estimates that average per capita emissions across C40 cities would need to drop from its current level of over 5 tCO2e per capita to around 2.9 tCO2e per capita by 2030. According to their estimates, doing so would keep cities on a trajectory consistent with either 1.5 or 2°C of warming, as it is only after 2030 that these trajectories diverge.

Adaptation needs: In relation to adaptation, the latest studies assessed by the Intergovernmental Panel on Climate Change (IPCC) in their Special Report on Global Warming of 1.5°C conclusively demonstrate that cities and urban infrastructure currently face an array of complex risks such as sea level rise, heat stress, flooding, and other effects of climate change (Bazaz et al., 2018). In fact, 85 per cent of the 620 cities reporting on the CDP disclosure platform in 2018 reported already having experienced major climate effects (CDP, 2019).

Coastal populations face increasing risk of the combined effects of sea level rise and coastal flooding. The number of people within the 100-year flood plain exposed to flooding for a 10–21 cm rise in global

sea level could increase from around 286 million to 411 million between 2030 and 2060 (Neumann et al., 2015). Of these, 75% live in South and Southeast Asia, with a substantial growth expected in Africa (e.g. in the Nile and Niger Deltas). Economic losses and adaptation costs will also rise. One study estimates that average yearly flood losses for the 136 largest coastal cities may increase from USD 6 billion in 2005 to USD 52 billion by 2050, due to socioeconomic changes alone (Hallegatte et al., 2013). Adding a 20–40 cm sea level rise plus subsidence would increase these costs to USD 60–63 billion by 2050 – even if there was investment to address present flood risks. Another study finds that 0.2–4.6% of the world's population could face annual floods given a sea level rise of 25–123 cm by 2100 (Hinkel et al., 2014). Costs of coastal protection (e.g. dikes) could range between USD 12 to 71 billion by the year 2100 but would be much lower than costs of no protection (Dawson et al., 2018).

The impact of warming above 1.5°C will magnify the risks faced by countries and cities that are only beginning to develop the adaptive capacity to manage. For instance, water vapor is a key driver of heat stress, making vulnerable populations in coastal cities located in regions with high temperatures and humidity even more susceptible to urban heat morbidity and mortality (Li & Bou-Zeid, 2013). More frequent heat stress events combined with coastal flooding and saltwater intrusion threaten slow onset crises in urban water supply. This will be of particularly high impact in Small Island Developing States (SIDS), where over 50 per cent of all urban settlement land area intersects the low elevation coastal zones (McGranahan et al., 2007).).

Equally, adaptation measures must be tailored to the scale, form and context of the city. Larger cities will often have more critical heat island[6] and water resource problems while smaller cities may be much more heavily impacted by drought and flood effects both on the urban area and on their surrounding hinterland, leading to different investment strategies. Larger cities, as we have seen, are also often more prone to rapid spread of disease, thus investment in health systems need to be a priority, particularly for vulnerable groups.

3.2 Country ambition and needs

While there is room for increased ambition in the urban sector, countries existing NDCs offer clear signals as to their demand for climate support in urban areas. Of NDCs submitted by developing countries, 101 contain urban content. Of those, 25 exhibit 'strong' urban content while 76 have 'moderate' urban content. Costs for implementing those urban priorities in all countries that include urban content in their NDCs cannot be accurately estimated since NDCs with cost elements vary in the level of detail and some do not include any cost estimates at all.[7] For present purposes, background research (GCF & UN-Habitat 2019c) identified NDCs from developing countries that have strong or moderate urban content that also contain detailed cost breakdowns and analysed their financing plans.[8] In NDCs with 'strong' urban content, on average, a third (33 per cent) of estimated costs for implementing those climate plans were associated with urban priorities. In NDCs with 'moderate' urban content the urban priorities represented only 10 per cent of costs.[9] (Figure 2) The case for a strong and coordinated intervention in cities is further made by an analysis of the Technology Needs Assessments (TNAs) undertaken by 85 countries since 2001.[10] Two out of three priority areas for investment in both mitigation and adaptation assessments

[6] Cities often have higher temperature levels than surrounding areas – they are islands of higher heat – because heat is better absorbed, and retained, by commonly used construction materials such as concrete that are exposed to direct sunlight.

[7] For instance, relatively few countries link NDCs to national urban policy frameworks and long-term capital investment plans containing infrastructure project pipelines listing potential low-emission, climate-resilient investments in specific cities.

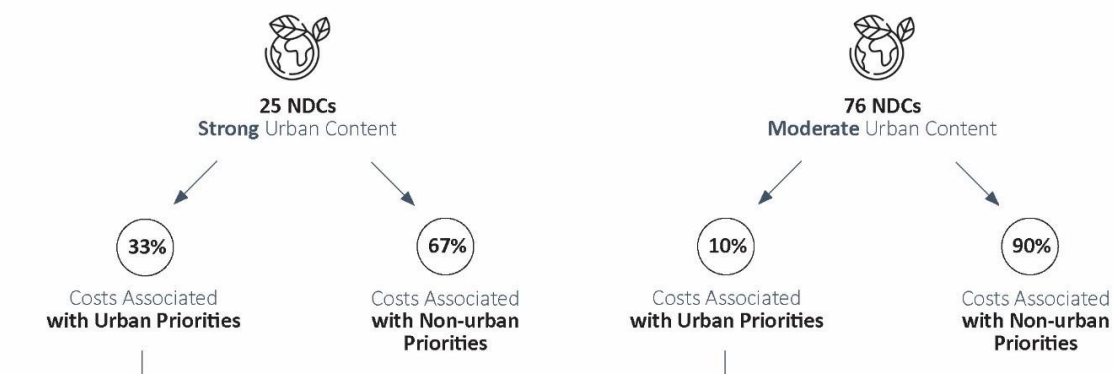
[8] That is, NDCs with cost estimates broken down to a programmatic level.

[9] NDCs with strong urban content analysed: Bangladesh, Lao PDR, Togo, Ghana and Burkina Faso. NDCs with moderate urban content analysed: Afghanistan, Lesotho and Kenya. (In Kenya's case the detailed cost breakdown came from their post-Paris National Climate Change Action Plan, developed to implement their NDC.) Further details on this and the following calculation are available upon request.

[10] See UNFCCC Technology Needs Assessment Summary. https://unfccc.int/ttclear/tna#:~:text=To%20determine%20their%20climate%20technology,implementation%20of%20prioritized%20climate%20technologies

need to be addressed through investments in urban areas. Of the mitigation TNAs, 55% cited energy as a priority area and 13% cited waste – both areas dominated by urban consumption. Of the adaptation TNAs, 34% cited water as a priority area and 14% cited infrastructure and settlements – again urban activity is central to addressing these issues.

Figure 2: Estimating external assistance to implement urban sector priority actions



Source: GCF & UN Habitat. (2020)

3.3 Mitigation and adaptation opportunities for high impact interventions

Mitigation opportunities: Research by Arup and the C40 has defined city-specific action pathways necessary to meet the target Paris Agreement commitments, laying out clearly the pace, scale and prioritisation of action needed between now and the end of the century. The report (C40 and Arup 2016) estimates that action by C40 cities can be replicated with substantial impact: If all cities with a population greater than 100,000 adopted the ambition for C40 cities set out in the report, they could save 863 GtCO2e globally by 2050. By 2100, they could have saved up to the equivalent of 40% of the reductions necessary for a 1.5°C scenario. Potential emission reductions can have large economic returns in the medium to long term. With 58% of these emission savings come from the buildings sector, 21% from the transport sector, 16% from materials efficiency and 5% from a more efficient waste sector, it is estimated that mitigation measures would have a net present value of USD 23.9 trillion, greater than the biggest economy in the world, the USA. (Coalition for the Urban Transitions, 2019).

Adaptation opportunities: Demand for support for urban adaptation and resilience interventions can be derived by comparing levels of vulnerability and exposure adjusted for levels of country readiness and rates of urban population growth (GCF & UN-Habitat, 2019b). Countries that have high vulnerability-low readiness could be expected to have the highest levels of demand for urban adaptation and resilience projects. Countries with high vulnerability and high readiness can also be expected to have relatively higher levels of demand and may have a higher yield in terms of benefits per input. Incorporating rates of urbanisation with this country-level data adds some additional perspective on potential demand for urban adaptation and resilience projects. Comparing the urbanisation rates for the 30 countries with the largest gap between vulnerability (high) and readiness (low), almost all are located in Africa, with a few in Asia and one in the Caribbean region (Notre Dame 2020).[11]

Generally, high rates of urbanisation combined with high vulnerability/exposure and low readiness imply countries lack the financial and planning capacity to adapt to climate change. Yet, they will be forced to adjust as population growth places increased strain on infrastructure and services in cities. These risks are particularly acute in country contexts where rural displacement to relatively larger secondary cities fuels uncontrolled land use expansion and development, and these cities will need higher relative levels of technical and financial support.

[11] The ND-GAIN dataset is available at https://gain.nd.edu. Many of the individual vulnerability indicators used to compile indices are relevant issues of concern for adaptation results at the GCF such as urban livelihoods and are based on indicators like infrastructure and slum population.

3.4 Financial requirements

Financing requirements related to climate change are often calculated as an increment to estimates of total infrastructure investment. The OECD estimates global infrastructure investment needs of USD 6.9 trillion per annum from 2016 to 2030 to remain below 2°C, roughly two-thirds of which are for developing countries at about USD 4 trillion per year. The associated annual incremental up-front cost of future infrastructure investments consistent with the below 2°C scenario was estimated to be around 10% (OECD 2017).

Other estimates are higher. Rydge et al. (2015) estimate about USD 90 trillion in infrastructure investment, mostly in urban areas and mostly in the sectors identified above, is needed by 2030 to achieve global growth expectations, particularly in developing countries. To achieve this, infrastructure investment needs to be both scaled up, and, due to climate risk, needs to be designed so as to integrate climate objectives. Shifting to low-emission infrastructure could add as little as 5% to upfront investment costs in 2015-2030. These costs could be offset by resulting energy and fuel savings. Critical to this change is radical change in the way such investments are formulated and financed, developing countries will need to integrate climate issues into systems of planning, design project structuring and financing.

Despite the advantages, less than 10% of available global climate finance architecture disbursements were prioritised for locally focused climate investments and most climate finance is for mitigation (Soanes et al, 2017). A vast majority of cities in developing countries struggle to have a regular and uninterrupted access to development and climate finance, prioritise green and resilience projects and optimally understand the targeted intervention sequence towards achieving the most potent and resilient climate impact for their communities and societies at large.

There is a huge gap between what is needed and what current levels of investment can achieve. More focus is needed on adaptation investment particularly in Less Developed Countries (LDCs) and SIDS. Leverage of PIC resources – the only potential source with the level of resources required – is thus urgently needed. Business models such as those set out in Section 5 will be necessary under the urban operational pathways to leverage the necessary finance.

4 The Paradigm-Shifting Pathways in the Urban Sector

4.1 Four paradigm-shifting pathways in the urban sector

Comparative research has yielded a set of paradigm-shifting pathways (PSPs) in urban areas with high potential to yield positive climate impact (Kučan, 2018, GCF & UN-Habitat, 2019a & 2019b). These are areas where mature technologies exist that have proven to deliver high-impact, cost-effective climate benefits at scale, with local benefits:

- ***Decarbonisation of urban energy systems –*** *Scaling up distributed renewable energy.* Given that 56% of energy is used in cities, every one quarter of the total global abatement potential comes from decarbonising the energy supply servicing those cities. Developing world cities have great potential to achieve reductions through distributed renewables. Scaling up distributed renewable energy in 60 countries with carbon intensive power systems by tripling the current installed capacity of solar PV would reduce GHG emissions by 108 Mt CO2e, an amount equivalent to the total annual emissions of Belgium in 2012 (GCF & UN Habitat 2019a).

- ***Energy efficiency in building stock*** *– Retrofits of existing buildings and city precincts, and construction of new, green buildings[12] and districts utilizing EBAs, with more energy-conscious construction (mimimising embodied energy and maximizing recyclability)*. Improving the energy efficiency of building stock and its associated infrastructure such as district heating and cooling systems would help cities contribute to the emissions reductions needed for the 1.5°C target. Potential savings in total energy are significant: 37 per cent (low-income large city), 33 per cent (low-income megacity), 21 per cent (middle income large city), 35 per cent (middle-income megacity). Cool and green roofs reduce temperatures and also help to reduce energy demand and CO2 emissions in cities by 3.3 ± 0.5 Gt for the summer months (GCF & UN Habitat 2019a). Adoption of low emissions building codes as well as use of local, low-carbon building materials, especially in public and residentials buildings present a high opportunity in the short-term for reducing emissions from urban building stock.

- ***Compact and resilient urban development*** *– Integrated planning and investment with provision for compact urban growth to avoid or reduce transporatin demand and integrate ecosystems based approaches to urban planning*. The form and management of urban areas can have a profound impact on both energy used and on adaptation/ resilience options. In respect of energy, transport investments are particularly shaped by urban development and planning policy. The effectiveness of reducing GHG impact from the transport sector, especially in relation to reducing forced mobility, creating more effective inter-modal operations, and strengthening the resilience of the population is dependent on paradigm shift in urban planning that is centered on compact and mobility centric city design[13]. In large, middle-income semi-dense cities, transit-oriented development (TOD)[14] could attain 5 per cent of the required 2030 emissions reduction for the 1.5°C targets assuming a 6 per cent increase in average density (GCF & UN Habitat 2019a). Adaption/ resilience considerations and investments relating to all sectors need to be integrated into planning for urban areas. Particular attention should be paid to use of EBA and to ecosystems serving urban areas, which provide important benefits by transforming resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services, such as clean air, water, and food.

  There is a strong linkage across urban development and housing policy, building codes and transport systems and modes and integration of these measures can be piloted in at scale using

[12] The term "buildings" is taken to include all types and uses of built form including housing.

[13] A holistic framework of "*Avoid-Shift-Improve*" forms the basis for sustainable and low emissions urban transport. This guide addresses aspects of "*Avoid*" through compact cities' design pathway. The Transport Sector Guide focusea on the latter two aspects of "*Shift"* and "*Improve".*

[14] Climate-focused TOD is the development of denser, energy efficient buildings and housing along a transit corridor with a low carbon transport mode as its backbone.

"zero emission areas" approaches. Building codes can make urban areas effective carbon-sinks and passive design standards and use of recyclable and renewable materials can enhance energy-efficiency. The use of synthetic materials for insulation should be disincentivized and phased out as soon as possible. Specific codes have an important impact on urban form and energy usage – for example, parking requirements (the number of parking lots per building) need to be reduced to discourage private car ownership and use and to encourage people to use public transport and active modes (walking and cycling).

- ***Circular urban economy –*** *shifting away from our current take-make-waste urban economies.* In so called 'linear systems', cities consume over 75% of natural resources, produce over 50% of global waste, and are responsible, directly and indirectly for emitting between 60-80% of greenhouse gases (GCF & UN Habitat 2019a). A circular urban economy aims to keep resources in use for as long as possible, to extract maximum economic value from them while in use, to keep materials out of landfills and incinerators, and to minimise waste by recovering and regenerating products and materials at the end of their service life[15].

The impact potential and relevance of the four PSPs outlined in this sector guideline has been established through work by C40 and McKinsey[16] in a range of city types. A diversity of city circumstances means that a diversity of approaches to the PSPs will be needed. Impacts, expressed in terms of the degree (%) to which ambitious action in those sectors would help cities make their fair contribution towards holding global warming to "safe" levels (i.e. below 1.5°C over pre-industrial levels) were assessed. In particular, the first three PSPs, related to urban energy, buildings, and transport, offer tremendous mitigation potential. This conclusion further supports the recommendations of the IPCC's 5th Assessment Report of 2007 (IPCC, 2014). Other PSPs also offer opportunities to significantly cut emissions or build urban resilience at scale, targeting vulnerable people and assets, with quantifiable climate benefits per GCF criteria. Their impact potential is outlined in Table 3 below.

Table 3: Impact potential of selected interventions in paradigm-shifting pathways

Pathway	Impact Potentials
Decarbonisation of Urban the Energy Systems	• Decarbonising the energy supply, including electricity and other sources of energy used for heating etc., would help cities contribute to the emissions reductions needed for limiting the temperature increase to 1.5°C above pre-industrial levels: Potential savings in total energy are significant: 43% (low-income large city), 43% (low-income megacity), 34% (middle income large city), 36% (middle-income megacity). • Developing world cities, especially those in lower income countries, have a high potential to achieve reductions through distributed renewables in addition to centralised decarbonised systems. • Scaling up distributed renewable energy in 60 countries with carbon intensive power systems, by tripling the current installed capacity of solar PV would reduce GHG emissions by 108 Mt CO2e, an amount equivalent to the total annual emissions of Belgium in 2012. • Improved distribution and storage of energy confers resilience benefits.
Improving Energy Efficiency of Building Stock and related	• Improving the energy efficiency of building stock and related infrastructure, reduction in embodied energy and use of the stock as a carbon sink would help cities contribute to the emissions reductions needed for the 1.5°C target. Potential savings in total energy are significant: 37% (low-income large city), 33% (low-income megacity), 21% (middle income large city), 35% (middle-income megacity).

[15] https://www.city2city.network/thematic-area/Urban-circular-economy

[16] C40 Cities (C40) & McKinsey Center for Business and Environment. (2017). Focused Acceleration: A strategic approach for climate action in cities. New York: McKinsey Center for Business and C40 Cities (C40).

Urban Infrastructure[17]	• Both the electricifation of building systems coupled with the use of renewable energy for electricity generation and the use of energy saving designs for buildings and internal equipment, and for assocaiated infrastructure such as steet lighting, are essential. Envelope retrofit strategies such as solar shading, window glazing, air tightness then insulation can reduce energy consumption of an average of 33%. • Cool and green roofs can reduce temperatures and also help to reduce energy demand and CO2 emissions in cities. Recent studies suggest that at the global scale, average urban heat island can be reduced from 1.2 to 0.8°C when roof albedo was increased to 0.9. A regional US model found that cool roofs can reduce CO2 emissions by 3.3 ± 0.5 Gt for the summer months.
Compact and Resilient Urban Development	• The form and management of urban areas can have a profound impact on both the effectiveness of the transport system in reducing its GHG impact, especially in relation to reducing forced mobility and more effective inter-modal operation, and on the resilience of the population. • In large, middle-income semi-dense cities, transit-oriented development could attain 5% of 2030 emissions targets assuming a 6% increase in average density. • A middle-income megacity could attain 6% of 2030 emissions targets through transit-oriented development, assuming a 10% increase in average density. A large, low-income city could attain 13% of 2030 emissions targets through transit-oriented development assuming an 8% increase in average density. • Urban form modifications driven by the comprehensive application of economic instruments such as higher gasoline prices can reduce energy use in cities (not just those in the developing world) by 26% by 2050. • The cumulative impact of climate change is huge if not mitigated through adaptive investment. For example, in China, the total loss due to drought projected in 2030 is expected to range from USD 1.1 to 1.7 billion for regions in northeast China and about USD 0.9 billion for regions in north China, with adaptation measures having the potential to avert half of the losses. Such adaptive investment will require different spatial allocation in cities. • Health impacts of high temperatures will be significant. Excessive heat events, or abrupt and dramatic temperature increases, are particularly dangerous and can result in above-average rates of mortality. From 2004 to 2018 the Centers for Disease Control and Prevention recorded 10,527 heat-related deaths in the United States, an average of 702 per year. These impacts are worstening with increasing temperatures. City greening, trees and natural vegetation can also help to reduce energy use and potentially subsequent CO2 emissions. • Ecosystem services within the hinterland of urban areas provide important benefits to these areas through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services, such as clean air, water, and food. The ongoing provision of these goods depends on a healthy functioning ecosystem and implies a balance between density and preserving such services. • Adopting low-emission mobility and transport solutions would help cities contribute to the emissions reductions needed for the 1.5°C target: 45% (low-income large city), 45% (low-income megacity), 38% (middle income large city), 21% (middle-income megacity). The success of such solutions is, in turn, based on the success of development policies that foster compact urban areas. Urban design and land use planning can reorganise land uses to accentuate walkability,

[17] Heating ventilation and air conditioning (HVAC) makes up a large part of building energy use. In developed countries, this end use sector accounts for 50% of building energy use. Efficiencies in HVAC and water heating systems will contribute substantially to CO2 reductions for a 1.5°C world and this thematic sub-area will be addressed in detail in the GCF Energy Efficiency Sectoral Guidance.

	shared ingress/egress, etc. appropriate to the income level and typology of the city. • Within an ASI framework, it will be important to encourage the modal shift to mass transit, walking and cycling can be achieved by applying a number of different demand and supply side management tools and reaping emission reduction benefits. For large, low-income cities, reductions could attain 18% of 2030 emissions targets to achieve a 1.5°C world if 80% of total distance traveled is by mass transit, walking and cycling. With the same percentage of total distance traveled, middle-income megacities could attain 5% of 2030 targets. Large low-income megacities could attain 14% of 2030 targets with 75% of total distance traveled incurred by mass transit, walking or cycling. Large, middle-income semi-dense cities could attain 8% of 2030 emissions targets assuming 70% of total distance traveled is by mass transit, walking and cycling. • Concomitant with shifting mobility from passenger vehicles to transit, cycling and other means, electrification of vehicles can reduce emissions by between 8 and 15% in developing world cities. This also implies a proactive public policy for encouraging the rollout of charging infrastructure. Large middle-income developing world cities using entire zero-emission, next-generation vehicle bus fleets can achieve 23% of their emission reductions necessary to reach the 1.5°C target by 2030. The same conditions, however, are lower in large low-income cities, as they can achieve only 15%. This value is even lower for low-income megacities, which can only achieve 8% of their emission reductions necessary to reach the 1.5°C target by 2030. • Low emissions transport of freight is also important in many cities. Freight transport and logistics contributes 8% of global CO2 emissions and as much as 11% if logistics sites are also considered.[18] There are numerous initiatives in this field – the Global Logistics Emissions Council that supports logistics and other companies to develop and implement a Sustainable Logistics Roadmap to cut emissions by at least 30% by 2030, and to reach zero emissions by 2050. Cities have a key role in incentivizing the implementation of low emissions freight solutions.
Circular Urban Economy: Changing Consumption Patterns and Improving Waste Management by Reducing Methane Emissions from Waste Disposal	• Because of rapid industrialisation, the weight of materials consumed worldwide has more than doubled since 1980, and increased ten-fold since 1900. Global primary materials use may more than double from 79 Gt in 2011 to 167 Gt in 2060, if existing trends continue. Applying circular economy strategies in just five key areas (cement, aluminium, steel, plastics, and food) can eliminate emissions of about 9.3 billion tonnes of CO2e in the production of goods in 2050 and would be equivalent to cutting current emissions from all transport to zero. • A circular economy development path could result in a reduction of primary material consumption (measured by car and construction materials, real estate land, synthetic fertilizers, pesticides, agricultural water use, fuels, and non-renewable electricity) by 32% by 2030 and 53% by 2050, compared with today • There is thus a need to foster the application of 5R principles, particularly in relation to reducing consumption (including reduction in the use of resources through consumption of local food – urban agriculture – and materials) and reuse of materials. • Improving waste management for reuse and recycling would help cities contribute to the emissions reductions needed for the 1.5°C target by the following values: 5% (low-income large city), 5% (low-income megacity), 7% (middle income large city), and 6% (middle-income megacity). • Post-consumer waste is responsible for approximately 5%, or 1.6 billion tons of global GHGs. The amount of emissions is projected to increase to 2.6 billion tons of carbon-dioxide equivalent by 2050.

[18] See https://www.smartfreightcentre.org/en/sustainable-logistics-roadmap/

	• Landfills are the third largest anthropogenic source of methane, accounting for approximately 11% of estimated global emissions. With only basic system improvements, the contribution of waste to global greenhouse gas emissions can be reduced by 25% or more. • Methane makes up 90% of the GHG emissions from waste.It is estimated that aggressive mitigation of methane across all sectors can reduce global warming over the next 50 years by as much as 0.5oC., with most of those reductions delivered by 2040. • Open burning is a widely practiced method of solid waste disposal in many regions of the world. Black carbon (BC) is a particularly serious air pollutant emitted from the uncontrolled burning of waste in open fires because it has a global warming potential (GWP) up to 5000 times greater than CO2 and is also linked to detrimental health impacts due to air pollution. The IPCC inventory does not (yet) take into account BC emissions from open burning. Recent research findings suggest that BC emissions from open burning of waste could amount to 2–10% of global CO2Eq emissions, and are about 2–8 times larger compared to methane (CH4) CO2Eq emissions arising from the decomposition of equivalent amounts of combustible biodegradable waste disposed at dumpsites. • Following a life-cycle assessment approach around 10-15% of global GHG emissions could be reduced through improved waste management through enhanced recycling, energy recovery from waste as well as optimised waste transport. If the effects of waste prevention to avoid emissions from the use of primary resources and waste recovery for other sectors are included, the contribution of waste management related measures to total GHG mitigation could increase to 15-20% (UNEP, ISWA 2015).

Source: GCF & UN-Habitat (2019a), Colenbrander et al (2018) and others as cited.

While delivery systems for PSPs are generally different, which is why they are treated separately, coordination of planning and integrated investment is needed to achieve potential sysnergies and this in turn requires capacity development of demand-side institutions and the development of incentive systems for finacial institutions that foster such investment. Also cutting across all these approaches and investments is the need to support developing countries foster a climate resilient recovery from the Covid-19 pandemic. Within this context in the urban sector, the GCF will work with its AEs, under ownership and support of NDAs, to support climate resilient investments with high economic, social and environmental co-benefits, in line with GCF Investment Criteria. Most urban climate investment will also deliver strong sustainable development co-benefits – this approach is consistent with the need to achieve progress on SDGs and provides the basis of a human rights-based approach to development. For example, labor-intensive investments including drainage systems, water supply and sanitation systems, solid waste management and waste to energy solutions, inclusive accessable green or public spaces, will revive economies and support sustainable urbanisation.

4.2 Key barriers to achieving these paradigm-shifting pathways in the urban sector

Recent surveys have identified a series of financial, technical and institutional barriers that hinder the development of low-emission, climate-resilient urban infrastructure at scale in developing countries (Floater et al., 2017a; CCFLA, 2015; Ahmad et al., 2019). Key barriers to urban finance (also for climate-friendly investments) include the following (Floater et al., 2017a & 2017b):

Barriers involving the lack of enabling policy frameworks, integrated policy and planning systems, and institutional and technical capacities:

- Many cities have not put in place an enabling policy and regulatory framework to foster sustainable investment in the urban sector. Such policy and frameworks are often made more difficult to design and implement because of the need for coordination across multiple

levels of government, sectors and diverse agencies. There is also pervasive uncertainty around regulations and tax policies related to emission and climate risks, and cities' commitment to low-emission, climate resilient infrastructure (LECR) and transportation systems.

- Limited integration of policy, planning and land management systems and capacity on the part of urban institutions to generate investment programmes that address the range of urban mitigation and adaptation needs identified in NDCs and national adaptation plans (NAPs).
- Fragmentation in decision-making responsibilities among city decision-makers, regional governments, and sub-sovereign public infrastructure entities is compounded in many countries by high levels of informality in the urban economy and settlement patterns.
- Lack of outreach, awareness raising and community involvement to build support for above policies and measures.

Barriers involving the lack of structures for upfront funding to cover due diligence and project preparation costs in climate planning, pre-feasibility studies, project design, and land preparation for PSP projects:

- Although the total life-cycle costs of resilient urban infrastructure are lower than business-as-usual infrastructure designs, upfront project preparation costs and due diligence requirements are high.
- Infrastructure plans and project designs in urban transport, waste management, adaptation might entail buyouts or other forms of compensation for right-of-way or facilitating communities to move away from land at risk of natural hazards, as well as costs associated with land assemblage.

Barriers that limit support for fostering new business models, institutions, technologies and financing structures:

- Lack of enabling policy frameworks to foster the development of new viable business models and institutions that are required for urban climate investments.
- The performance of innovative technologies may also be untested and their supply chains underdeveloped.
- Lack of new financing products and structures that can transform LECR investment opportunities in the urban sector in developing countries into credible financial products across asset classes to match the risk profile of products familiar to institutional investors.
- Lack of viable business models for adaptation projects in particular.

Barriers related to the increased perceived risk/reward profile by project developers and financiers due to higher upfront costs and longer payback periods of LECR urban investments:

- LECR urban investments are typically characterised by higher upfront capital requirements but lower operations and maintenance costs, and longer payback periods compared to high emission climate vulnerable investments.
- Higher sensitivity to policy stability and regulatory certainty.
- Lack of borrower track record, including their cost recovery performance, which creates greater uncertainty for financiers around revenue streams.

Barriers related to the lack of access to long-term finance at affordable rates and with appropriate repayment schedules due to shallow domestic capital markets and financing systems:

- Due to their cash profile, LECR investments also require access to long-term, affordable finance. However, short-term finance is more readily available in municipal markets in developing countries.
- National policies, financial rules, and regulations may limit the scope for borrowing from domestic and international capital markets, for example the lack of city credit worthiness may relate to the quantum and structure of inter-governmental fiscal transfers.
- Domestic financial institutions (including NDBs) may not have enough liquidity or capacity around climate investments.

- Capital requirements for commercial banks can discourage long-term financing in urban segment of domestic credit markets.
- Lack of aggregation mechanisms and instruments to facilitate financing of smaller projects, lower income local governments and smaller private sector project sponsors.

Barriers related to the supply of PIC finance:

- Lack of common definitions, standards and taxonomies related to LECR urban investments.
- Non-mandatory climate-related financial disclosures.
- Lack of agreed project assessment methodologies for LECR infrastructure investments, such as quantification and common pricing of avoided emissions and valuation of climate resilient assets, limit the capacity of investment decision-making to balance risks associated with higher upfront costs of low emission, resilient infrastructure with their lower operations and maintenance costs and lower climate physical and transition risks.

Barriers related to knowledge and performance data associated with LECR urban infrastructure which limit the potential for replication and scale:

- Limited information on LECR technologies and systems, their cost, and feasibility for different urban contexts, particularly across the wide variety of secondary cities with different emission profiles and facing different climate risks.
- Lack of rigorous city climate emissions and vulnerability analyses.
- Lack of mechanisms to build expertise of urban institutions, financial institutions and private sector organisations in low emission and resilient technologies.

These barriers are largely confirmed by Accredited Entities and Nationally Designated Authorities that responded to a survey to assess the market for urban climate finance.[19] Respondents were asked about the major challenges in urban climate finance that their entity is facing. Interestingly, none reported the lack of a project pipeline as an obstacle. The most common response was the low capacity of urban public actors to develop projects ready for investment. Limited access to international finance was the second most common challenge reported. When these two latter barriers are understood in the context of low local own source revenues, a clearer picture emerges around the difficulties of matching the supply of multilateral climate finance to local needs in the urban sector. Structures to address these barriers are set out in Section 5.1.

In relation to the ability of cities to plan and implement PSP investments, there are significant differences across megacities and secondary cities. Specifically, the capacity to plan or influence investment across PSPs varies considerably. Secondary cities tend to have less influence on infrastructure investment decisions because they often have more oversight by and involvement of higher levels of government. In such cases, the agencies of higher levels of government become critical stakeholders in climate investment. Secondary cities have fewer human and financial resources, meaning that structuring new business models is more difficult. These issues also constrain secondary cities for conventional investment, and they are even more of a factor in relation to climate investments which are often large, unfamiliar and which stretch administrative mandates. In addition to the issue of city primacy, the country context is very important for cities in LDCs and SIDS. Cities in these countries have more and higher barriers to negotiate and will require more support. As such, financing solutions need to be tailored so as to address the specific barriers and opportunities inherent in a city's existing planning, project development and financing systems for climate investment.

[19] This urban sector survey was sent to Accredited Entities and National Designated Authorities as part of the present assignment "Consultancy services for market & sectoral research to support drafting of the GCF-wide sectoral guidelines & plan for the urban sector (cities and climate change)", undertaken by UN-Habitat for the Green Climate Fund.

4.3 Role of the GCF in supporting developing countries

Based on its mandate and comparative advantages, the GCF offers a four-pronged approach for both mega/ large and secondary cities to address barriers and drive implementation of the PSPs at scale (Table 4). These drivers will affect the systemic change needed through changing incentives for sectoral and other regulatory institutions that determine investment in each of the identified PSPs. Business models, project development systems, financing structures and ability to attract PIC finance will differ significantly between mega/large and secondary cities.

- ***Transformational planning & programming:*** Demand-side measures focused on strengthening the capacity of urban institutions to foster policy integration and enabling policy frameworks, as well as to plan, programme and build a pipeline of climate investments and improve skills in green procurement.

- ***Catalysing innovation in the urban sector:*** Invest in policy, institutional, business model, financial and technological innovations in each of the PSPs, with the potential to break existing trends and dramatically scale-up climate and resilience impact.

- ***Mobilising finance at scale:*** Leverage GCF financing instruments to catalyse Private, Institutional and Commercial (PIC) financing for PSPs. This includes de-risking a pipeline of low emission climate resilient urban investments through blended finance and improving cities' access to international and domestic capital markets and carbon markets.

- ***Coalitions and knowledge exchange to scale up success***: Generate and disseminate knowledge across the GCF urban sector project portfolio, leverage partnerships with urban networks and coalitions to share lessons learned and replicate good practices in order to reach scale.

Table 4 highlights examples of actions of these four drivers of change across the four PSPs.

Table 4: Drivers of change across paradigm-shifting urban action pathways

Paradigm-shifting pathway	Drivers of the Paradigm-Shifting Pathways			
	Transformational Planning & Programming	**Catalysing Climate Innovation through New Business Models**	**Mobilisation of Financing at scale**	**Coalitions and knowledge to scale up success**
Decarbonisation of urban energy systems	Fostering improvements in enabling frameworks & planning for new & retrofit clean energy. For example, through Feed in Tariffs (FiT), carbon pricing and other mechanisms that incentivise distributed, resilient and low emission energy sources for urban development	Invest in new business models that derive revenue from large scope 2[20] emission reductions in urban development. For example, through mechanisms that reduce the up-front cost of capital investment (e.g. pay-as-you save schemes).	Given that such installations can range from individual houses to large scale urban development projects, financing mechanisms need to be capable of financing both large- and small-scale projects	Given urban networks, particularly those focused on financing such as the Cities Climate Leadership Alliance (CCFLA), are multi-sector in nature, K&L activities need to partner with such networks and, where applicable sector networks, to: > Develop knowledge products on business models through the Community of Practice for each PSP > Utilise partnerships within CCFLA to upgrade & upscale assessment & project development systems especially in National Development Banks (NDBs) and International Financial Institutions (IFIs) in order to structure programmes of investment which maximise the leverage of PIC financing > Partner with other agencies & networks to maximise knowledge feedback / learning loops in each PSP sector > In line with GCF's operational framework for complementary and coherence, create synergies with other climate funds (e.g. GEF, AF, CIF) to replicate successful
Energy efficient building and related infrastructure	Improving enabling frameworks & planning systems to incentivise both zero energy/ maximum energy efficiency solutions in new development & retrofit energy efficiency programmes. In respect of the former Floor Space Ratio (FSR) incentives can be used. In respect of retrofit other incentives can be used and including effective carbon pricing and recovery of a larger proportion of the real cost of energy from user (lower subsidies)	Promote and mandate energy ratings and new performance standards (appropriate to both cold and tropical climates) to incentivise net zero buildings, and operationalise by investing in innovative Energy Service Companies (ESCOs) and other arrangements that derive revenue from energy savings to buildings and infrastructure.	The same range in investment scale applies as set out above with the same implications for the financing system but large scale energy efficiency (EE) retrofit is particularly difficult and will require demand-side institutional forms such as development corporations to structure and contract such investment.	
Compact & Resilient Urban Development	Better incentives & network planning for low emissions design of urban development including EBA and integrated low emission transport – avoiding and intervening against forced mobility effects. Coordinated investments in a number of sub-sectors, for example in Non-Motorised Transport (NMT) and in low emission fleet capacity (eg. eBuses) are needed. The latter in turn, require incentive structures that promote reduction in scope 1, 2 and 3 emissions. Planning & incentives for inclusive resilient development & redevelopment need to be provided which will involve improving climate impact and vulnerability data for cities and, in turn,	Foster fiscally viable urban development models such as Transit Oriented Development (TOD) and the provision or upgrading of infrastructure such as drainage and water supply systems to increase resilience funded through such structures as Land Value Capture (LVC)[21] systems. Specific models are needed for the 3 categories of adaptation investment: (a) reducing exposure to hazards through the provision of basic infrastructure and services; (b) managing new risks by retrofitting existing infrastructure; and (c) building new infrastructure specifically to	Given the need for large scale redevelopment of cities to put them on a low emission footing, the capacity of NDBs, IFIs and other financing systems to provide large-scale, long-term finance for urban development corporations and such vehicles needs to be developed. Such mechanisms need to be able to finance both green & brownfield development. Financing instruments will need to be adapted to the needs of mega- and large cities/ projects vs secondary cities/ smaller projects through the such mechanisms as fostering capital	

[20] For definitions and guidance on calculating emissions at different scopes see: https://ghgprotocol.org/standards

[21] LVC is taxation or collection of other revenue from areas benefiting from a particular infrastructure investment in order to fund that investment.

	improving the “green design” process that will take this context into account when formulating urban plans and mitigation and adaptation/ ecosystem services projects.	respond to climate hazards, such as sea level rise. Institutions for Payment for Ecosystem Service mechanisms will often needed to be developed for EBA and ecosystem service development projects.	markets access in the former case and using aggregated financing instruments in the latter case.	practices and apply lessons learned. > Effectively disseminate knowledge and show case good practices using the GCF knowledge repository and networking events and organizations – and through peer-to-peer learning structures of partners. > Build community coalitions to provide the demand base for 5R solutions and the political base for their implementation.
Circular urban economy	Foster appropriate standards & incentives for all forms of recycling. For example, providing structures for reducing waste, such as tipping fees and deposits; for recycling such as legislating producer responsibility for products; and, where appropriate, for Waste to Energy (WTE) investments.	Invest in new market structures for Rethink, Reduce, Reuse, Repair and Recycle (5R) so that companies can derive a viable revenue stream from sharing the use of products, recycling products or ensuring that products do not reach a disposal site (promoting circular economy and resource recovery).	Financing has to be available for each step in the supply and logistics chain of recycling industries & recycled products. If investment falls short in any step in the process the circle will be broken.	

5 Financing Paradigm Shifting Pathways in the Urban Sector: Catalysing Public and Private Sector Finance

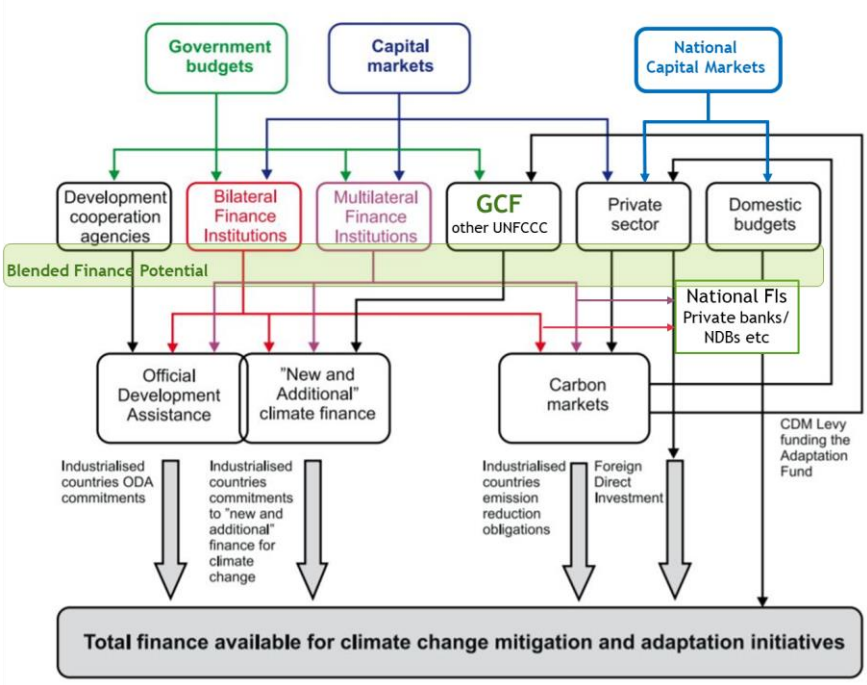
5.1 Global context of urban climate finance.

Cities in developing countries suffer from a number of constraints to financing their infrastructure in general and climate-related infrastructure in particular. Currently, such infrastructure is financed through a mix of public revenue, transfers from higher levels of government, grants from donors, and loans – generally from public financial institutions, in particular National Development banks (NDBs). Given their constrained revenue base, local authorities are often heavily dependent on central government transfers to offset deficits in their operating expenditures, and on grants from higher levels of government and from donors to address their most pressing environmental and social problems. Decentralisation policies have often devolved functional responsibilities without the fiscal resources needed to discharge service mandates (Seragelden et al 2008).

In scaling up climate finance and enhancing cooperation with the private sector, the GCF, in line with the recently approved USP, should also aim to explore innovative financial models through combination of diversified financial instruments available on a country- and demand-driven basis. The role of AEs and Direct Access Entities will be key in this context taking into account the priority to strengthen the engagement capacity as a key priority area for the GCF business model to support planning, programming and investment design as well as development of the climate investment capabilities of national investment institutions (such as through building novel investment partnership with long-term institutional investors, see USP para 23b). Structuring options to attract larger institutional sources of finance through aggregation and securitization, and improve affordability of technologies, is clearly identified in the USP as a mean to mobilize private sector resources at scale (USP para 23c). In addition, depending on the city and country context, support to private sector involvement in financing adaptation investments should be a priority.

As noted in section 4.2, most cities lack of access to long-term financing, notably through national or international capital markets, which hampers their ability to fund urban development. Yet such markets are potentially an appropriate fit for the long-maturity, stable returns available from many urban infrastructure projects. Commercial banks and investment companies manage nearly USD 70 trillion of assets, while pension funds, insurance companies and sovereign wealth funds (which tend to have lower risk appetites and longer-term investment horizons) represent nearly USD 44 trillion more (Colenbrander et al, 2018). Some cities, such as Mexico City and Johannesburg can tap national, and even international, capital markets, issuing bonds and others have experience with PPP projects for urban tollways and public transport. The schematic outline of the global climate finance system is set out in Figure 3. In this context, it is then clear that extending climate finance to cities in developing economies often requires significant focus on the capacity of the recipient urban institution, as highlighted in the key drivers of change.

Figure 3: Global climate finance architecture



Source: Adapted from Atteridge, A et al (2009)

Notes: CDM=Clean Development Mechanism, FI=Financial Institution, NDB=National Development Bank, ODA=Official Development Assistance

Domestic Finance

The development and climate finance landscape is changing rapidly, especially with regard to infrastructure, with emerging economies playing a greater role than before (OECD 2018a). In 2014, for example, non-OECD Development Assistance Committee (DAC) countries (including many emerging economies) provided an estimated 17% of total global development co-operation – around USD 32 billion – with this amount being seen to increase year on year between 2010 and 2017 (Benn and Luijkx, 2017). The relatively modest role of international development actors is also highlighted clearly in the breakdown of infrastructure financing in developing countries. Miyamotoi and Chiofaloi (2016) estimate that official development finance – from donors, MDBs and bilateral banks – makes up only 6-7% of infrastructure financing in developing countries, with most of the resources coming from national governments and a third from the private sector.

Within this context, NDBs,[22] particularly those from emerging economies, are set to play an increased, and potentially transformational, role in scaling up finance for low-emission, resilient infrastructure (Studart and Gallagher, 2016). They can contribute to build the capacity of local governments to finance urban infrastructure projects, develop bankable project pipelines and structure urban and municipal markets in the long term, including for intermediary cities.[23] However, NDBs may have limited capacity to collaborate effectively with cities in pipeline development and structuring, and the absence of widely adopted systems and standards for monitoring, reporting and validation of green investments constrain their urban climate finance capacity.

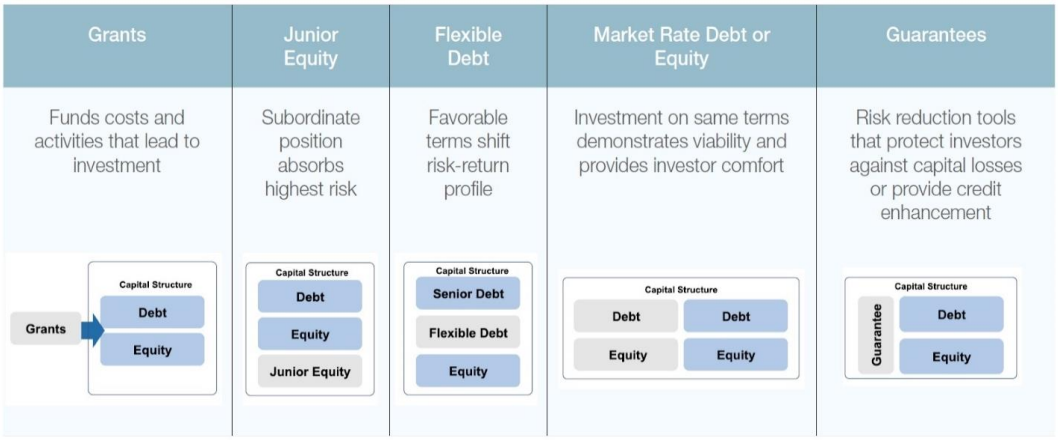
[22] Including, for the purposes of this document the range of public or private banks and other financing institutions with a specific mandate to provide funding and financing to local and regional governments for public services provision and investments in infrastructure projects and/or to the private sector for investments in line with national development goals.

[23] See Human Settlement Climate Action Pathway of the Marrakech Partnership for Global Climate Action p 23 https://unfccc.int/sites/default/files/resource/Action_table_HS.pdf

Blended and Other Innovative Financing Models

For purposes of this guide, **blended finance** is defined as the strategic use of public climate finance to mobilise climate investment in developing country cities and develop private sector markets in support of increased climate-positive investment in cities (WEF & OECD, 2015). Figure 4 summarises the main approaches of blended finance in urban investments.

Figure 4: Common uses of financial instruments in blended finance



Source: World Economic Forum & OECD, 2015.

Blended finance can operate with multiple sources of funds (debt, equity, grants), and can employ a variety of uses of funds (grants, loans, equity and guarantees to project or program facilities for both mitigation or adaptation projects). They can be structured to engage through a range of business models (public, private, PPPs, SPVs, etc.). Guarantees can potentially addres the full range of risk management solutions including mechanisms to reduce, share, and transfer risks.

In the urban context, blended finance facilities can de-risk and catalyse private sector initiatives, contributing to a number of outcomes that otherwise may not materialise. Specifically, the GCF will seek to leverage its support to mobilise diverse financing sources for climate finance such as:

- Support to raising capital, for example:
  - Municipal green project debt – Creditor sells debt at a discount while committing to make climate-smart investments.
  - Crowd-based and community financing – Leveraging individual investors.

- Matching concessionality to non-monetised climate benefits generated, for example:
  - Auction facilities – The subsidy provider (city) ensures that green building design standards are implemented at the lowest possible financial incentive.

- Supporting improved deployment of investment funds, for example:
  - Environmental impact 'bonds' – City and private investor agree on a climate-smart investment project with clear performance metrics. Private sector provides equity financing to build the asset. As results are achieved, city reimburses private investor with premium.
  - Energy Service Company (ESCO) model – there are a number of models possible that can be customized appropriately to the context (see Section 5.3).
  - "Impact Investing" – Potential to achieve both climate and social objectives through cobenefits of climate projects. Needs a significant level of capacity to design such projects.

- Supporting AEs in catalysing bond issuance, for example:
  - Green city bonds – Various forms, such as general obligation, revenue obligation or

through facilities which aggregate investments as backing for bonds..
    - Resilience bonds – Bonds incorporate the value of reduced risk to assets due to a resilience project. Usually issued by a special purpose vehicle which can be set up by an IFI, investment bank or similar.

- Mobilising institutional financing, that is, financing from pension funds, life insurance companies and sovereign wealth funds – both domestic and international.

Diversity of Climate Financing Needs – Mega-and Large vs Secondary Cities

The appropriate choice of the mix of particular instruments will vary by the size and wealth of the city, the sector involved, the scope of the mandate of the project sponsors or implementing organisations, the relative roles and contributions of various levels of government, and the local capital market context. In general however, several key constraints apply: cities, particularly small cities, are often highly constrained as to their use of debt, the use of debt financing or may be uncomfortable with taking on debt at all; the use of equity in urban infrastructure finance generally requires more complex structures than lending and thus is often restricted to larger cities that can cope with the transaction costs; and cities, especially small cities, are often uncomfortable with FX exposure. This analysis also leads to a more general distinction in financing structures required for megacities and larger and wealthy cities in the one hand and for secondary cities on the other.

In relation to the ability of cities to finance PSP investments, there are again significant differences across megacities and secondary cities. Specifically, the capacity to structure and access financing varies considerably – secondary cities tend to have less own-source revenue in both relative and absolute terms and have more stringent oversight by and involvement of higher levels of government in their finances. In such cases, the agencies of higher levels of government become critical stakeholders in climate investment. Further, secondary cities have lower levels of financial capacity and fewer resources to engage consultants with required skills for more complex transactions implied by some PSP business models. As in planning and project development, these issues constrain secondary cities even for conventional investment, and they are even more of a factor in relation to climate investments which are often large, unfamiliar and stretch administrative mandates. As such, these issues need to be addressed in national and international financing systems for climate investment.

While larger cities may be able to directly access capital markets, other approaches will be needed for smaller cities. In partnership with its Accredited Entities, the GCF can support the bundling or aggregation of projects that, taken individually, would not be of sufficient size to interest private capital. This aggregation could represent a one-off effort (e.g. to aggregate similar investments in energy efficient technologies from a number of cities to finance via a green bond). Or it could take the form of institutional strengthening in countries where local entities have shown promise in playing a credit enhancing role such as a bond bank. Secondly, through the provision of guarantees, the GCF (again through its AEs) could support creditworthy larger cities in issuing green municipal bonds to finance key investment opportunities that emerge from their city climate action plans – but for smaller cities it may be more appropriate to apply guarantees to a fund that is financing a range of climate projects in a number of such cities and the guarantee would apply to the issue a green bond on the back of the aggregation of city climate projects.

5.2 GCF objectives, portfolio and financing structures

The GCF's overarching mandate is to "promote the paradigm shift towards low-emission and climate resilient development pathways by providing support to developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change." The GCF achieves this through co-financing and risk-sharing with its Accredited Entities, and providing readiness and project development assistance.

After five years of full operation, the GCF has developed a strong urban portfolio with projects and

programmes across all regions.[24] As of the conclusion of the Initial Resource Mobilisation (IRM) period in 2019, 20 funding proposals covering urban sector activities in 61 countries had been approved within the Urban Sector and Energy Efficiency Portfolio, with a total value of USD 7.27 billion. GCF funding at the portfolio level totaled USD 1.84 billion. With co-financing at the portfolio level amounting to USD 5.4 billion, the ratio of co-financing to GCF funding was 3 to 1 for the IRM.[25]

Over time, the GCF's urban sector portfolio has evolved to be a rather balanced distribution between adaptation and mitigation projects. The combined mitigation impact from projects in the urban portfolio during the IRM period is estimated at 1,046 $mtCO_2eq$ (see Table 5).

Table 5: Mitigation impact in the urban sector and energy efficiency portfolio

	Overall (MtCO2eq)	**Public** (MtCO2eq)	**Private** (MtCO2eq)
Portfolio	1046.5	181.04	865.5

Source: Green Climate Fund (2019a).

Of the 20 approved funding proposals within the Urban Sector and Energy Efficiency Portfolio, 14 (70 per cent) are public sector projects, with 6 (30 per cent) classified as private sector. Public and private sector projects differ on costs performance: public sector project abatement costs come in at USD 44.32 per tCO_2eq, while private sector projects are 36 per cent lower, at USD 28.38 per tCO_2eq (Figure 5). The breakdown of the current GCF portfolio of projects against PSP investment areas shows that, while energy efficiency and, to an extent, renewable energy and resilience are well represented in the portfolio, other areas of PSP investment will have to be strengthened.

Of the current portfolio, the regional distribution of approved urban projects is relatively balanced. The Asia-Pacific (35 per cent) region hosted the most projects by the end of 2019 and Latin America (19 per cent) and Central Asia hosted the fewest (19 per cent). Africa had 27 per cent of the projects. The Urban Sector and Energy Efficiency Portfolio contains 7 cross-country projects and 5 cross-region programmes. The existing portfolio thus provides a strong base upon which to build during the next replenishment, while starting to show areas of comparative advantage and uptake in the market.

A few trends can be identified since the start of the Urban Sector Portfolio in 2016. First, over time, more projects that combine mitigation and adaptation impacts have started to emerge.[26] Cross-cutting projects first appeared in 2016, with three such projects. An additional seven cross-cutting projects were added to the portfolio in 2018. The increasing share of projects in the portfolio that combine mitigation and adaptation impact areas reflect in part a holistic approach to addressing climate change adaptation and mitigation at the city level.

[24] Information presented at the portfolio level in this section relate to the GCF's Urban and Energy Efficiency Portfolio, which entails projects across various results areas including the Buildings, Cities, Industries, and Appliances (BCIA) Results Area. Figures are derived from the GCF presentation "Urban Sector and Energy Efficiency Portfolio Analysis", dated 5 November 2019.

[25] This will be updated with data through the end of 2020.

[26] The following discussion, drawn from GCF & UN-Habitat (2019c), is based on a subset of 41 GCF projects with urban content.

Figure 5: The GCF urban portfolio

Source: GCF & UN Habitat. (2020)

In respect to total financing, the 70% of public sector FP represents about 50% of the GCF urban portfolio and about 65% of total investment. Private sector projects have a higher efficiency (32% lower abatement cost) but public sector projects have a higher "leverage". Thus, while public sector projects remain critical to support the urban transition, there is a pressing need to continue to support the mobilisation of the private sector in this transition.

The review of the portfolio also shows that there are numerous potential linkages with other result areas/sectors. In particular, because of the programmatic structure of support for urban projects which can be implemented through multi-sectoral funds, projects in other areas/ sectors can be accommodated. Examples of such projects could include: ecosystem services, which can be financed as part of resilience investments in urban water supplies; energy systems resilience, which can result from investments in urban decentralised energy; and support for the private sector, for example by providing support for energy efficiency investments.

5.3 Value added of GCF finance in the urban sector

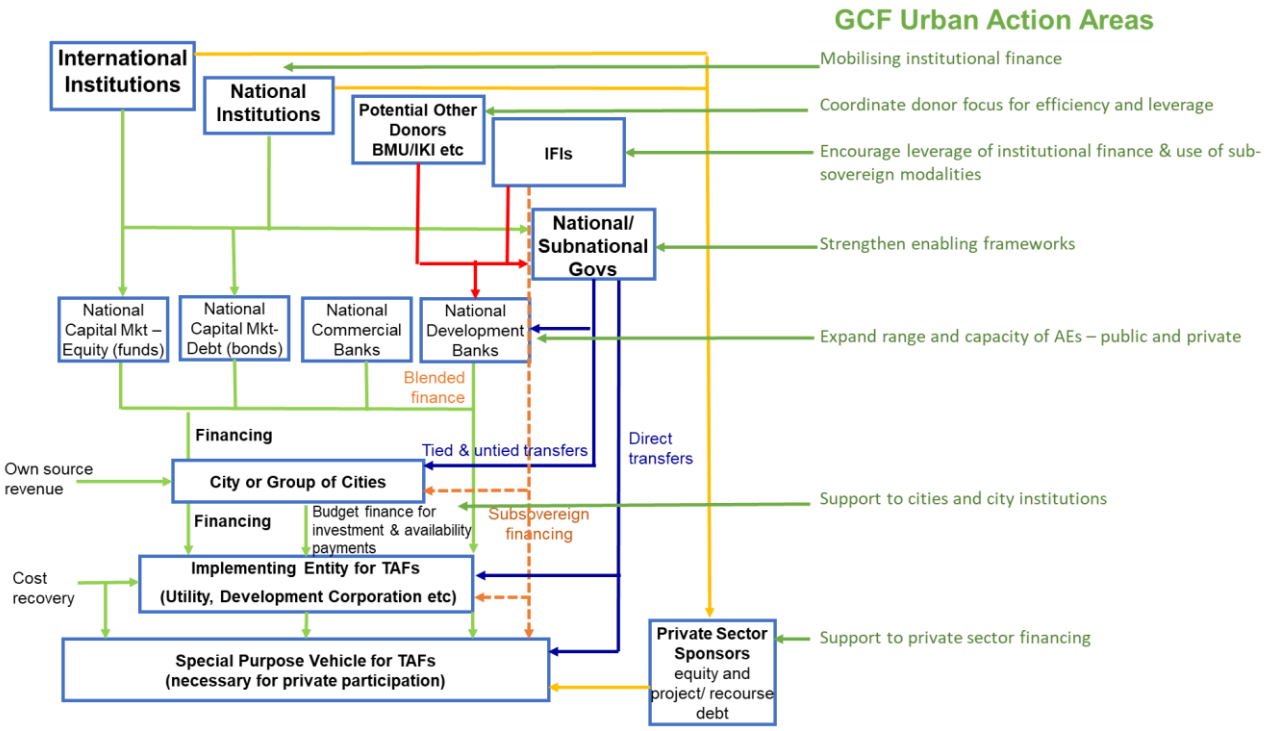
The GCF offers AEs a flexible range of financing facilities and instruments. First, its Readiness Grants and Project Preparation Facility (available through its NDAs, Focal Points and Direct Access Entities) support developing cities in planning, putting in place enabling frameworks and project development of PSP investment programmes. Such financing support is critical in reducing the high upfront costs in project preparation. Private capital may well not invest in such early stage preparation. Grants can be usefully deployed here, either without expectation of repayment or else on a repayable basis, if and when a planned transaction comes to pass.

Second, the GCF can structure financing packages that use different combinations of financial instruments – grants, loans, equity and guarantees – to de-risk and catalyse private investment. This provides GCF and its AEs with the opportunity to design blended finance mechanisms to *accelerate the tipping or crossover points at which climate-positive investments become attractive to private sector investors*. Such points are familiar in the energy sector, where renewable energy sources have gradually become more competitive with carbon-based sources. In such circumstances, strategically deployed concessional finance has been credited with accelerating by several years the arrival of such crossover points, with a resulting transformative impact at the national scale on investment decisions (Bloomberg NEF, 2019). Opportunities for thus accelerating the crossover points exist as well in the urban sector (e.g. for investing in decentralised renewable energy, purchasing clean fuel buses).

Third, the GCF has supported financing models that aggregate or pool smaller projects or the projects of smaller cities. This task assumes particular importance in the urban sector (Liu et al, 2017; Kamiya & Zhang, 2017), for several reasons. Certain urban PSPs by their nature are atomised (e.g. in the building sector, where building ownership is typically fragmented among a multitude of households and enterprises). In such cases, serving the myriad of small- and even micro-scale investments required will not be of interest to most institutional investors. Even at the city level it may be difficult to assemble a critical mass of investment opportunities that is sizeable enough to attract institutional investors. Building on this experience, Figure 6 shows the "ecosystem" of urban financing and the critical potential

action areas for GCF financing.

Figure 6: GCF and priority urban financing action areas



Source: Author

Table 6 sets out how GCF engagement could benefit some of the PSP sector-specific business models through the use of the instruments set out above. These will be at various stages of maturity, and will emerge naturally under existing legal and regulatory frameworks. In many other cases, a number of developmental building blocks will first need to be put in place, and a series of regulatory barriers dismantled, before these new models can thrive. Moreover, robust uptake of most of these new business models will require some retraining and capacity-building of professionals and technicians.

There are two distinct business model types for most urban climate investment sectors – those that apply to new build and those that apply to retrofitting. Business models for both generic types will differ according to context of the sector in a particular city and national capital market and legislative context and by the scale of the investments involved. Both types of models will, in many countries, have to take into account high levels of informality. Where community-level investments are the object of financing, it is critical that instruments used are designed so as to be appropriate to the communities involved – gender mainstreaming is particularly important in this context. LDCs and SIDS will face particular challenges of affordability and scale of investment.

Financing of new build projects is essentially about financing the additional capex that is associated with the installation because the installation will often be integrated into the development – either on site or off-site. Given the economic costs (if not financial costs given subsidies) of fossil fuel consumption related to BAU development, concessional financing of the incremental cost of climate positive investments is justified. Such financing needs to be flexible in relation to different types and scales of investment. Individual smaller scale investments will usually need to be financed through loans from a dedicated AE facility (to which GCF can contribute usually in the form of loans) – usually at an NDB. Large scale investments can be financed in a similar way and, if through a fund structured appropriately, could involve equity finance (in addition to debt) if structured through some sort of corporate vehicle. If the corporate is sound enough and needs to raise significant PIC funds, a guarantee could be appropriate.

Financing of retrofit projects is essentially about financing new capex that is associated with adding an installation to existing development – again, whether on site, as in most projects related to buildings, or off-site as can be the case in infrastructure. The economic rationale is as above, but often unit costs are higher. Given the economic benefit, concessional financing of the cost is justified. Again, such financing needs to be flexible in relation to different types of buildings and types of infrastructure and to individual and large-scale installations. Individual small-scale investments will need to be financed through loans from a dedicated facilitywithin an AE – usually at an NDB. Large scale investments can be financed in a similar way, but, as above, if structured with a corporate vehicle, equity funding is possible, and a guarantee could be appropriate.

In all fund-structured instruments, which will be by definition blended finance facilities, GCF could encourage the participation of other concessional financiers in order to maximise the flexibility and impact of the funds. Given most mitigation investments will be profitable in the long term, grant funds are most appropriate for supporting the strengthening of enabling frameworks and for project development and structuring of pilot projects. Adaptation investments are more difficult to structure as a profitable project and thus there will be a larger role for the use of grants and concessional support to demonstrate sustainable business models that may involve ongoing transfers (for example, payment for ecosystem service models).

Table 6: Examples of GCF interventions in support of paradigm-shifting pathways

Paradigm-shifting pathways	GCF Support of PSP Business Models
Decarbonisation of Urban Energy Systems	• Financing of new build projects is essentially about financing the additional capex on site, as in most projects related to buildings (such as small scale geothermal), or off-site, as can be the case in relation to infrastructure (e.g. a PV farm providing power to a metro). The investments could involve equity finance as well, but if structured through a property development or Independent Power Producer (IPP) corporation.. • Financing of retrofit projects is essentially about financing new capex that is associated with adding the installation to existing development – again, whether on site, as in most projects related to buildings, or off-site, as can be the case in infrastructure. Individual small-scale investments will need to be financed through loans from a dedicated facility such as the US PACE program – usually at an NDB. Large scale investments can be financed in a similar way, but if structured as an IPP, as above, direct debt and equity funding is possible, and a guarantee could be appropriate.
Improving Energy Efficiency of Building Stocks and Related Infrastructure	• Financing of new build projects is essentially about financing the additional capex that is associated with buildings because the installation will be integrated into the design.. Such financing needs to be flexible with individual smaller scale investments needing to be financed through loans from a dedicated AE facility (to which GCF can contribute) and large scale investments that can be financed in a similar way. If such a fund is structured appropriately, financing could involve equity as with the facility established by the Shandong Government in China (see Section 4). To utilize equity, implementation will need to be structured through a property development or Energy Service Company (ESCO) corporation. • Financing of retrofit projects is essentially about financing new capex that is associated with upgrading or replacing HVAC systems and insulating existing development. Large scale investments that can be financed by debt or equity from a facility established at an AE as with the Energy Efficiency Facility established by

	the Qingdao City government in China. If structured as an ESCO, direct debt and equity funding is possible..
Compact and Resilient Urban Development	The differences between the land use control and infrastructure investment models for low emission/ compact development on the one hand and incentivising resilient urban development (especially in relation to the use of EBA) and infrastructure (especially transport infrastructure) on the other hand are small and they can generally be addressed together. Indeed, these two aspects of sustainable urban development should be addressed at the same time. Further, these two development imperatives share a common characteristic that makes financing more challenging – often there are no or only small incremental direct revenue sources deriving directly from the investment itself. • Financing of low emission/ compact and resilient greenfield development depends on the funding model for such development – in particular the relative proportion of transfers from higher levels of government, of local fees and taxes and of private sector participation – and on the implementation structures for planning, developing, structuring and implementing the development. Widely different approaches are taken to these issues, but in terms of fostering effective implementation and large scale climate-positive impact, a comprehensive approach supervised by an empowered development corporation or utility with its own substantive revenue base – usually based on some form of land value capture – is preferable. Successful examples exist in China, India, the Philippines and other countries. • Financing of low emission/ compact and resilient brownfield development also depends on the funding model for such development and on the implementation structure chosen. A development corporation can be "overlaid" on existing development as well as on greenfield sites. Funding models based on capturing some of the redevelopment gain or increased amenity due to resilience investments can provide a sound funding base for financing. Additional complexity is added due to the presence of an existing community, but inclusive governance and management structures can manage this successfully. Successful examples exist in Argentina, South Africa and other countries. • Financing ecosystem services is a special case of adaptation finance in that it often requires additional structuring as the ecosystems in point are maintained by communities outside the administrative jurisdiction of the urban institutions that regulate the derived services. In these cases, it may be necessary to set up special mandates, revenue bases and transfers. Where the financing of the rehabilitation of natural capital is required, financing facilities often need to be able to cope with a large number of prospective beneficiaries, small credits or grants provided over an extended period and the need to monitor inputs and outcomes. Business models relating to water resilience investments may offer mechanisms of cost recovery for ecosystem services. Within an ASI framework, there are also three business model types for integrated low emission mobility which is a necessary compliment to compact and resilient built form (and which need to be planned and implemented in a coordinated manner) – those relating to public transit vehicle fleets, freight systems and major facilities, those relating to individual or small group mobility (such as taxis and e-scooters) and those relating rights-of-way and NMT development. The regulatory framework will have a significant impact in determining what business models are viable. Within these models there is a huge range of potential configurations and consequent financing options.
Circular Urban Economy	There are numerous business models in this area – they can be broadly categorised into two areas by the various stages of the supply chain to which they are mainly applicable. These are: waste collection, the distribution of recycled items and final

	disposal; and the manufacture and distribution of products made from recycled materials. Innovative business models can be found in all these areas. The privatisation of selected waste streams, especially of various types of packaging, can both reduce city expenditure on waste management and create opportunities for the private sector to contribute, incentivised through extended producer responsibility (EPR) and other mechanisms systems (See: EPR Toolbox for stakeholders in developing and emerging countries PREVENT Waste Alliance, 2020 and EPR: Updated Guidance for Efficient Waste Management OECD, 2016). • Financing of waste collection depends on the revenue model for collection and for disposal. For solid waste, collection is either fee-based or achieved through a PPP concession funded through fees and availability payments of some sort. Given this revenue base, a collection fleet can generally be financed conventionally, but the low emission aspects of disposal – low-emission collection systems, methane capture and waste to energy/ biomass recycling systems need other mecahnisms of finance. Waste heat can also be used to replace high carbon energy sources. These investments will often require separate financing sources that are more specialised in climate finance and familiar with expected performance of such systems. • Financing of recycling businesses and exchanges will involve a very wide range of investment size and type – from the manufacture of building products from waste to the use of waste material as the input of another industrial process. Again, such financing needs to be flexible in relation to both small- and large-scale investments by small- and large-scale enterprises.

6 Country Case Studies

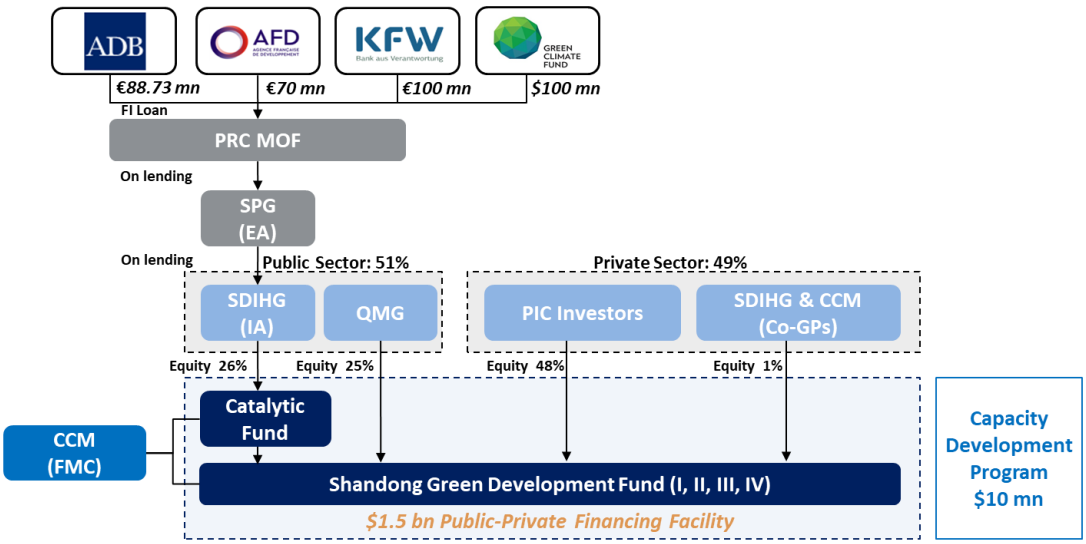
This section highlights four *transformative initiatives* that serve as examples of for GCF support to PSPs.

6.1 ADB Shandong Green Development Fund

ADB's Shandong Green Development Fund in China is an example of a programmatic facility leveraging PIC finance[27]. The project establishes an innovative, replicable and scalable form of financing facility that will tap new funding sources, both public and private, and leverage existing sources of finance for a pipeline of viable climate resilient and low emission investments. The Fund will do this by: (a) ensuring that it addresses priority climate impacts and vulnerabilities in Shandong through incorporating these priorities into its portfolio objectives; (b) incorporating a project development facility to develop a pipeline of sustainable and replicable sub-projects that will support project sponsors to achieve high levels of performance against GCF Investment Criteria; and (c) incorporating structures for both financially incentivising sub-projects which perform both at a high level against GCF Investment Criteria and which leverage of Private, Institutional and Commercial (PIC) finance. Private financing will be leveraged at both fund and project levels.

The USD 1.4 b fund is supported by a USD 100m GCF loan, ADB and other co-financing of USD 320m, Shandong government financing of USD 375m and PIC finance of approximately USD 625m. Figure 7 shows the structure of the Fund.[28]

Figure 7: Shandong Green Development Fund structure



CCM = CICC Capital Management Co., Ltd.; EA = Executing Agency; FI = Financial Intermediation; FMC = Fund Management Company; GP = General Partner; IA = Implementing Agency; MoF = Ministry of Finance; PIC = Private, Institutional and Commercial; PRC = People's Republic of China; QMG = Qingdao Municipal Government; SDIHG = Shangdong Development & Investment Holding Group; SPG = Shandong Provincial Government.

Source: Source: Asian Development Bank. 2020. ADB Briefs No. 144, July 2020.

6.2 EBRD Green Cities Facility

EBRD's Green Cities project as an example of a programmatic approach to a regional facility[29]

Cities in the EBRD's countries of operation play a critical role in the global response to climate change. However, their climate investment needs are significant, with municipalities facing budgetary constraints and limited capacity to structure and deliver 'bankable' projects. In response, the EBRD established a Green Cities Facility to address cities' climate change challenges while building the market

[27] See https://www.greenclimate.fund/project/fp082

[28] See GCF FP082 Catalyzing Climate Finance (Shandong Green Development Fund) https://www.greenclimate.fund/project/fp082

[29] See https://www.greenclimate.fund/project/fp086

case for private-sector investment in sustainable urban infrastructure. The Facility addresses multiple barriers to climate action through four components that: (a) deliver policy and strategy support to cities to assist them in prioritising actions; (b) facilitate green city infrastructure investments; (c) build capacity of key stakeholders; and (d) facilitate and provide a pathway for cities to access green finance and capital markets. This systematic approach is based on a well-developed and tested methodology to develop a Green City Action Plan. The Facility makes concessional financial instruments available. Overall, GCF funding allows the Facility to take on more ambitious investments, more effectively target innovative solutions in new market segments, and further incentivise market participants by reducing financing costs and risks. The Facility's investments will focus on urban infrastructure in six sectors: low-emission and climate resilient buildings, water and wastewater, solid waste, urban transport, municipal energy systems (district heating / cooling) and street lighting.
The €258.6-289.6m facility is supported by a €65m GCF concessional loan and €21m GCF grant, EBRD loan of €133m, additional donor grants of €13.6m and local contributions of 25-56m.

6.3 World Bank Scaling Up Energy Efficiency in Vietnam

World Bank's Vietnam Scaling Up Energy Efficiency for Industrial Enterprises Facility is an example of a risk mitigation mechanism leveraging PIC finance[30]. The project comprises an integrated package of credit risk mitigation, technical assistance and capacity building activities to various stakeholders from public entities to local financial institutions and industrial enterprises, complemented by an IBRD credit line project. This reduces energy efficiency investment market barriers, such as lack of access to finance and capacity of stakeholders, high project risk perceptions, and the existence of an insufficient policy and regulatory framework that governs energy efficiency in the industrial sector. The project comprises two interrelated and closely coordinated components:

- Component 1: USD 78 million GCF Risk Sharing Facility (GCF-RSF)
- Component 2: USD 10 million World Bank and GCF Technical Assistance (WB/GCF-TA)

The project is complemented by an IBRD Loan project: USD 100 million from the World Bank Energy Efficiency Credit Line. The joint implementation of the two components and the IBRD supporting project promotes a market-driven approach to industrial energy efficiency and opens up the commercial lending market to local banks and non-bank financial institutions developing a new energy efficiency product line. The Project will mobilise approximately USD 407.3 million of energy efficiency investments, supporting over 100 industrial companies to reduce energy consumption and generate about 120 MtCO2eq of GHG emission reductions over the lifetime of the investments.

The USD 497m facility is supported by a USD 72m GCF loan and USD 24m grant, World Bank and other cofinancing of USD 147m loan and USD 43m in grants.

6.4 C40 Cities Finance Facility

The C40 Cities Finance Facility is an example of demand side support to programmatic pipelining of climate projects[31]. The CFF is a collaboration of C40 cities and GIZ. The CFF supports cities in developing and emerging economies to develop finance-ready projects to reduce emissions limiting global temperature rise to 1.5°C above pre-industrial levels and strengthen resilience against the impacts of a warming climate. The CFF is funded by BMZ, BEIS and the United States Agency for International Development (USAID).

The CFF works closely with cities to deliver pre-feasibility and feasibility-level assistance to develop "bankable" investments. Based on the cooperation with cities in its pilot phase (Mexico City and Bogotá), the CFF has established follow-up cooperation with C40 cities and non-C40 cities in the vicinity of these existing cities working on projects in similar sectors. Cities were invited to apply for CFF support through informal channels and based on the knowledge of C40 and GIZ about existing project concepts. The objective of the CFF cluster approach is to extend technical support and experiences of C40 cities on innovative projects to smaller sized non-C40 cities – and to take advantage of economies of scale and raise the efficiency and effectiveness of CFF support provided – realising its catalytic and

[30] See https://www.greenclimate.fund/project/fp071
[31] See https://www.c40cff.org/

transformative potential. Such an approach potentially develops pipelines of climate projects that can be financed on a programmatic basis.

7 Guidance For Developing Impactful GCF Urban Projects

The present origination framework seeks to provide "guidance for developing quality project proposals in the sector that fully meet GCF investment criteria."[32] GCF seeks to promote a systemic change in urban systems that focus on the high impact interventions set out above – particularly in emerging high GHG emitting economies and in vulnerable states as urban areas in these countries are both the source of emissions and the locus of vulnerability. The guidance recognises that project outcomes will vary significantly across megacities and secondary cities.

In identifying climate investment priorities within a given city, project proponents and implementers are encouraged to use methodologies that develop pipelines of climate projects suitable for programmatic approaches to financing such as the C40 Climate Action Planning Framework methodology or similar.[33] The process of assessment typically involves extensive consultation and has the following stages:

- Stage 1 – Data collection – primary and secondary sources of information regarding the state of current and future planned infrastructure in the city.
- Stage 2 – Appraisal – assessment of current and planned urban infrastructure in the context of the city's role in accomplishing NDCs, its climate change exposure and vulnerability, and the emissions profile of the city, using spatial analysis, qualitative risk assessment, and expert judgement.
- Stage 3 – Prioritisation of low carbon and climate resilient investment options for the city – utilising semi-quantitative multi-criteria analysis and expert judgement.
- Stage 4 – Programme and project preliminary costing, financing and investment analysis – to develop a prioritised portfolio, assess the financing needs of specific projects, and identify potential pathways for financing options within the city.

The GCF investment criteria need to be applied to each investment project. These criteria are described in the summary below.[34] These criteria and sub-criteria are further detailed in the GCF Programming Manual (see below). This section will elaborate issues relevant to the PSPs and pathways that are specific to the urban sector.

7.1 Impact potential

The project proponent must specify the climate mitigation or adaptation impact. The two core indicators for impact potential are:

- Mitigation core indicator: Total tons of CO2-equivalent to be avoided or reduced per annum. Specific indicators are: 5.0: Strengthened institutional and regulatory systems for low-emission planning and development; 5.1 Institutional and regulatory systems that improve incentives for low-emission planning and development and their effective implementation; and 5.2 Number and level of effective coordination mechanisms. Urban energy efficiency and urban transport (especially emobility) have particular potential to have significannt reductions in the use of energy and the more the existing grid is fed by generation based on fossil fuel, the greater the savings. Facilities designed to finance energy efficient production and retrofitting of energy inefficient capital goods can have a significant impact. If an emobility project can arrange for wheeling of renewable energy across the grid, such savings can be further increased. Similiarly, distributed renewable energy incorporated into new development will replace such generation for the grid.

- Adaptation core indicator - expected total number of direct and indirect beneficiaries and number of beneficiaries relative to total population.[35] Urban flood control projects, when designed to take into account the future impact of climate change, have the potential to

[32] See GCF/B.24/Inf.08/Add.02.

[33] See: https://resourcecentre.c40.org/climate-action-planning-framework-home .

[34] Additional guidance on developing quality proposals in the urban sector is provided in "Guidance Document on Good GCF Project Development in the Urban Sector (GCF/UN-Habitat 2019d).

[35] There are other methods of calculating adaptation benefits but they require higher levels of data input than are commonly available in developing economies.

improve the lives of many urban residents. Such projects do not have to be large scale urban drainage as building the infrastructure in informal settlements will also have a significant impact. Similarly, urban water supply projects desigend to counter the impact of rising sea levels or salt water intrusion, or by changes in rainfall patterns that reduce the yield of raw water can benefit large numbers of citizens. It should be noted that GCF will finance the incremental cost of investment designed to counter the impact of climate change so it is important that such ”additional” investment be clearly documented and justified.

7.2 Paradigm shift potential

In terms of paradigm shift, the application should address its achievement in relation to the factors below. The project proponent should provide the estimates and details of specific activities or investments that will achieve the following:

- Scaling Up and Replication for mitigation and adaptation
  The key ways that a proposal can demonstrate a high potential for scaling-up and replication are to (a) demonstrate sustainable programmatic mechanisms to address pathways, moving from projects to programs (i.e. support to incentives for action on robust urban climate plans; project development systems fostering programme pipelines of viable PSP investments; national financing systems which can handle aggregated financing through standardization of approaches, effective linkage with institutions and IFIs for large scale finance; and IFI engagement programmatic financing structures leveraging PIC finance); and (b) to demonstrate sustainable business models for PSP investments that can be upscaled. These can be “soft” investments such as an early warning system for an individual city that can be scaled up to other nearby cities or “hard” investments such as city-wide mechanisms for distributed energy on buildings, but the proponents should set out specific replication opportunities and a plan for doing so and for documenting inputs and results.

- Innovation
  Innovative ideas or elements should be highlighted and described by the project proponent. These elements can be (a) systemic, addressing the pathways (i.e. support to mandates for, and use of robust urban climate planning methodology for PSPs; support to innovative design & business models for PSPs; support to city PSP investment formulation/ new financing structures including PIC finance; and innovative financing structures leveraging PIC funds for PSP investments); or (b) related to PSP business models or new technologies. It should be emphasized that innovation is not just technical innovation. Many low carbon technologies are relatively well developed but have critical needs for management and or market innovation in order to be impactful.

- Knowledge and Learning
  Any potential for knowledge sharing or learning at a project or institutional level should be highlighted. In particular, collaboration with city networks such as C40 and with urban climate finance networks such as CCFLA in order to spread good practice both nationally and internationally should be highlighted. Technical assistance integrated into projects can, for example, finance knowledge products, capacity development, workshops, community outreach and related costs. An important part of the contribution to knowledge and learning will be the project or program contribution to best practices and technology databases which are the basis for improved project content and effective distribution of best practice.

- Improving the Enabling Environment/ Improving Regulatory Framework and Policies
  The sustainability of outcomes and results beyond the completion of the intervention should be highlighted by the project proponent, for example showcasing systemic changes achieved by policy reforms and capacity gains, as well as setting out the arrangements for long-term and financially sustainable continuation of key outcomes and activities. Collaborations with bilateral agencies or such networks as CFLA to work with governments on improving the enabling frameworks to counter market failures and improve incentive systems relevant to

the pathways (climate planning, project development, city financing systems and links to IFIs and PIC finance) should be highlighted. Further, it is important to stress the importance of cooperation between levels of government (local and state/national) as conceptualized in multi-level governance/vertical integration/collaborative climate action(GIZ 2020).[36]

7.3 Sustainable development potential

The project proponent must provide the expected environmental, social and health, and economic co-benefits. This is important as projects which are "needs driven" and have significant co-benefits will most likely be easier to implement and be sustainable. Where applicable, the description of these benefits should nominate the various Sustainable Development Goals to which they contribute. Also, the proponent must provide an assessment of the gender impacts, which will aim to reduce gender inequalities in climate change impacts.

- Economic co-benefits are often very significant in urban climate projects and should be detailed. Both in respect to mitigation and adaptation projects, tangible economic benefits are quantifiable in terms of jobs created, reduction in health costs, efficiency in transport of people and goods, and costs avoided relating to flooding, or other events. The latter will often be a significant contribution to Disaster Risk Reduction strategies. The assessment of these can be integrated into project assessment process and indeed, with many AEs are an essential part of the assessment of the project.

- Social co-benefits of urban projects are also usually large and should be described. They include improved access to education, cultural preservation, and health and safety. Many AEs already have safeguards in place that will ensure that no harm will result from the project, but a more proactive description of such benefits as increased community involvement and education, limits to negative health effects and safety promotion, should be set out. Projects and programmes can also lead, at a higher level, to active adoption of climate positive action by stakeholders involved, building their community resilience to climate change impacts. Good design will ensure that the investment benefits are shared by lower income/ disadvantaged or vulnerable groups in terms of employment, community participation and quality of life but once again will often need to proactively address the issues posed by informality particularly in relation to economic activities and tenure systems. Where possible, it is important to establish a baseline assessment in each impact area so as to more accurately assess project impact.
  In relation to gender, many AEs have stringent gender policy needs which will need to be addressed adequately and described in the GCF FP. A Gender Plan and a Gender Action Plan are required for the FP.[37] Good project design supports proactive involvement of women in project planning and implementation and as the clear beneficiaries of targeted interventions. Such measures can build needed community support and awareness. Technical assistance integrated into projects can finance knowledge products, workshops, community outreach and specific education programmes designed to ensure women directly benefit.

- Environmental co-benefits include improved air quality, water and soil quality, and biodiversity. AEs often have strong and well-established urban safeguards in this area. Projects and programmes can act as catalyst for broader adoption of policies and process which will provide significant co-benefits such a better air or water quality in the project area, but also, if of sufficient size, in the broader region or in other regions.

[36] See for example "Recover green: Higher NDC-Ambition through Collaborative Climate Action" https://collaborative-climate-action.org/wp-content/uploads/2020/07/Recover_Green-Higher_NDC_Ambition_through_CCA.pdf

[37] See GCF *Mainstreaming Gender in GCF Projects.*

7.4 Needs of recipient

Critical to the proposal will be an assessment of the rationale for the specific type and quantum of financing required based on a review of gaps in the existing financing mechanisms applicable to the sector and on the needs of the beneficiaries.

- Justification of GCF financing: for example, if, due to risk mispricing or less developed capital markets, there are no alternative sources of financing. Project proponents may describe the barriers that created the lack of alternative funding sources for the project or programme or the unsuitability of the terms of available finance such as tenor of loan. Also, in relation to the leveraging of GCF funds, proponents may set out the justification for the use of blended finance mechanisms to bridge the gap between the current returns on climate-positive investments and the baseline returns needed by private sector investors.

- Vulnerability levels: this section is intended to describe the specific vulnerabilities implied by benefits declared under the impact criterion, setting out the scale and intensity of potential climate impacts on both the country and on project beneficiary groups. Examples could include the exposure of people, social or economic assets or capital in urban areas to risks derived from climate change. Any activities designed to support especially vulnerable groups such as informal settlers should be highlighted.

7.5 Country ownership

Ownership is critical to the success of the project. The project proponent must provide details of:

- Coherence and alignment with national and subnational climate strategies and priorities: refer to long-term low greenhouse gas emission development strategies, NAMAs, NAPs, NDCs, Technology Needs Assessments (TNAs) or others, as appropriate. Demonstrated commitment from cities is also important. Where cities have their own climate plans or localised NDCs and NAPs, reference should be made to these as a context for the project as well as to overall city development plans. Alignment with national GRR plans, where they exist, should also be set out.

- Capacity of project proponent to deliver a climate project: the project proponent should provide a brief description of how the project will be implemented (e.g. local developers, partners and service providers), and the roles these entities will play, respectively. The track record and relevant experience of the entities in similar or relevant project or programme circumstances can be elaborated.

- Stakeholder engagement process and feedback received from civil society organisations and other relevant stakeholders: the consultative process must be emphasised in the description of the country ownership, both with the relevant national designated authority and with the wider group of stakeholders – including women. Establishing clear transparency and stakeholder engagement criteria would help to meaningfully engage citizens in shaping green solutions for cities that would serve their needs and will make them active participants in developing their cities while ensuring sustainability and cohesion in the cities development.

In the case of secondary cities, involvement of, and approvals by, higher levels of government may be necessary. In such cases, the agencies of higher levels of government become critical stakeholders in formulating the project or programme.

7.6 Efficiency and effectiveness

Economic and financial analysis primarily drives the efficiency and effectiveness criterion, and the application should make the case for strong cost effectiveness and financial soundness. The efficiency and effectiveness of the proposed financial structure is particularly important, as the requested funding should be the appropriate amount necessary, and in the proper form (i.e. proposed financial instrument) to make the project or programme viable, but not more. Two indicators under this criterion are standard tests of viability for any development financing institution:

- Economic Internal Rate of Return (EIRR);[38] and
- Financial Internal Rate of return (FIRR).

The project proponent must provide estimated values and supporting justification and assumptions, including the calculation methodology and citations of relevant studies, for these core indicators. In addition, two other indicators are needed:

- For mitigation, the estimated cost per tCO2 eq. (total investment cost/expected lifetime emission reductions), and for adaptation the estimated number of beneficiaries per amount of both GCF funding and total financing. An assessment of the efficiency of the intervention benchmarked against relevant comparators should be provided.

- Expected volume of finance to be leveraged as a result of the fund's financing, disaggregated by public and private sources

In general, the economic and financial analysis, including the financial model if applicable, should guide the preparation of the response to this criterion. Project proponents should set out, in particular, the assessment of financial viability, the appropriateness (need for) of using concessional funds; and of how the proposed financial structure (funding amount, financial instruments, tenor and term) is adequate and reasonable to achieve the goals of the project.

7.7 Assumptions and risks

Project proponents also need to set out the assumptions and risks applicable to the project. Key risks in the urban sector are usually policy consistency especially across administrations, financial management capacity (including currency mismatch), compliance to GCF and AE procurement rules and policies, and environmental and social risks. In addition, other risks relate to project readiness (e.g. land acquisition and resettlement) and financial risks in terms of poor projections of revenues or costs. There are also risks associated with the actual implementation of the project, for example, projects or programmes to develop climate-friendly cities, buildings and urban systems may have their own environmental and social consequences, such as fragmentation of wildlife habitat, introduction of invasive species, extreme urbanization, involuntary resettlement, air pollution, etc.

Risk mitigation usually involves action at two levels. The first, at the institutional level, is to ensure the project involves partnerships among institutions which have strong relationships with regulators and strong incentives to maintain continuing relationships among participants and involved communities, and to ensure the involved organisations are technically sound. The second, at the operational level, includes providing (a) support to set up effective financial management (including exchange rate management), MRV and environmental and social safeguards (ESS)[39] systems and (b) technical assistance during implementation to support the local financial institutions and project sponsors to use such systems proactively so as to manage risks. Where possible, projects and programmes should use project sponsors that are familiar with IFI levels of rigor in project implementation.

7.8 General GCF guidance

Project Proponents should also consult the **Programming Manual**[40] to guide their project formulation and documentation process. This manual presents the GCF programming modalities and processes, and outlines the roles of key stakeholders throughout the project cycle. The key objective of the Programming Manual is to create a better understanding of how the GCF works for our key partners, notably by the project origination, development, appraisal, approval and implementation roles, responsibilities, tools and processes. The Programming Manual also provides guidance for our partners on how to prepare and submit a funding proposal that meets all GCF investment criteria.

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[38] If it is not possible to undertake an economic (social) Cost Benefit Analysis to derive an EIRR then Cost Effectiveness Analysis can be used. The analysis should include both costs and benefits of decarbonisation and adaptation action and of social impacts.

[39] International financing AEs have relatively aligned safeguards systems that serve as models and will need to be applied in parallel with GCF requirements if they are participating in a GCF project.

[40] https://www.greenclimate.fund/document/programming-manual

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