The State of Cities Climate Finance

Part 1: The Landscape of Urban Climate Finance

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CITIES CLIMATE FINANCE LEADERSHIP ALLIANCE

CLIMATE POLICY INITIATIVE

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ABOUT THE CITIES CLIMATE FINANCE LEADERSHIP ALLIANCE

The Cities Climate Finance Leadership Alliance is a coalition of leaders committed to deploying finance for city-level climate action at scale by 2030. Trillions of dollars will be required to help cities build the low-emissions, resilient infrastructure necessary to combat and react to climate change. The Cities Climate Finance Leadership Alliance is the only multi-level and multi-stakeholder coalition aimed at closing the investment gap for urban subnational climate projects and infrastructure worldwide.

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1. INTRODUCTION

Finance for climate action in cities is unquestionably needed in global efforts to address climate change. Cities are primary protagonists in both producing emissions and suffering the consequences of climate change, with acute socioeconomic impacts resulting from extreme weather events increasingly affecting a rapidly urbanizing population (CDP, 2018; UN DESA, 2019). The anticipated growth of cities, however, is an opportunity to harness local-level decision-making to satisfy city dwellers' demand to build a cleaner and more resilient living environment. The United Nations' Sustainable Development Goal (SDG) 11, which targets making cities and human settlements inclusive, safe, resilient, and sustainable, will also require cities to accelerate and increase their provision of sustainable infrastructure and services while reducing their mortality and morbidity related to climate disasters and air pollution.

Trillions will be required annually by 2050 to address climate risks for urban infrastructure. Urban infrastructure investment needs have been estimated at USD 4.5 – 5.4 trillion per annum from 2015-2030 with a portion of this (10-25%) related to additional investment costs or incremental costs to ensure infrastructure is low emission and climate resilient (Alliance, 2015). Specifically on adaptation, cities need significant sums of capital, with the World Bank estimating that between USD 11-20 billion will be required annually by 2050 to address climate risks for urban infrastructure[1].

The 2021 State of Cities Climate Finance report, produced by the Cities Climate Finance Leadership Alliance, provides a snapshot of the current state of global financial preparedness at the city level, informing the Alliance's goal of mobilizing finance for city-level climate action at scale by 2030. The report is divided in two parts: Part 1 is focused on estimating and characterizing current urban climate finance volumes; Part 2 is dedicated to analyzing the enabling frameworks for financing climate-smart infrastructure at the city level (see Executive Summary). Both sections seek to review the current state of play of climate finance in cities and highlight key gaps in knowledge or investment that need to be filled.

Part 1, The Landscape of Urban Climate Finance, provides a framework for consolidated tracking estimates of urban climate financial flows, which can be used in the future to monitor and benchmark progress, and to provide a building block to improve funding performance. In this report, we estimate how much capital is being invested to address climate change mitigation and adaptation in cities and how much of an investment gap exists at a global scale. As the first comprehensive review of the landscape of cities' climate finance, we have developed a working definition of urban climate finance and proposed a methodological approach for tracking relevant investment flows, which are also outlined in this report.

1 It is not possible to make a precise comparison of needs estimates with estimates of current flows of finance in this report as the latter aggregates estimates and data reported by different entities under different principles whereby some data relates to total costs of mitigation and adaptation projects while other data (e.g., MDB joint reporting) includes only components of projects specifically related to adaptation or mitigation (potentially synonymous with incremental cost). Nonetheless, we understand that the majority of current investment flows captured do relate to total project costs. Hence, current flows do appear to be of an order of magnitude below required levels

Using this framework, we estimate that an average of USD 384 billion was invested in urban climate finance annually in 2017-2018. The Alliance includes all sources of finance flowing to and within cities and channeled by both public and private actors. Where possible, we analyzed all facets of the investment, including the sources of finance, the financial instruments used, the geographical location of the investment, and the sectors and activities supported. The first analysis on financial instruments includes a deeper look into how certain urban sectors are typically financed and how innovative financial mechanisms can work to catalyze more capital at the city level. The second, sectoral analysis expands and contextualizes the landscape of finance for urban adaptation.

Throughout this report, we emphasize two sectors: sustainable urban transport and green buildings, which together produce an estimated 70% of urban emissions in C40 cities[2] (C40 & McKinsey, 2017). Both sectors are significant to climate mitigation in the urban context, not only because of their investment opportunities (IFC, 2018), but also due to their large potential to reduce emissions (CUT, 2019).

This paper has six main sections:

- Section 2 explores the role of cities and the challenges they face to access urban climate finance, considering the need and importance of tracking urban climate flows globally.
- Section 3 introduces the Alliance's approach and framework for tracking urban climate finance, which includes definitions and a discussion on methodological challenges.
- Section 4 presents overall estimates of climate finance flows, which aggregates project-level data and sector-level capital expenditure estimates.
- Section 5 highlights the providers of urban climate finance and the volume of investment in different geographies.
- Section 6 highlights which sectors and activities are the most recent focus of investments, highlighting volumes of urban mitigation and adaptation flows, including a focus on innovative financial models in urban climate finance.
- Finally, Section 7 provides recommendations to the Alliance's main stakeholders on how to scale urban climate investment in cities, based on the results of this report.

Due to data availability, this report uses mainly data from 2017-2018 in its analysis. According to CPI's updated view on the Global Landscape of Climate Finance 2019, preliminary estimates suggest a 6-8% increase in climate finance for 2019 compared to the 2017-2018 average. In this period, several development banks have signaled intention to lead on climate action and are taking concrete steps to do so in their investment strategy, including increasing their climate finance commitments to USD 61.5 billion in 2019 compared to USD 43.1 billion in 2018, which should include urban climate finance as well. Investments in eclectic vehicles is also expected to increase by 6% in 2019 compared to the previous year.

2 C40 Cities consist of more than 90 cities that represent more than 700 million citizens around the world (C40, 2021; C40, 2019a).

The impact of COVID-19 on climate finance, and specifically on urban climate finance, is yet to be measured and will vary considerably across different contexts. The green recovery stimulus packages announced so far, covering sectors such as low-carbon mobility, energy efficiency and other infrastructure sectors have mostly been created for developed economies. Countries in middle- and low-income economies, some of which are still dealing with a high number of cases of COVID-19 and without a clear end in sight for this crisis, have been hit with declining resource mobilization. Cities have also had a considerable reduction in their revenues and budgetary priorities, which can also affect resource allocation for urban climate finance.

2. CHALLENGES OF MOBILIZING URBAN CLIMATE FINANCE

2.1 CITIES PLAY A CRITICAL ROLE IN ADDRESSING CLIMATE CHANGE

Seventy percent of cities globally are already experiencing the effects of climate change, with an even larger number expected to face a dramatic change in climate conditions by 2050 (C40, 2012; Bastin et al., 2019). Ninety percent of cities are at risk of flooding from sea-level rise and storms due to their coastal location. Flooding events in coastal cities currently generate average annual losses of USD 6 billion, which could rise up to USD 52 billion by 2050 (C40, 2012; Hallegatte et al., 2013). In addition to financial repercussions caused by direct physical damages, indirect issues, such as the severe interruption of business operations or rising credit constraints of cities with budgets potentially affected by unexpected extreme weather-related expenditures, all contribute to cities being at high risk from climate hazards (C40, 2012).

In addition to their unique vulnerability to climate change, cities contribute 70% of global CO2 emissions, use 75% of all the natural resources, and produce 50% of all waste (UN HABITAT, 2011; UNEP, 2015). Without rapid action, this concentration of emissions will strengthen as approximately 2.5-3 billion people are expected to move from rural to urban areas by 2050. Half of this global urban population growth is expected to be in Africa and Asia (UN DESA, 2019). Notably, 60% of the needed infrastructure in those urban areas anticipated to accelerate in population growth by 2030 is not yet built, especially in emerging economies (NCE, 2018; ODI, 2019). Therefore, there is an urgent need — and opportunity — to build new infrastructure compatible with climate goals while transforming the existing infrastructure to more low-carbon and resilient systems.

On a more positive note, cities are increasingly seen as focal points of climate action decision-making. According to the OECD, in a sample of 30 countries, subnational governments were responsible for 55% of environmental and climate related spending on average over 2000-2016 (OECD 2019). City dwellers increasingly demand improvements of local environmental conditions in response to climate change impacts as well as related environmental issues. The health impacts of air pollution, which causes 7 million premature deaths annually (WHO, 2018), is also a strong motivator for city-level action in sectors such as transport. Compared to policies imposed at a national and international scale, decision-making by city officials has a more direct and immediate impact on city residents. Local-scale actions provide an opportunity for local stakeholders and experts to identify local needs and allows engagement with city residents, facilitating the development of targeted solutions. However, the authority and autonomy of cities to make these decisions may vary considerably, especially in developing countries. In countries like India, decision-making is often held in the state level (forthcoming Alliance research).

The concentrated nature of cities also allows for lower carbon footprints when services are planned and delivered efficiently (WEF, 2019). For instance, cities have great potential to scale up renewable energy use and to incorporate renewables into their services such as waste management, public transport, and public housing with the installation of solar photovoltaics (PV), electric vehicle (EV) charging points, and waste-to-energy systems (REN21, 2019). Considering the lifespan of infrastructure assets, investments made today determine how cities grow and 'lock-in' emissions pathways. Urban expansion will determine emissions across several sectors and can be a catalyst for adopting clean and low carbon infrastructure, buildings, and technologies (IPCC, 2018).

2.2 CITY GOVERNMENTS FACE MAJOR CHALLENGES IN ACCESSING FINANCE

Despite the critical role cities play in ensuring that Paris Agreement objectives are met, city governments currently face significant challenges in unlocking the finance required to close the investment gap to reach required levels of capital to address climate change. These access challenges are not only financial but also institutional and political, particularly in emerging economies.

Local governments often have budget capacity constraints and are unable to finance the large volumes of climate-smart infrastructure needed to realize climate transitions. Access to finance is often limited by the high levels of debt and low rates of creditworthiness. The World Bank indicates that, of the 500 largest cities in emerging economies, only 21% have investment grade credit ratings, and 4% are in low-income countries (World Bank, 2019). In addition, studies suggest that 56% of countries forbid any kind of borrowing by local governments (including the issuance of municipal bonds), and only 16% of countries allow any taxation powers (World Bank, 2012; NCE, 2019). As a result, many cities globally are severely restricted in raising sufficient capital to finance their projects. In addition, studies suggest that 56% of countries forbid any kind of borrowing by local governments (including the issuance of municipal bonds), and only 16% of countries allow any taxation powers (World Bank, 2012; NCE, 2019). As a result, many cities globally are severely restricted in raising sufficient capital to finance their projects.

Local governments also often lack the capacity to prepare infrastructure project proposals for private and public investment. While various project support facilities have been developed over the years, cities have much larger needs than the support these existing facilities can provide (Alliance, 2018). Lack of investor-ready bankable projects of sufficient size and quality is one of the major roadblocks to scaling up urban finance (WBG and UNDP, 2020). Furthermore, many project proposals prepared for private investors lack detailed evidence on financial viability and sustainability (Climate-KIC, 2016). Private investors are often not aware of sustainable urban infrastructure opportunities at the subnational level (ODI, 2019; UNFCCC, 2019) and their financial products are often not tailored to the needs of city governments.

Other institutional and political barriers exist for cities, including the inherent conflict between long-term development and city budgeting cycles (Climate-KIC, 2015). In cities in several low-to-middle-income countries, intergovernmental fiscal resources are distributed unevenly, with limited spending autonomy or may be blocked by corruption and political and cross-government differences (Floater et. al, 2017). Also, these intergovernmental transfers are targeted to specific areas (education, health) and do not integrate climate or environmental criteria in their use. Furthermore, sovereign macroeconomic risks often prevent long-term private investment in emerging economies which in turn impacts cities. More locally, the mismatch of the scope of infrastructure projects with the administrative boundaries of cities can also create political conflicts (ODI, 2019). Finally, many international public investors, particularly from multilateral development banks, require international funding to be channeled through the national government (World Bank, 2019), making urban-related climate finance inaccessible for some cities.

Box 1: The work of the Alliance in supporting to address the finance gap through exchange between project preparation facilities

The lack of bankable projects is constantly pointed as one of the main reasons why cities, especially in the Global South, cannot access finance for low carbon infrastructure projects. In the recent years, project preparation facilities (PPFs) have gained space to support cities in preparing projects, through technical assistance and capacity development, to better access funding.

The Alliance's Project Preparation Action Group (PPAG) is a forum through which PPFs can exchange learnings and discuss the challenges of preparing projects and bringing them to a bankability stage for financing. It does this through activities led either by the Alliance Secretariat or by its members, assessing common challenges, developing knowledge products, and organizing events for cities and other relevant audiences.

In the past year, the PPAG has developed solutions such as a harmonized application form for project identification for PPF support and a glossary for project preparation work.

Among the knowledge activities produced, the PPAG and its members have developed a think piece on project preparation benefits (led by C40CFF, forthcoming) and is currently developing and testing integration of PPF knowledge and its suitability for pilot projects on SOURCE, a platform for sustainable infrastructure.

Finally, it also supports learning and networking opportunities such as a Project Preparation Readiness Program, led by FELICITY, and a Project Practitioners Forum in Mexico led by ICLEI and FMDV, who are also currently assessing replication of these events in other geographies.

2.2.1 COVID-19 HAS INCREASED MANY OF THESE CHALLENGES

For cities that were already facing considerable challenges in accessing climate finance, the health and economic crisis generated by COVID-19 has worsened this scenario. According to UN-HABITAT, the majority of COVID-19 cases have been in urban areas, with poor and more densely populated areas being the most deeply affected (UN Habitat, 2020). The health crisis has resulted in a major economic and social crisis. Cities have a key role to play in the short and long-term recovery process to rebuild from the pandemic.

However, in the wake of COVID-19, some cities are also facing decreasing revenues from transfers, local taxes, and service fees, such as transport fees which are often large sources of revenue for local governments. Cities are also facing increased expenditures for healthcare, social protection, and basic services. Even cities that are able to cover their operating expenditures have been forced to significantly decrease or stop all capital expenditures. While the crisis puts short term pressure on health and social expenditure, its strongest impact on subnational budgets is expected in the medium term (OECD, 2020). Larger climate-smart infrastructure and capital expenditures are being put on hold to allocate more financing for operational needs.

Cities will need to respond to the COVID-19 pandemic with a long-term vision that integrates green and resilient recovery. However, accessing finance will remain a major hurdle. According to the Alliance's report on COVID-19 recovery, USD 20.5 trillion had been pledged for COVID-19 relief globally through October 2020 (the Alliance, 2020b) by national governments, development finance institutions, and the private sector. Yet only USD 1.1 trillion of this relief was promised in whole or in part to cities. Over 80% of this amount (about USD 916 billion) was directed toward short-term liquidity needs to replace lost revenue from taxes and fees in cities.

More money still needs to be channeled towards cities for long-term challenges and climate-smart infrastructure investments. Addressing the challenges cities face accessing green recovery funds (see Box 2) are an important first step.

Box 2: How to better use green recovery funds for urban climate finance

Key funders – such as national governments, development finance institutions (DFI), and climate funds – should improve cities' ability to borrow and access international public funds. Most cities need to go through their national governments to have access to public international finance, leading to a lack of local control over municipalities' resources. Some of the solutions presented to this challenge by the Alliance's latest report on COVID-19 and green recovery funds are:

- Provide fiscal support for local governments so that they can maintain their credit ratings and borrowing capacity.
- Earmark funds for urban climate finance to facilitate a green recovery.
- Design DFI-sponsored instruments to allow cities direct access to funding, rather than having to access capital from a sovereign loan.

Source: Analysis from "Urban Climate Finance in the Wake of COVID-19" (Alliance, 2020b) policy brief.

3. APPROACH TO TRACKING URBAN CLIMATE FINANCE

3.1 URBAN CLIMATE FINANCE TRACKING HELPS MONITOR PROGRESS AND MOBILIZE SUPPORT

This report provides a framework for consolidated tracking estimates of urban climate finance flows, which can be used to monitor and benchmark progress against climate objectives and Nationally Determined Contributions (NDCs) over time. This snapshot of the volume, sources, and destinations of finance provides valuable suggestions on where investment and public support may be insufficient or lacking.

Estimates of investment volumes, when compared with investment needs, can be a powerful motivation for stakeholders to address the barriers that hinder climate capital flows in cities. Tracking data, if comprehensive and accurate, can help identify gaps and opportunities, to ensure a more effective deployment of national, local, and international resources, policies, and incentives. Key actors and providers of climate finance at the city level can be identified as well as sectors and activities that are potentially underfunded or under-supported. Tracking and estimating climate investment can also offer insights on the financial instruments currently employed to finance urban infrastructure and contribute to strategic thinking about whether other financial mechanisms could help bring more capital to cities for identified needs.

While tracking climate finance has been conducted at a global and national level[3], tracking at the subnational level is currently lacking.

While this report focuses on estimating urban climate finance at the global level, tracking investment in a specific city can be very beneficial, especially against NDCs, local objectives, and climate plans. Investment data can be analyzed more effectively at the local level to calculate impact, for example GHG emission reductions in a given year. Importantly, increased transparency of local budgets, with climate-relevant tagging, can increase accountability and trust with city dwellers, donors, and other stakeholders. Tracking climate finance provides an opportunity to engage stakeholders, opening dialogues to potentially identify future co-financing opportunities. Finally, tracking progress can help reformulate more detailed policies and targets for the future.

3 Global and national level tracking has been conducted by Climate Policy Initiative, particularly through the Global Landscape of Climate Finance (CPI, 2019).

Local government budget structures may also vary from country to country, and even within cities in the same country, which complicates identifying climate investment. Cities and government agencies often do not tag budget expenditures for mitigation and adaptation relevance.

Box 3: OECD approach for subnational climate finance tracking

To address urban climate finance data limitations, the Organisation for Economic Co-operation and Development (OECD) carried out a pilot study in 2018-2019 to develop a preliminary methodology for classifying environment and climate-related expenditure and investment at the subnational government level. The methodology is based on a top-down approach using National Accounts data and the Classifications of the Functions of Government expenditure classification system (OECD, 2019). The results of the study showed that subnational governments generate a significant proportion of climate-related public expenditure and investment. In 2016, across 30 OECD countries, subnational governments accounted for 55% of public spending and 64% of public investment related to the environment and climate, on average. The study also revealed the need for an international standardized methodology to enhance the tracking and measurement of subnational public expenditure and investment related to climate priorities.

With this in mind, in 2020 the OECD and the European Commission launched a new joint project to develop a standardized methodology for tracking and measuring subnational government climate finance. The project has three streams of work: a literature review of the state-of-play of climate finance tracking initiatives and methodologies; a macro-level analysis making use of the EU Taxonomy to identify climate-related expenditure for subnational government climate finance; The fiscal database will be complemented by a qualitative compendium of international, national, and local-level frameworks and fiscal instruments that support subnational government climate action in EU and OECD countries. and a micro-level analysis, featuring two case studies (one city-focused, one regional) consisting of a subnational green budgetary analysis from both the expenditure and the revenue sides.

To achieve these aims, this joint project will be important to connect and collaborate with key stakeholders and networks in the subnational climate finance space, in particular with Cities Climate Finance Leadership Alliance and its members.

Source: This box content was produced by the Decentralisation, Public Investment and Subnational Finance Unit of the Centre for Entrepreneurship, SMEs, Regions and Cities at the OECD. http://www.oecd.org/cfe/regionaldevelopment/Project%20Brief.pdf

3.2 THE ALLIANCE'S APPROACH TO TRACKING AND ESTIMATING URBAN CLIMATE FINANCE

The Alliance's analysis aims to provide as comprehensive as possible an overview of existing investments and expenditures supporting climate mitigation and adaptation objectives at the city level. While this topic is referred to as "climate finance" in shorthand, we include all sources of finance flowing within cities, and channeled by all types of actors, both public and private towards climate mitigation and adaptation. Where possible, we analyze the investment's key characteristics, including the sources of finance, the financial instruments used, the geographical location of the investment, and the sectors and activities supported.

Our estimates combine reported project-level investment commitment data for every sector and additional capital expenditures estimates for the transport and building sectors only, calculated using installed capacity and unit cost data. Reported project-level commitment data has a large amount of data gaps, particularly related to private and domestic public, and the complementary estimations are a first attempt in providing a more comprehensive picture of total urban climate finance. Capital expenditure data includes general figures on investment in buildings energy efficiency and renewable energy, paired with assumptions to downscale this expenditure to the urban level; transport estimates include, for example, the number of additional electric buses multiplied by conservative unit costs (see the methodology Annex for more detail on the approach and activities estimated). Project-level data and capital expenditure estimates are combined (with due care taken to avoid double counting), to give a more realistic estimate of the potential magnitude of urban climate finance.

Following the methodology outlined in the Global Landscape of Climate Finance (CPI, 2019), data sources for project-level commitments include the OECD Creditor Reporting System (CRS) database, World Bank Public-Private Infrastructure data, Bloomberg New Energy Finance, Climate Funds Update, Climate Bonds Initiative, and dedicated surveys to development finance institutions (DFIs). This approach captures projects that reached financial closure in 2017 and 2018, as opposed to calculating disbursements of capital.

Granular commitment data reveal detailed information on financial flows, including the financial provider, the financial instrument used, as well as the regions and sectors receiving the capital. While project-level data allow us to understand financing flows in more granularity and with more confidence, comprehensive data for every sector are lacking, and it is therefore also useful to complement the data with top-down capital expenditure data for key sectors to produce a more comprehensive picture of the level of investment currently captured in cities.

Urban transport and green buildings were chosen as key sectors in the urban context, not only because of their investment opportunities (IFC, 2018) but also for their large potential to reduce emissions (CUT, 2019) as they together produce an estimated 70% of urban emissions in C40 cities (C40 & McKinsey, 2017). However, our conceptual framework and project-level data collection includes other key sectors that may be under-represented in project finance reporting and would ideally be expanded on by future editions of the Landscape of Urban Climate Finance through focused estimation methods.

To understand better how public and private climate investment flows are being channeled in cities, additional analysis on financial instruments includes a deeper look into how certain urban sectors are typically financed and how innovative financial mechanisms can work to catalyze more capital. Further analysis and contextualization of finance for urban adaptation are provided in the sectoral analysis.

3.3 DEFINITIONS AND FRAMEWORK OF URBAN CLIMATE FINANCE

The definitions used in this report are based on the definitions of climate finance developed by Climate Policy Initiative (CPI) for mitigation and adaptation projects in the Global Landscape of Climate Finance (CPI, 2019)[4].

These definitions were adapted to the urban context, in particular, to delineate whether projects could be considered urban.

4 CPI's definition of climate finance is based on the tracking and reporting methodologies developed by the joint group of Multilateral Development Banks, members of the International Development Finance Club, the OECD's Development Assistance Committee, and the group of Multilateral Climate Funds that reports commitments through the Climate Funds Update (MDB, 2019; OECD, 2018; ODI & HBF, 2020). See CPI's Global Landscape methodology for more details on the approach adopted by CPI (CPI, 2019).

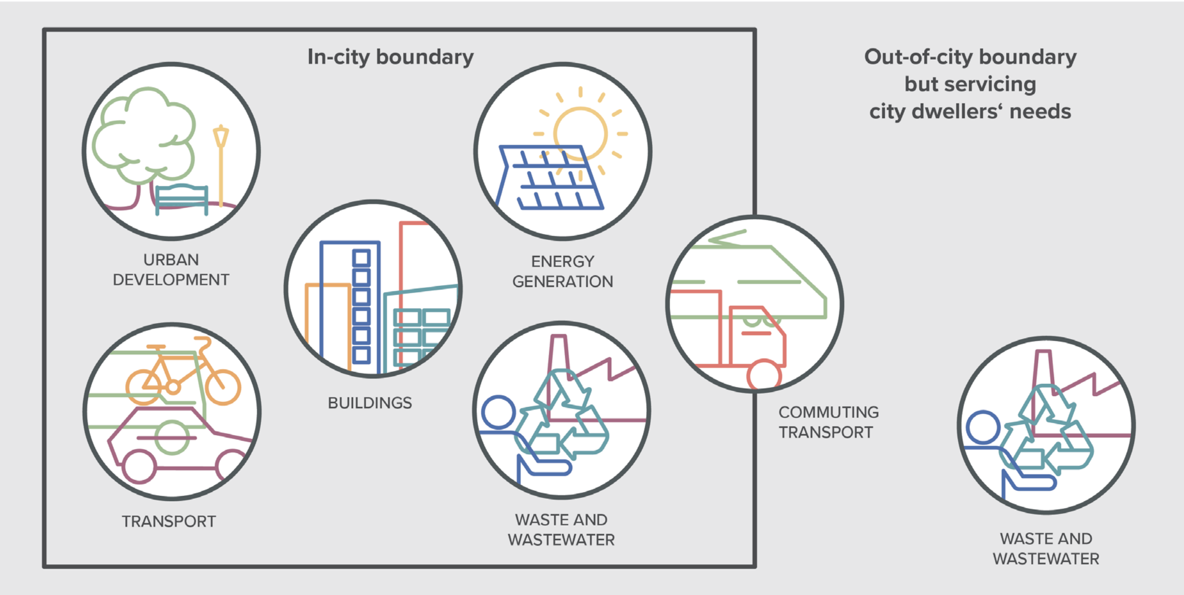
Throughout this report, **urban climate finance** refers to resources directed to activities limiting city-induced GHG emissions or aiming to address climate-related risks faced by cities, contributing to resilience and low carbon development.

Urban geographic boundaries are defined geopolitically, although this is challenging to apply globally as governance structures vary. To identify projects in practice, we used the Functional Urban Areas (FUA) boundaries developed by the OECD in partnership with the European Commission, which include both urban and nearby commuting areas to define physical boundaries for a city.

Urban climate finance refers to resources directed to activities limiting city-induced GHG emissions or aiming to address climate-related risks faced by cities, contributing to resilience and low carbon development.

Urban climate mitigation is defined as projects and interventions contributing to reducing or avoiding GHG emissions from sources located within a city's boundaries or for those produced as a consequence of activities occurring in the city exclusively. This framing of mitigation activities follows the approach of the Global Protocol for Community-scale GHG Emissions Inventories (GPC), which offers cities a comprehensive greenhouse gas emission accounting framework and is used by cities reporting through CDP-ICLEI Unified Reporting System (C40, ICLEI, WRI, 2014). Some examples of climate mitigation activities are technological energy efficiency improvements in buildings and wastewater treatment facilities. The conceptual framing of urban climate mitigation activities and geographic boundaries is illustrated in Figure 1.

Figure 1. Urban inclusion boundaries for climate change mitigation



Note: To account exclusively for urban climate finance, activities such as large-scale renewable energy projects and agriculture activities located outside of urban boundaries and inter-urban transport were excluded when it could not be determined that such activities were for the sole benefit of urban dwellers. Waste management facilities that serve cities exclusively were included. See the Methodology section in the Annex for a detailed taxonomy and urban inclusion rules.

Urban climate adaptation refers to projects and interventions that aim to maintain or increase the adaptive capacity and resilience of cities and urban communities in response to climate-related risks affecting cities directly. Examples of climate adaptation include the reinforcement of river basins, dams, and wastewater collection to reduce vulnerability to extreme weather events.

This report presents the first comprehensive taxonomy for urban mitigation and adaptation. Sector-specific rules to include climate finance projects for urban relevance were layered on to the definitions of climate finance used in the Global Landscape of Climate Finance (CPI, 2019).[5] For climate mitigation, the project should be contributing to reducing GHG emissions within city boundaries for most sectors, while waste management projects were considered as urban-relevant if they aimed to reduce GHG emissions resulting from activities occurring within the city. For climate adaptation, projects were included if they were located within city boundaries or if they aimed to address a climate risk faced by the city, depending on the type of activity. See the Annex for a detailed note on methodology and taxonomy.

3.4 CHALLENGES TRACKING URBAN CLIMATE FINANCE

Tracking urban climate finance remains challenging despite its clear benefits. A foremost challenge is that there is no universally accepted definition for "urban" or "city" or of city boundaries, which differ across countries. And lack of georeferenced project-level investment data means it is difficult to identify city investments in existing investment datasets.

The role of city governmental budgets, in particular, is especially complex although recent work from the OECD and the European Commission has made progress improving urban tracking work (OECD/EU, 2020), setting urban boundaries on projects deployed at the national level, for instance.

Many city governments around the globe have different decision-making powers over their sectors, often sharing responsibilities with national governments on providing services directly to city dwellers, which makes it more challenging to provide the sole urban component.

Existing investment datasets rarely provide urban tagging. Tagging and reporting of urban projects is not yet widely adopted by donors, development finance institutions, and local governments. Where reporting does exist, it is not yet harmonized. For instance, donor datasets like the OECD CRS include sector categories for urban development or urban transport, but projects financed in other sectors are not yet tagged for urban relevance in the way they are for climate or gender relevance.

5 It is important to note that, as climate finance projects are tagged for urban relevance using the defined rules, their qualifying as urban climate finance does not translate directly to the remaining climate finance projects as being relevant for rural geographies only. The urban inclusion rules necessitate the projects to be either explicitly urban because of their physical location, the information that it was procured by the city, or if project description clearly states urban dwellers as main beneficiaries, all of which are dependent on project documentation. Furthermore, national-scale projects are particularly challenging to delineate for urban relevance.

Similar to tracking climate finance in general (CPI, 2019), capital committed by private entities is challenging to capture, too. In the context of cities, it is particularly challenging to disentangle private and public finance for urban projects, where public-private partnerships are common. In addition, limited disclosure from private actors, as well as a general lack of standardized reporting of data, is a challenge for key urban sectors. Additional analysis conducted for the transport and buildings sectors illustrated the challenge of identifying investment in centralized databases.

Box 4: Addressing data gaps and double counting in the landscape

The total USD 384 billion of urban climate finance reported in this report includes figures from project-level data (corresponding to USD 75 billion) and estimated capital expenditure data (USD 308 billion) that relate to the deployment of capital for long-term transport and building infrastructure.

As Figure 2 shows, project-level data consists primarily of international public finance for most sectors, which includes measures such as capacity building. In contrast, the capital expenditure estimates for transport and buildings, where sectoral added capacity is combined with unit costs to estimate investment, corresponds to infrastructure expenditure that is more likely to originate from domestic public or private financiers. Including both thus shows a complete picture of the potential size of the financing going to urban climate mitigation and adaptation projects. See the methodology note in the Annex for a more detailed explanation of how these numbers were estimated.

While some estimated infrastructure investments may not correspond to the same exact timeframe as project-level data, potential double counting between the two approaches was mitigated in the analysis through manual checks of project-level data. Capital expenditure corresponding to building energy efficiency and transport infrastructure sub-sectors that were deemed to be potentially overlapping with investment project-level estimates were removed from the reported numbers. For example, estimated investment in urban mass rapid transit infrastructure that may have also been captured in project-level data was removed from the total urban climate finance figure.

Figure 2. Urban climate flows estimated, coverage by sector and provider type, annual average 2017-2018 (USD billion)

	Sustainable Transport	Building Infrastructure and Energy Efficiency*	Urban Development and Management	Waste and Wastewater	Renewable Energy Generation	Adaptation
Private	36.5	0.2	0.01	0.2	2.6	1.5
Public (international)	7.7	5.2	1.2	1.5	1.0	4.8
Public (domestic)	10.4	0.1	?	0.04	0.1	0.5
Unknown Source	147	161				

TRACKED
TRACKED With data limitations
NOT TRACKED No or very limited data
ESTIMATED Using the capital expenditure approach

*Buildings and appliances include energy efficiency and renewable electricity and heat installations on-site

Figure 2 shows the coverage of the more granular project-level data, broken down by main sectors and the provider type. International public actors, such as multilateral and bilateral development finance institutions, bilateral donor governments, and climate funds, typically provide higher quality data with projects tagged for climate relevance, translating to strong coverage of their commitments.

On the other hand, finance data from domestic public actors are limited for all sectors, as there is no centralized database of domestic government expenditure, at the national or subnational level. Finance from private actors was also limited due to lack of centralized reporting and data confidentiality. The capital expenditure approach provided an approach to identify an additional USD 308 billion estimated for the transport and buildings but data is insufficient to ascertain which portion originated from public domestic and private financiers for which more detailed project level reporting and tracking would be required.

4. OVERALL URBAN CLIMATE FINANCE FLOWS

We estimate that a total of USD 384 billion was invested annually in urban climate finance globally, on average, in 2017-2018.

Urban climate finance averaged USD 384 billion in 2017-2018. Using project-level data tracked in CPI's Global Landscape of Climate Finance (2020), complemented by a top-down capital expenditure approach to estimate investment in key urban sectors (hereafter "estimated capital expenditure"), this report provides the most comprehensive landscape to date of climate finance relevant to cities.

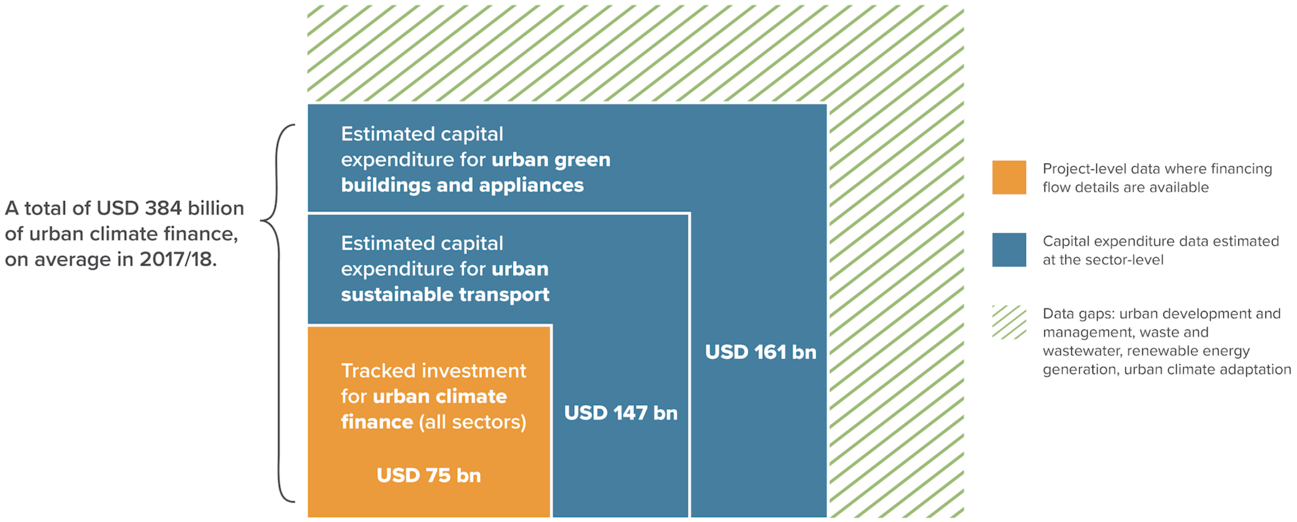
Out of the USD 384 billion total urban climate investment, the Alliance was able to track USD 75 billion of project-level data using CPI's database of global climate finance, corresponding to approximately 1,030 tracked projects.[6] These projects represent approximately 13% of the total of USD 574 billion global climate finance tracked by CPI for the 2017-2018 period (CPI, 2020). This relatively low number is in part due to challenges in identifying projects with urban benefits (see Box 4 on data gaps and the Annex on Methodology) and barriers to mobilizing investment into climate at the city level. Regardless, commitments estimated for urban climate finance would appear to be orders of magnitude lower than the scale of investment opportunities in the sector, which the IFC estimates to be at least USD 2.45 trillion annually for private investment only (IFC, 2018).

In addition to project-level data, the Alliance estimated an additional USD 308 billion of urban climate relevant investment in transport and energy efficiency in residential, commercial, and industrial buildings using the capital expenditure approach.

This report covers the total USD 384 billion while providing more detailed breakdowns where available. Figure 2 explains the breakdown of our coverage of urban climate finance.

6 Numbers in this report may not add up completely due to rounding. As project financing is sometimes tracked in an aggregate manner, e.g., for some DFIs surveyed for this report, the exact number of projects tracked is likely higher.

Figure 3. Summary of estimated urban climate finance, annual average 2017-2018 (USD billion)

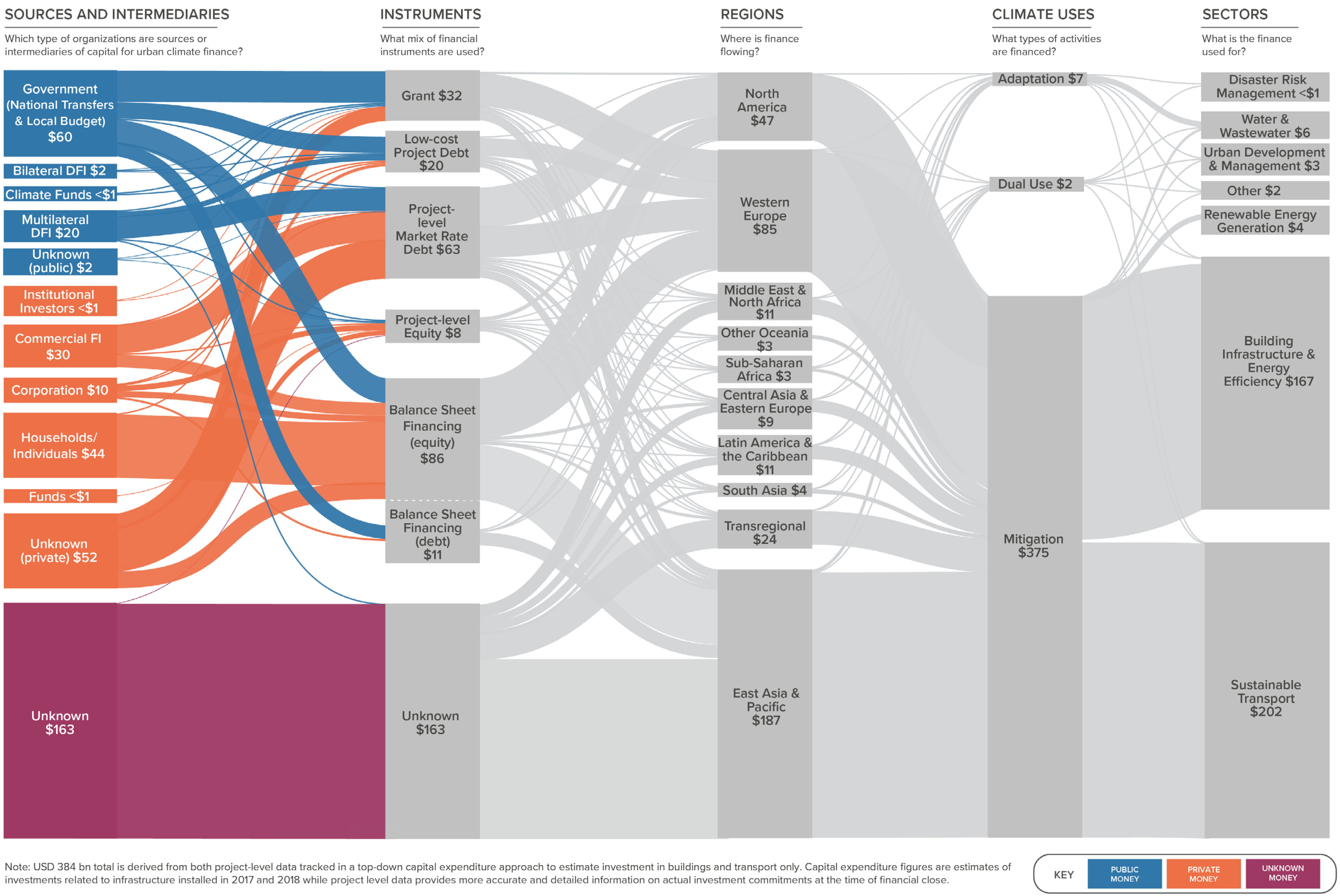


Note: Numbers in this graphic and elsewhere in the report may not add up due to rounding.

The Sankey diagram on the following page presents a visual overview of the lifecycle of urban climate finance flows from sources through to end uses. It includes both tracked and estimated data, depicting the life cycle of investment flows averaged over 2017 and 2018. It shows that urban climate finance flows were primarily mobilized in the East Asia and Pacific region (driven by investment in China) and Western Europe, most often to capitalize on activities in the transport and buildings sectors. A Sankey focused on project-level data only is available in the methodological Annex.

LANDSCAPE OF URBAN CLIMATE FINANCE 2017/18

384 BN USD ANNUAL AVERAGE



Note: USD 384 bn total is derived from both project-level data tracked in a top-down capital expenditure approach to estimate investment in buildings and transport only. Capital expenditure figures are estimates of investments related to infrastructure installed in 2017 and 2018 while project level data provides more accurate and detailed information on actual investment commitments at the time of financial close.

5. URBAN CLIMATE FINANCE PROVIDERS

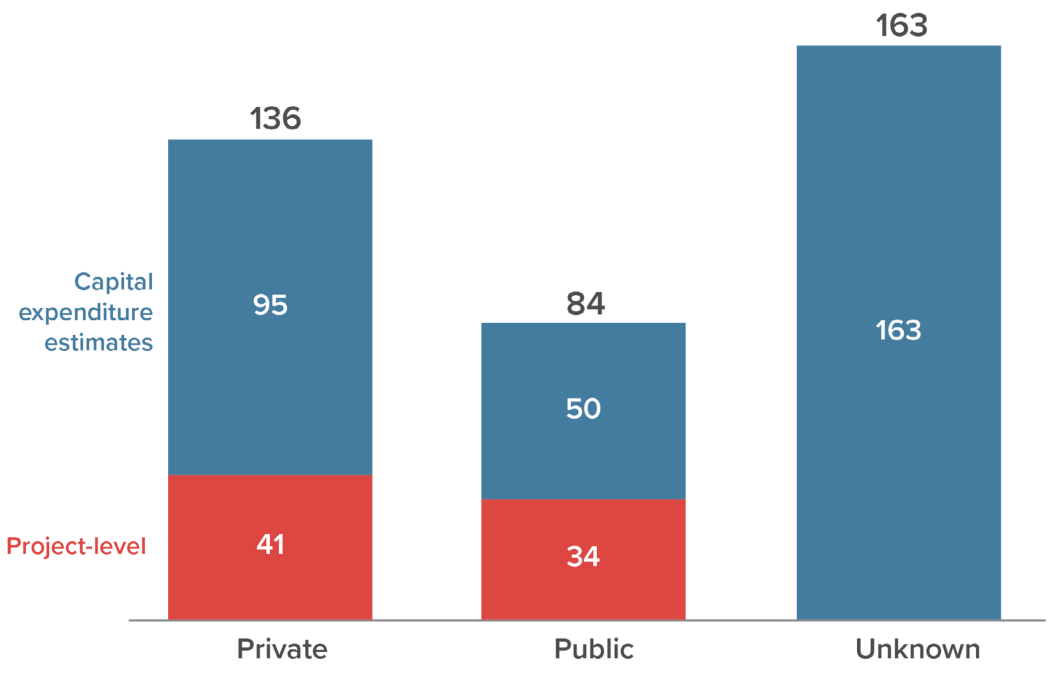
5.1 OVERVIEW OF URBAN CLIMATE FINANCE PROVIDERS

Out of the USD 384 billion estimated on average in 2017-2018, the Alliance was able to capture whether capital was sourced from public or private actors for USD 221 billion. This corresponds to combined project-level data and capital expenditure estimates that were traced with enough granularity (see Figure 4).

Private finance actors invested an annual average of USD 136 billion in 2017-2018, while public actors committed USD 84 billion in the same period. When focusing on project-level data this difference remains, with private sector investment totaling USD 41 billion and public sector USD 34 billion in 2017-2018. As a single actor, national governments financing projects domestically were the highest contributing finance providers (USD 60 billion), driven by spending on urban transport and buildings (see Figure 6).

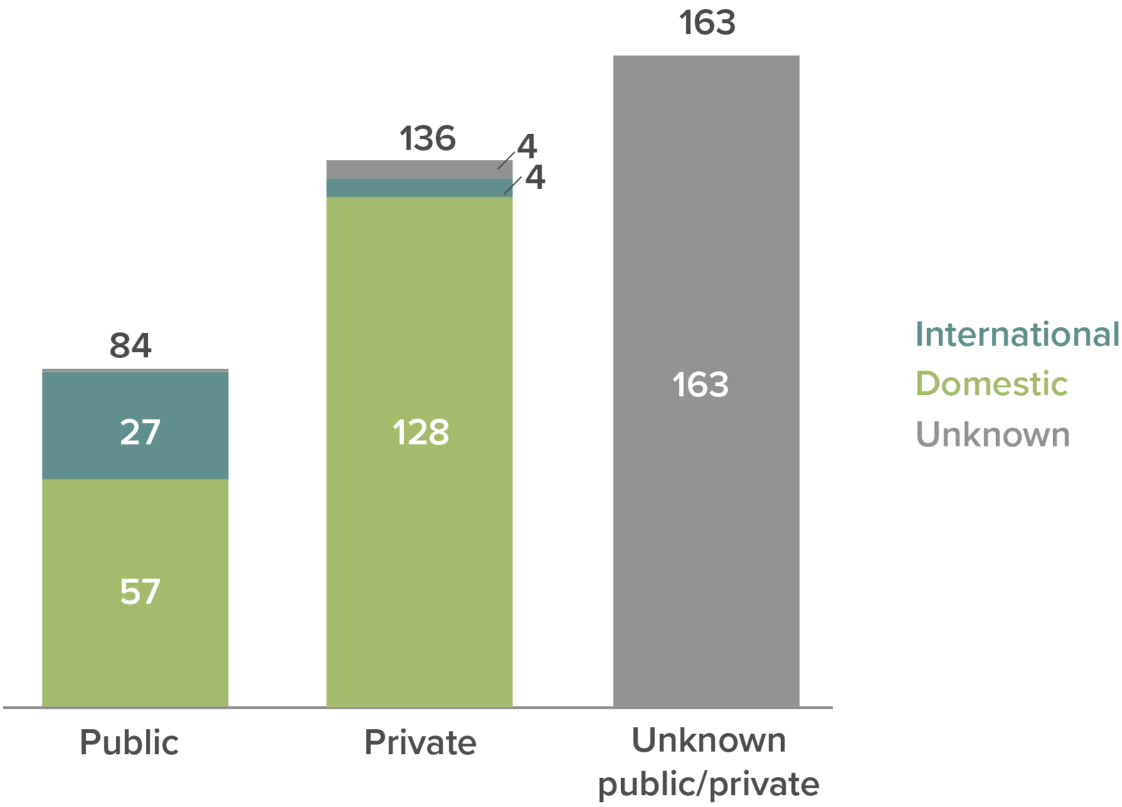
Lack of detailed project-level data, especially in key sectors such as urban transport and buildings, limits a deeper understanding of the most significant actors participating in closing the investment gap for cities (see the Methodology annex for more details).

Figure 4. Urban climate flows by source, annual average 2017-2018 (USD billion)



Domestic private finance was the main source of capital, amounting to 128 billion in 2017-2018 (see Figure 5). Domestic private finance corresponds most significantly to household expenditure[7] on private electric vehicles as well as for energy efficiency in buildings, while the latter also attracted domestic private commercial finance. This domestic private finance total also includes investments by corporations toward waste-to-energy projects and adaptation projects such as water and wastewater management. In contrast, we only estimated USD 4 billion of capital committed by international private financiers in the same period, illustrating the challenge in determining the urban component of large, privately-funded projects, especially for renewable energy generation.[8]

Figure 5. Urban climate finance flows by financing institution type, annual average 2017-2018 (USD billion)



While private domestic financiers mobilized the majority of urban climate finance, the largest single provider, according to available data, was governments, which corresponded to USD 60 billion in 2017-2018 (see Figure 6). These amounts were estimated primarily through the capital expenditure approach and went to support projects in urban buildings and transport. Furthermore, project-level data indicates that public finance played a stronger role proportionally in developing economy cities, contributing USD 45 billion as opposed to USD 36 billion from private sources. This is in

7 CPI's Global Landscape of Climate Finance methodology defines as private finance sources of capital that are not a government of public budget sourced finance, including household expenditure.

8 It was not possible to determine whether capital was financed internationally or domestically for the remaining USD 4 billion of private finance, corresponding to capital expenditure estimates for transport and buildings.

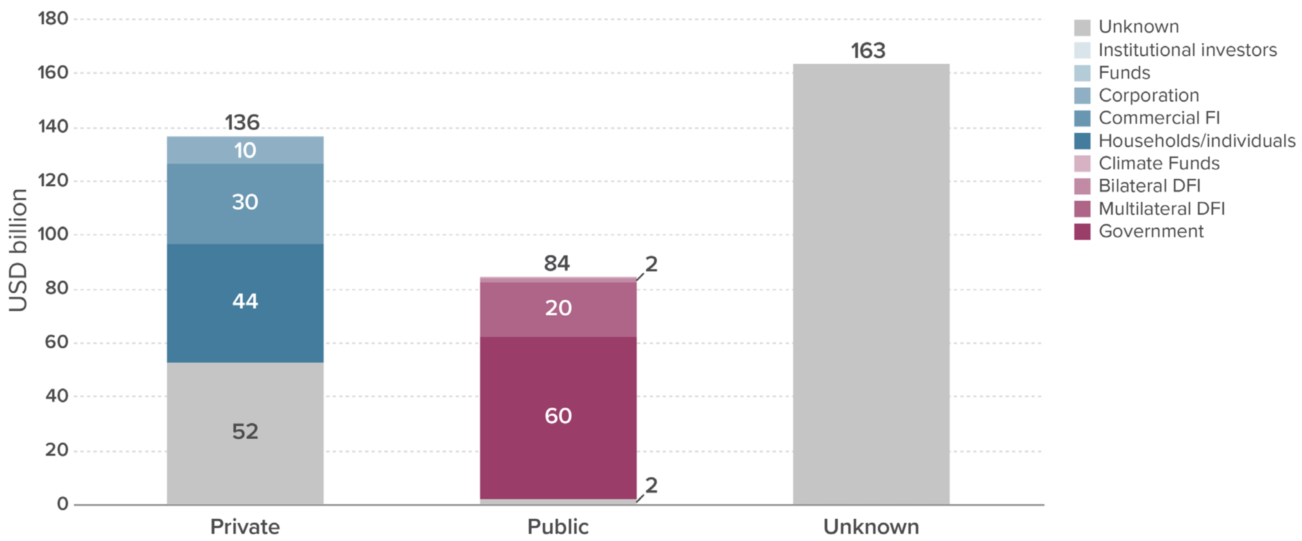
contrast with cities in OECD countries, where private sources dominated with USD 100 billion compared to USD 39 billion from public financiers.

The second key provider of urban climate finance consisted of households, corresponding to USD 44 billion in 2017-2018. A significant portion of this finance was spent on building appliances, equipment and lights, as well as purchases of electric private vehicles, most significantly for households in the Western Europe, East Asia and Pacific, and North America regions.

Finance provided by commercial financial institutions, averaging USD 30 billion in 2017-2018, went primarily to urban building energy efficiency, especially to finance appliances, equipment, and lighting.

Corporations also contributed a significant amount of private finance (USD 10 billion on average in 2017-2018), with a large share of spending linked to renewable energy generation as well as water and wastewater management. Project-level data indicates that a significant portion of urban transport capital is provided by private or state-owned transport enterprises running public urban rail or metro, utilizing public-private partnerships to co-finance.[9] An example of this is Paris Charles de Gaulle Express Rail Link, which was co-financed with a project special purpose vehicle (SPV) between the French public finance institution Caisse des dépôts et consignations, state-owned transport operator SNCF, and Aéroports de Paris, a private corporation that manages the city's airports.

Figure 6. Urban climate flows by providers, annual average 2017-2018 (USD billion)



Estimated investments indicate that significant contributions are channeled through private actors and governments. At the project level, multilateral DFIs committed on average USD 20 billion in 2017-2018, mainly toward transport (38%) and building energy efficiency (24%) and water and wastewater management (10%). DFIs provided USD 3 billion to water and wastewater management interventions. An example of a project is

9 Due to the lack of harmonized definitions and opacity of data, companies that are partially or fully owned by the state are categorized as private corporations in the database if they have commercial activities (CPI, 2019).

an Asian Development Bank project to develop sustainable water supply services in a rapidly urbanizing region in India. Cities in non-OECD countries, where USD 11 billion of multilateral DFI funding was committed, also saw significant investment in disaster risk management projects, for example in Nepal and Romania. DFIs can play a key role in de-risking or providing guarantee mechanisms to support private sector investments, especially when local governments bear significant challenges, such as low creditworthiness (see Section 6 for a deep dive into the role of innovative financing in urban contexts).

Box 5: The work of the Alliance in fostering investment-friendly enabling environments with focus on the role of National Development Banks

The Alliance's Action Groups are comprised of members that work together towards common objectives in a particular area of city-level climate finance. The Enabling Frameworks Action Group (EFAG) of the Alliance was launched in 2020, with the aim of strengthening national legal, regulatory, and policy frameworks that can boost climate finance for cities. The focus of this group recognizes the key role of national governments in creating investment-friendly enabling environments for finance to flow to local levels, and in supporting cities to develop capacity to manage their fiscal resources and to access climate finance (these topics are further explored in Part 2 of this report). Currently, the group brings together over 15 member organizations who are interested in advancing these objectives by collaboratively working on action-oriented products and exchanging knowledge, information, and good practice. The group is closely tied to Component IV of the Leadership for Urban Climate Investment (LUCI) initiative hosted by the Alliance. LUCI's Component IV seeks to improve national and financial framework conditions conducive to climate-friendly projects, with a particular emphasis on supporting the role of National Development Banks.

National development banks: A key player for urban climate finance

During 2020-2021, the EFAG focused on the role of National Development Banks (NDBs) in supporting climate-smart urban infrastructure.[i] As many cities face challenges in accessing private and international public finance providers, NDBs are well-positioned to support urban climate finance investments through increasing access to funding and financing to local and regional governments. In exploring this topic, the EFAG collaboratively developed two publications: a think piece (commissioned by FELICITY) on Enhancing the role of national development banks in supporting climate-smart urban infrastructure (Alliance, 2020) and a more action-oriented knowledge product, Leveraging national development banks to enhance financing for climate-smart urban infrastructure (Alliance, 2021).

The publications found that NDBs share some common features that can be very advantageous for urban climate finance: they often provide country-level-expertise, increasing their local knowledge of the barriers and opportunities for urban climate investment. NDBs can also access a large number of finance providers, not often easily available to local governments, such as institutional investors, international markets, and public international financiers. Finally, NDBs can potentially pool different types of private sector providers to increase cities' access to climate finance. For example, FINDETER, a Colombian NDB, and the Interamerican Development Bank have created the Sustainable and Competitive Cities, which promotes strategic projects aimed at transforming cities. They provide project preparation through every stage of the project lifecycle from conception to financing and implementation, increasing bankability in city-level projects (Alliance, 2021).

However, there are still challenges and barriers faced by NDBs in providing finance and funding opportunities for cities, as many NDBs do not have a clear climate mandate established, let alone an urban climate one. This lack of a mandate also leads to a lack of capacity to identify, assess, and fund urban climate-smart projects. NDBs can play a significant role in filling the technical and financial gaps that prevent cities from raising capital from private and public markets, and should focus and prioritize supporting and financing cities where funding and capacity are limited, but a political and social momentum toward climate-smart planning exists.

[i] National Development Banks (NDBs) are "any type of financial institution that a national government fully or partially owns or controls and has been given an explicit legal mandate to reach socioeconomic goals in a region, sector, or market segment" (World Bank, 2018).

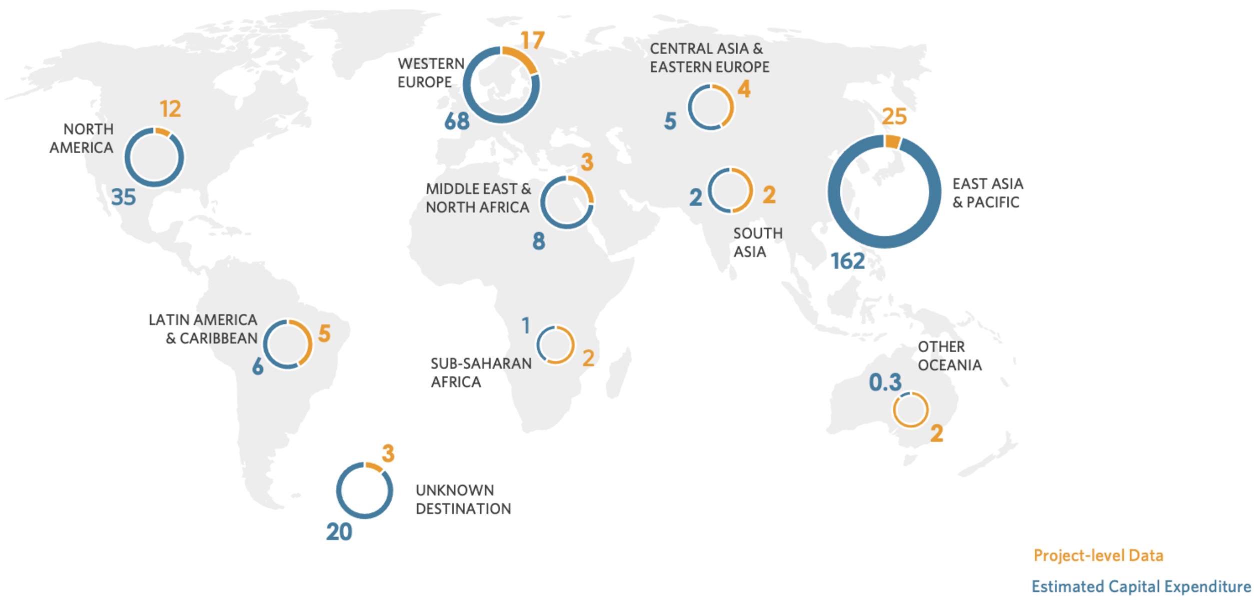
5.2 GEOGRAPHIC FLOWS IN URBAN CLIMATE FINANCE

Out of the total USD 384 billion of urban climate finance estimated, on average, in 2017-2018, the largest portion of finance was invested in and for China and in developed economies. The majority of this finance corresponded to significant investment in transport and buildings in China (see Figure 7 for a breakdown between project-level data and capital expenditure data). With the exception of the East Asia and Pacific region, the highest levels of capital were invested in cities in developed economies, particularly Western Europe (with USD 85 billion) and North America (USD 47 billion).

Out of the finance that was tracked with enough granularity to determine the regional origin of the capital provider, financiers located in developed economies financed on average USD 149 billion in 2017-2018. Ninety-one percent of this capital was employed to finance projects within OECD countries, most often domestically. The OECD region that attracted the highest amount of urban climate finance was Western Europe, averaging USD 85 billion in 2017-2018, corresponding to significant capital expenditure estimates for the transport and buildings sectors, in addition to large transregional flows such as those committed by the European Investment Bank.

Domestic actors provided 86% of urban climate finance where this level of detail was available.[10] While the origin of finance providers remains opaque, available data indicate that urban climate finance from emerging markets was committed mainly domestically (97%), averaging USD 66 billion in 2017-2018. Domestic urban climate investment consisted primarily of urban building energy efficiency and electric vehicles in China, indicating an awareness in the country of the need for a low-carbon pathway alongside rapid urbanization.

Figure 7. Urban climate finance by destination region, 2017-2018 (USD billion)



10 Domestic finance represented USD 185 billion out of USD 216 billion where this detail was available. Domestic finance represented 48% of total urban climate finance if accounting for data where this detail was unavailable. (Unavailable data accounted for 44% of total urban climate finance.)

The East Asia and Pacific region dominated the urban climate finance landscape, with USD 187 billion invested on average in 2017-2018, driven by China. Although it was only possible to determine the country where capital was committed for half of the finance tracked for the region, projects in Chinese cities made up a large proportion of the investments, receiving USD 92 billion in 2017-2018. Financing for China featured significantly in the capital expenditure estimates tracked for urban transport and buildings: for instance, the estimated USD 34 billion spent on electric buses was almost entirely spent in the country. This reflects China’s low-carbon public transport as a key policy objective including the provision of subsidies and quotas for electric vehicles, with cities moving to deploy an increasing amount of electrically powered passenger and freight transport (GIZ/FELICITY, 2020).

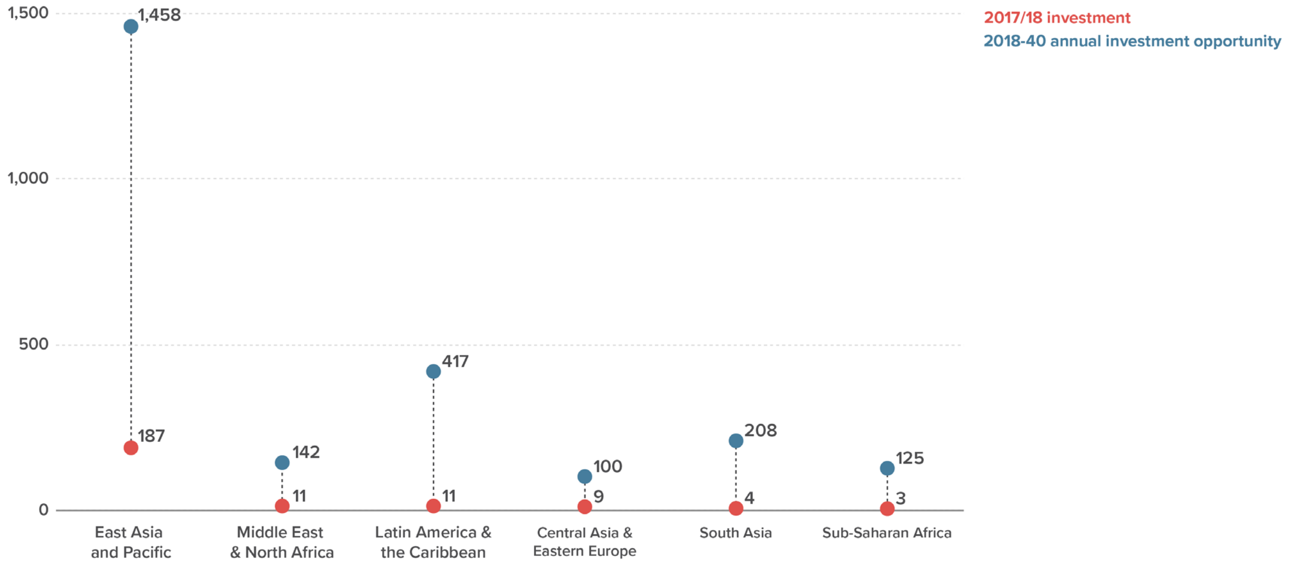
With the East Asia and Pacific region representing 60% of total investment opportunities in cities in emerging markets according to the IFC, it is critical that the rapid population growth is accompanied by its low carbon transition (IFC, 2018). See Figure 8 for a comparison of current estimated urban climate flows and the annual private sector investment opportunity defined by the IFC.

The region of Latin America & the Caribbean, where USD 11 billion of climate finance was invested in its rapidly expanding urban areas, saw commitments primarily in Argentina and Brazil. Financing in the region remained at less than 3% of the USD 416 billion of financing opportunities available each year (IFC, 2018), as shown in Figure 8. The top sector recipients in the region were in urban transport and buildings, attracting USD 3 billion and USD 6 billion, respectively. An example of an investment at the project level was the expansion of the São Paulo metro, which attracted finance from commercial financial banks.

Vastly insufficient amounts of urban climate finance were invested in other regions, including South Asia and Sub-Saharan Africa, which saw an annual average investment of USD 4 billion and USD 3 billion, respectively. These investment levels in emerging economy cities are markedly below their projected opportunities, which are USD 208 billion in South Asia and USD 125 billion in Sub-Saharan Africa, annually. Concessional and catalytic financing is needed in these regions’ cities. However, they are currently severely underfunded and are unlikely to be able to access capital markets due to low creditworthiness and lack of bankable projects.

International public finance from bilateral and multilateral DFIs was invested mainly in Western Europe (41%), Latin America & the Caribbean (17%), and East Asia and the Pacific (12%), with Sub-Saharan Africa, the Middle East, North Africa, and South Asia ranging from 6-8%.

Figure 8. Urban climate finance estimated in 2017-2018 compared to the annual private sector investment opportunity, by emerging market region (USD billion)



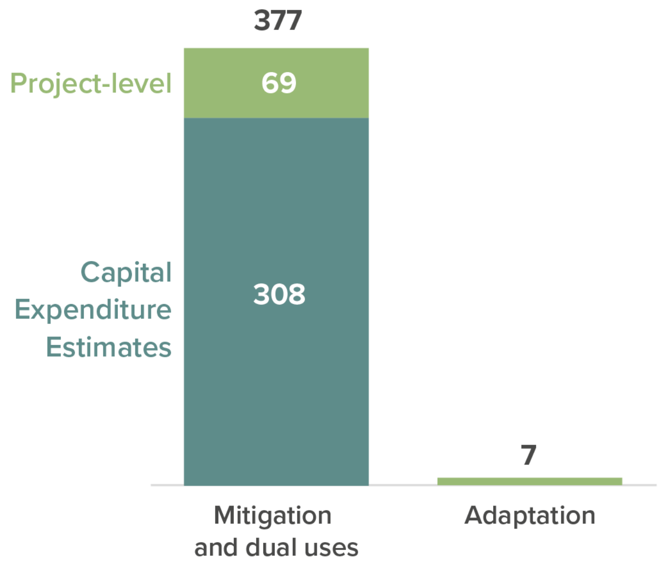
Source: Alliance and IFC data (IFC, 2018).

6. SECTORS AND ACTIVITIES IN URBAN CLIMATE FINANCE

Finance for adaptation projects amounted to USD 7 billion in 2017-2018, representing 9% of investments tracked at the project level, against the 91% (USD 69 billion) for mitigation and dual uses. However, the proportion of adaptation projects remains low in project-level data (see Box 6 for an explanation of data limitations in adaptation finance), in line with global climate finance figures, where adaptation finance also accounts for 9% of the total tracked for the same period (CPI, 2019).

When adding capital expenditure estimates that were captured for mitigation activities in the transport and building sector, we estimate that USD 377 billion of total urban climate finance in 2017-2018 (or 98%) went to investments in mitigation projects (see Figure 9). USD 308 billion estimated by the capital expenditure approach and USD 69 billion by the project-level data approach. While significant amounts of mitigation finance were invested in both developed and emerging markets (on average USD 221 billion and USD 132 billion, respectively), 79% of adaptation finance was committed to non-OECD countries (USD 5 billion).[11]

Figure 9. Urban climate finance by use, 2017- 2018 (USD billion)



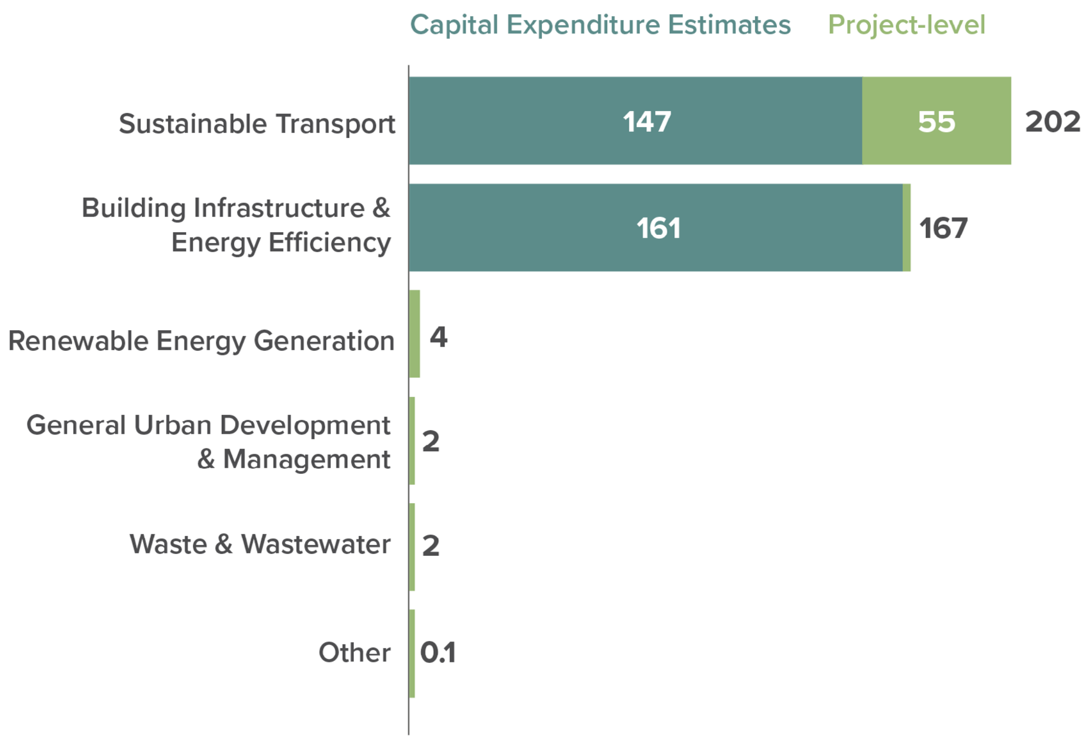
Note: Dual use finance consists of investments with both climate adaptation and mitigation objectives. We tracked USD 1.7 billion of urban dual use climate finance, on average in 207-2018, representing less than 1% of the total tracked for the mitigation and dual uses category in the figure.

11 As discussed in an "Analysis of Urban Climate Finance Adaptation" paper (Alliance, 2021c), a background paper for the State of Cities Climate Finance report, the predominance of non-OECD region destination projects for urban climate finance adaptation may be partially explained by the fact that the World Bank PPI data is more weighted in East Asia, with more than 50% of tracked urban adaptation finance activities taking place in China.

6.1 FINANCIAL FLOWS FOR URBAN MITIGATION AND DUAL USES

Investment in urban transport represented 53% of total urban climate finance estimated at USD 202 billion in 2017-2018 (see Figure 10). Out of this amount, USD 55 billion was calculated at the project-level, of which USD 40 billion targeted private electric vehicles and charging infrastructure.[12] The remaining USD 15 billion corresponds to a variety of urban projects such as low-carbon public transport like metros and trams, or cycle lane and walking projects, which contribute to urban transport modal shift. The remaining USD 147 billion corresponds to capital expenditure estimates for urban transport infrastructure and non-motorized transport, which was calculated based on the number of vehicles sold in 2017-2018 and the amount of relevant new infrastructure added in those years, and estimate finance on the basis of the identification of relevant unit costs (see the Methodology annex for more details and inclusion rules). A majority of capital for urban transport estimated went to metros and tram infrastructure and vehicles, averaging an estimated USD 112 billion in 2017-2018 (see Figure 11). Electric and hydrogen buses attracted USD 33 billion while non-motorized transport attracted on average USD 12 billion for 2017-2018.

Figure 10. Urban mitigation and dual use finance, 2017-2018 (USD billion)



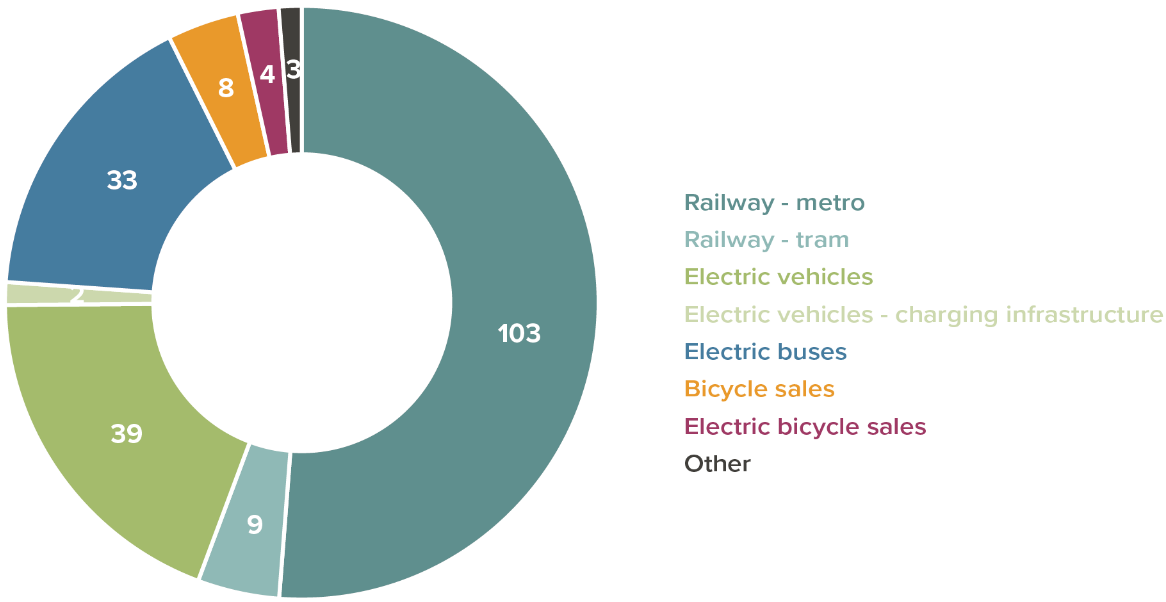
Note: Building infrastructure and energy efficiency include energy efficiency in buildings and appliances, as well as renewable electricity and heat installations on-site. General urban development and management activities include urban-relevant policy support measures in addition to urban agriculture and land-use interventions.

12 Figures for private electric vehicles and charging infrastructure were estimated using IEA data, taken from CPI's Global Landscape of Climate Finance, were categorized as project-level data in this report for better comparability with global climate finance numbers (CPI, 2019). Furthermore, these estimates include breakdowns for the lifecycle of investments. See the methodology section for an explanation of private electric vehicles and charging infrastructure figures, as well as other transport estimates.

The transport sector is a key sector in the urban context, contributing approximately 30% of total emissions in cities and representing an opportunity of USD 217 billion annually in emerging markets alone (McKinsey & C40, 2017; IFC, 2018). Local air pollution, which city dwellers and policymakers prioritize due to the severe health impacts, is a strong driver for investment in the transport sector. By focusing on targeted projects in the transport sector, cities have the opportunity to address issues such as health and traffic congestion in addition to climate change, which is accentuated with local air pollutants such as black carbon contributing through decreased reflected light (UNEP, 2019; C40, 2019d).

When identifying the urban-relevant component in climate mitigation projects and estimating additional expenditure, this report considered urban transport as eligible if the infrastructure and vehicles (whether motorized or not) had the potential to contribute to a climate-neutral economy at the urban level. To estimate expenditure at a sectoral level in a conservative manner, some components were excluded. For example, while bus-rapid-transit (BRT) has the potential to contribute to a modal shift in road transport, this was excluded from estimations as the infrastructure could potentially be used by diesel buses and it was not possible to effectively discern which component could be considered as urban climate finance.[13]

Figure 11. Estimates for urban transport, by mode, on average 2017-2018 (USD billion)



Note: this graph excludes estimated investment in hydrogen private vehicles and buses as both were inferior to USD 0.5 billion, on average in 2017/18.

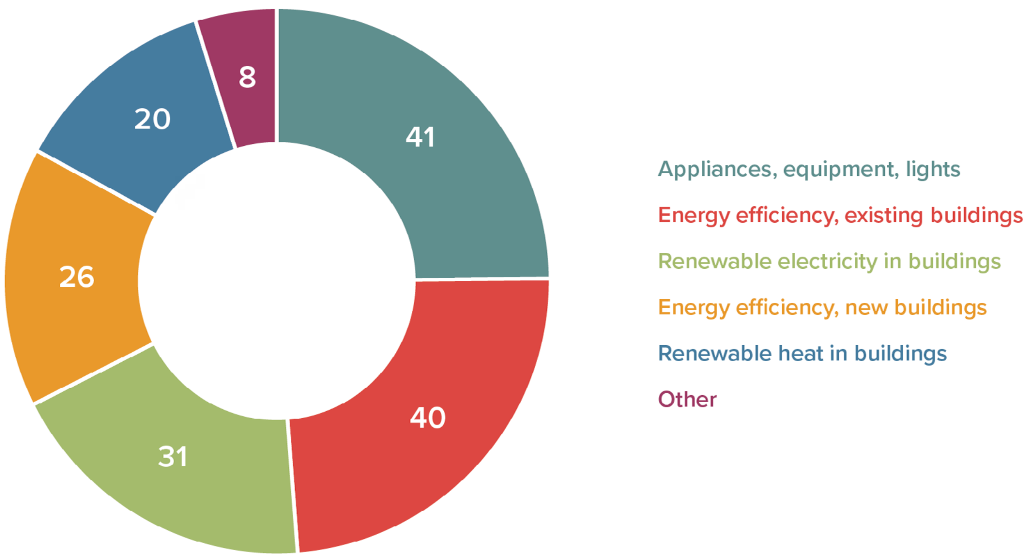
13 Investments and expenditures captured in CPI's Global Landscape of Climate Finance do not capture fossil fuel investments that have a high risk of locking in significant future greenhouse gas emissions. Based on this principle, fossil fuel-based lower-carbon and energy-efficient generation transactions, such as financing for efficiency retrofits of coal-fired power plants, are excluded. In this report, capital expenditure estimates for the transport sector follow the same logic and consider only zero-carbon mobility to produce conservative figures. To this end, several transport infrastructure projects, such as BRT or urban development were excluded as it was not possible to determine the extent to which such infrastructure is supporting use of fossil fuel powered vehicles. We acknowledge that there are emerging alternative standards, definitions, and classifications including, among others, the EU taxonomy, Climate Resilient Principles for green bonds, and others. However, these standards are still under development and are therefore not currently reflected in this report (see the Methodology section for more detail).

Building infrastructure and energy efficiency attracted the second highest level of finance, with USD 167 billion estimated for 2017-2018, representing 43% of total urban climate finance. Out of this, only USD 6 billion was estimated at the project level, mostly consisting of commitments for technical assistance for energy efficiency, e.g., for public sector buildings. Using investment data from the International Energy Agency (IEA), complemented with additional analysis, we estimate that an additional USD 161 billion of finance for incremental energy efficiency measures in residential, commercial, and industrial buildings could be attributed to urban areas, on average in 2017-2018. The expenditure on climate mitigation and climate adaptation activities in urban buildings include incremental capital expenditure to acquire physical assets, such as energy-efficient appliances and renewable heat (see the Methodology annex for more details and inclusion rules).

Despite the significant challenges posed by tracking energy efficiency, it is a critical sector in the context of cities, contributing 40% of total urban emissions (McKinsey & C40, 2017). Measures in building energy efficiency translated to future energy savings provide profitable opportunities; capturing opportunities in this sector is especially important as building stock is typically regenerated only after three decades and ignoring green improvements thus locks in emissions for years to come (McKinsey & C40, 2017). Furthermore, the IFC identifies green buildings as the largest investment opportunity in emerging economies, particularly in the East Asia & Pacific and Latin America & Caribbean regions (IFC, 2018).

As illustrated in Figure 12, expenditure on energy efficiency in appliances, equipment, and lights accounted for the most significant proportion of investment in buildings across regions, corresponding to USD 41 billion on average in 2017-2018. Energy efficiency improvements of existing buildings attracted USD 40 billion, driven by investments in Europe and North America. The investment in energy efficiency measures integrated in the construction of new buildings, driven by China, amounted to USD 26 billion. Finally, the investments of USD 31 billion in renewable electricity onsite installations are slightly higher than that in renewable heat installations of USD 20 billion.

Figure 12. Estimates for urban building investments, by measure, 2017-2018

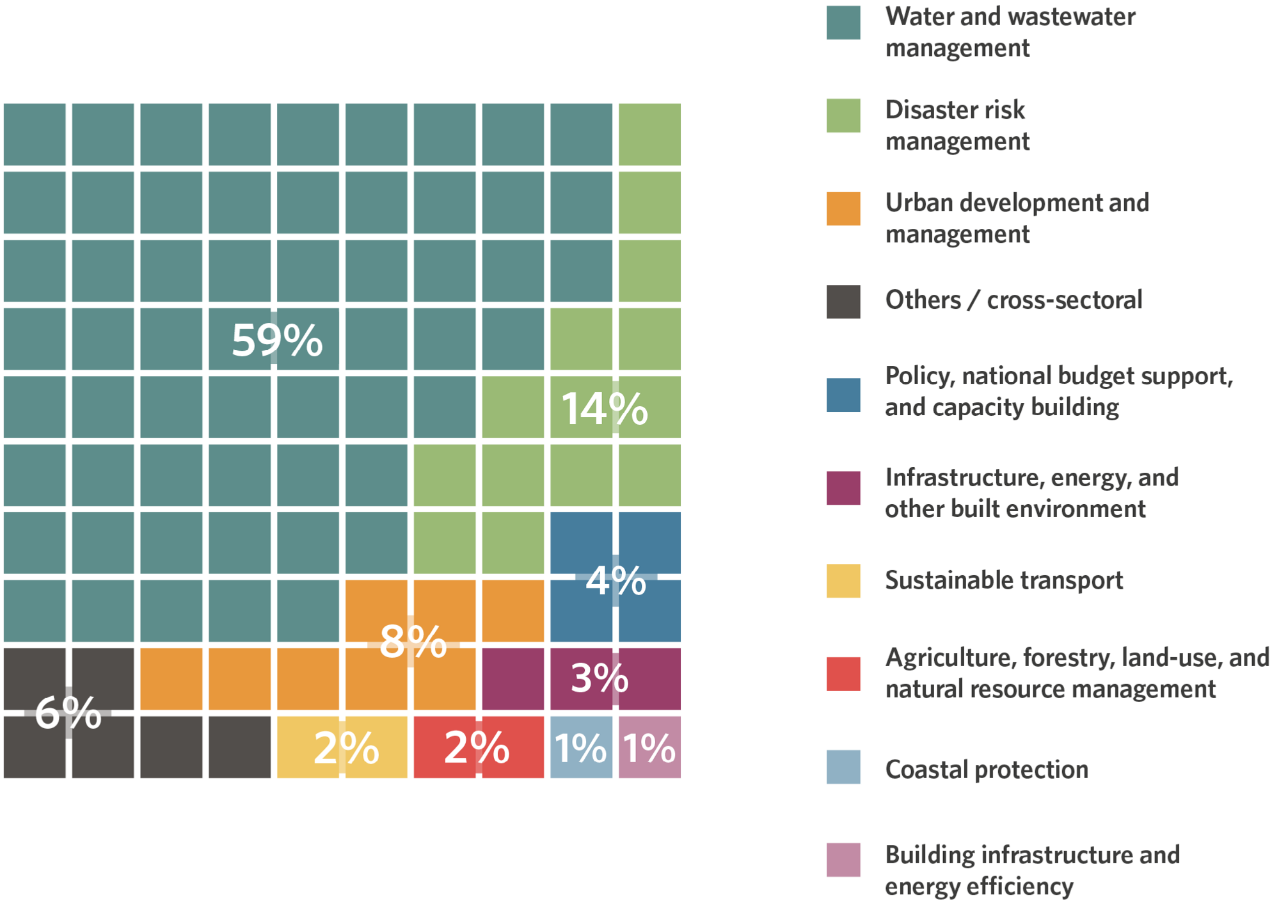


Relatively low levels of financial flows were committed for utility-scale renewable energy generation (USD 4 billion), consisting primarily of waste-to-energy projects or larger projects that could be attributed to urban areas. The vast difference between the total of USD 337 billion of finance for renewables tracked globally (IRENA, 2020) and the levels that could be attributed to urban areas is a direct result of the definition of urban climate finance, as delineating projects that occur at the national level, such as large-scale grid-connected renewable power generation, is a significant challenge. While waste-to-energy projects deal with waste generated by the city, and the energy generated potentially includes heat and power used primarily by the nearby city, it is more challenging to explore these assumptions for large-scale grid-connected solar PV and wind power, which typically attract more significant investment. See the Methodology Annex for the urban climate finance taxonomy used and a discussion of difficulties in data collection.

6.2 FINANCIAL FLOWS FOR URBAN ADAPTATION TO CLIMATE CHANGE

Just 9%, or USD 6.8 billion, of the USD 75 billion of urban climate finance tracked at the project-level on average in 2017-2018 was invested annually in adaptation across more than 1,000 projects. These projects include those tagged as urban adaptation finance where sufficient information available (see Figure 15). The majority of projects tracked were water and wastewater management projects (USD 4.0 billion annually). This sector includes demand-side activities aimed at reducing water consumption or increasing water use efficiency, and supply-side management activities including increasing water supply, reducing water losses, or improving cooperation on shared water resources (CPI, 2017). Water and wastewater management projects of the kind frequently tracked in CPI's Global Landscape of Climate Finance are often large infrastructure projects so they may be especially likely to be tracked in the data because the capital that flows to those projects is relatively straightforward to identify and measure. Projects that may be more difficult to track, and therefore may not be included in the urban adaptation finance data, include instances where resilience components are built into larger projects (e.g., a transit investment that takes into account climate-related flood risk) and may not be tracked as adaptation finance.

Figure 13. Urban adaptation finance, 2017-2018 (USD billion)



Box 6: Limitations in tracking urban adaptation finance

There are significant data and reporting challenges that limit the capture of global adaptation finance flows. These include:

Definitional challenges associated with adaptation finance and the boundaries between adaptation and broader development or infrastructure projects.

Lack of universally accepted impact metrics, which are critical to a full accounting of adaptation finance because the incremental cost of adaptation is not necessarily reflective of the benefit of that investment.

Data gaps among financial actors including limited reporting of private sector and domestic public investment on adaptation spending due to a lack of disclosure requirements and definitional and reporting barriers.

These same challenges persist in urban adaptation finance tracking. An additional set of challenges emerge related to defining geographic and jurisdictional boundaries of investments – especially when the investments address climate risk within and outside a city's formal boundaries.

The high proportion of finance for water and wastewater management aligns with findings from CDP-ICLEI Unified Reporting System data that imply high estimated costs associated with addressing water-related climate hazards (storms and wind and extreme precipitation). Box 7 includes additional information on the CDP-ICLEI Unified Reporting System answers on climate hazards.

While North America features the most mitigation and adaptation projects by number, East Asia and the Pacific is the most common recipient of both overall adaptation finance and urban adaptation finance by investment amount. Approximately USD 2 billion in urban adaptation finance flowed to East Asia and the Pacific annually in 2017-2018, followed by Latin America and the Caribbean (USD 960 million), Sub-Saharan Africa (USD 780 million), and Western Europe (USD 710 million). South Asia, which includes three of the ten most populous (and climate vulnerable) cities – Mumbai, Delhi, and Dhaka – received just 6% (USD 460 million) of the total urban climate adaptation finance.

Box 7: CDP-ICLEI Unified Reporting System on urban climate finance

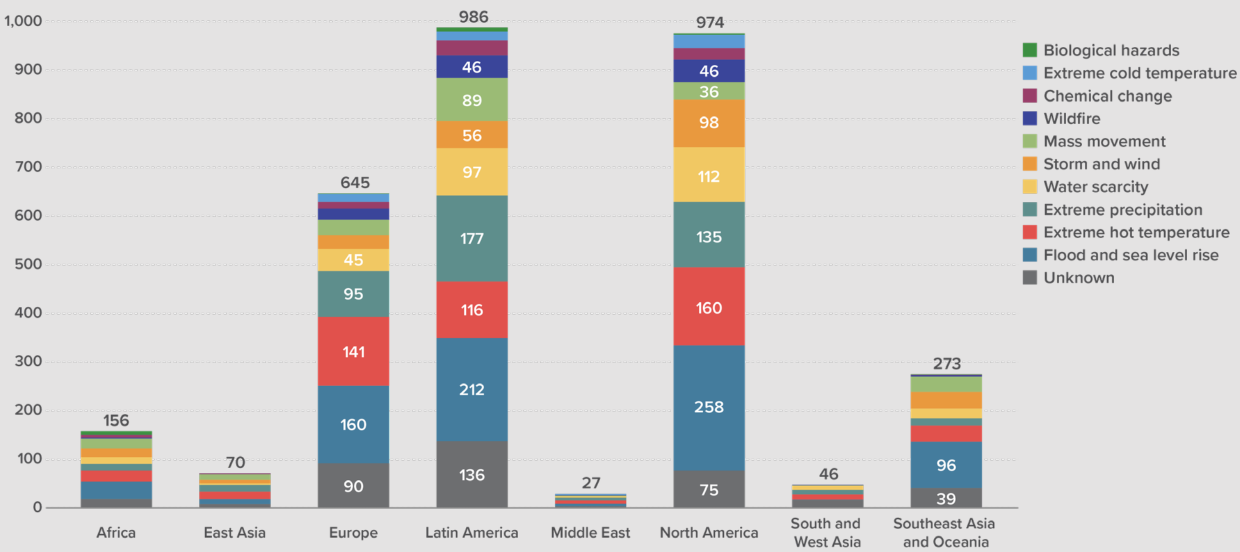
CDP Cities data was assessed from the 2019 city responses to CDP's questionnaire. This analysis focuses on responses to a question that asked cities to identify their key climate hazards and the activities underway to address those hazards.

Responses indicate that the cost of projects varies significantly across climate hazards. Of the projects reported to CDP with a specified cost value (either already financed or sought to fund the project), projects addressing storm and wind hazards had the highest total cost at USD 21 billion. Extreme precipitation was next at USD 13 billion. These projects included risk mapping, awareness campaigns, investments in infrastructure resilience, and evacuation systems.

Figure 14. CDP Cities: Climate hazards faced most by cities and associated costs (USD billion)

The most common climate hazards addressed by projects varied by region, but in almost all regions, extreme hot temperatures, as well as flood and sea level rise, were the most common hazards reported. In South and West Asia, only one city reported flood and sea level rise as a climate hazard being addressed by the city, while 10 cities in that region reported extreme precipitation. More detail on the climate hazards projects reported by region are shown in Figure 15.

Figure 15. CDP Cities: Number of Projects Reported by Climate Hazard and Region



Note: CDP-ICLEI Unified Reporting System data is distinct from other sources of data used in this report and does not include detailed information on financial flows. Instead, information from the more than 800 cities responding to the CDP-ICLEI questionnaire provides insight into the climate hazards and responsive actions cities report. In the 2019 questionnaire, the more than 800 cities responding reported just under 2,800 actions taken to address reported climate hazards. This analysis focuses on responses to Question 3.0, which asks cities to identify key climate hazards and activities underway to address those hazards.

Box 8: Urban adaptation finance in practice: three case studies

Though adaptation finance remains a very small percentage of total urban climate finance, an increasingly robust set of examples of urban adaptation finance and climate risk transfer mechanisms are emerging. Three examples follow:

1. Pakistan urban resilience to water scarcity. The Adaptation Fund approved a USD 6 million grant to two cities in Pakistan, Rawalpindi, and Nowshera, to enhance urban climate resilience to water scarcity caused by floods and droughts. The funding was approved in June 2020. It will fund household and municipal public facility water harvesting facilities and support city-level spatial strategies to assess climate-related floods, droughts, and water scarcity. The funding will also strengthen national and provincial capacity to guide city-level development while considering climate-related risks.

2. Athens urban resilience strategy. The city of Athens in Greece faces significant climate risks including heat waves, forest fires, and flash floods. In 2018, the European Investment Bank signed a EUR 55 million loan to support Athens's 2030 Resilience Strategy via a Natural Capital Finance Facility. The Facility's focus is broader than climate change but includes elements that focus on climate change adaptation. These include EUR 5 million in financing from the Facility towards climate adaptation projects to revitalize an urban forest, stabilize water management, create green corridors and squares to lower temperatures, and improve air quality in the face of rising average temperatures.

3. Philippine City disaster insurance pool. The Philippines is located in one of the world's most disaster-prone areas and is at risk of earthquakes and volcanic eruptions as well as climate-related hazards including typhoons, floods, droughts, and landslides. The design of this insurance pool was led by the Philippines Department of Finance and supported with technical assistance from Asian Development Bank. Ten cities participated in the design of the pool and were selected based on factors including disaster risk and risk management governance, geographic location, and data availability. The pool is designed to provide post-disaster financing based on an insurance model and features payouts determined by the physical features of the natural hazard event (i.e., wind speed). The Pool is part of a broad local level strategy to address the need for rapid access to early recovery financing after a hazard event.

Multilateral DFIs provided the majority of urban adaptation finance tracked, at USD 4.1 billion annually in 2017-2018, followed by government budgets and agencies funding at USD 640 million annually and bilateral DFIs at USD 340 million annually.[14] In total, 77% of urban adaptation finance in 2017-2018 was provided by the public sector, while 22% was provided by the private sector (and the remainder from unspecified sources). In the private sector, corporations were the dominant source of finance tracked, providing USD 1.32 billion annually of the total USD 1.5 billion in private finance to urban adaptation.

Project-level market-rate debt and low-cost project debt were the predominant sources of urban adaptation finance. Furthermore, all balance sheet financing tracked as adaptation fits within the narrower urban adaptation finance definition. Despite the potential for guarantee instruments to contribute to de-risking and to leverage private financing to projects with urban adaptation benefits, we find that a very limited amount of guarantee instruments were offered to projects in this space: one such example identified in the World Bank PPI database was a bulk water facility in Rwanda, which benefited from USD 10 million in guarantees from the Multilateral Investment Guarantee Agency (Alliance, 2016).

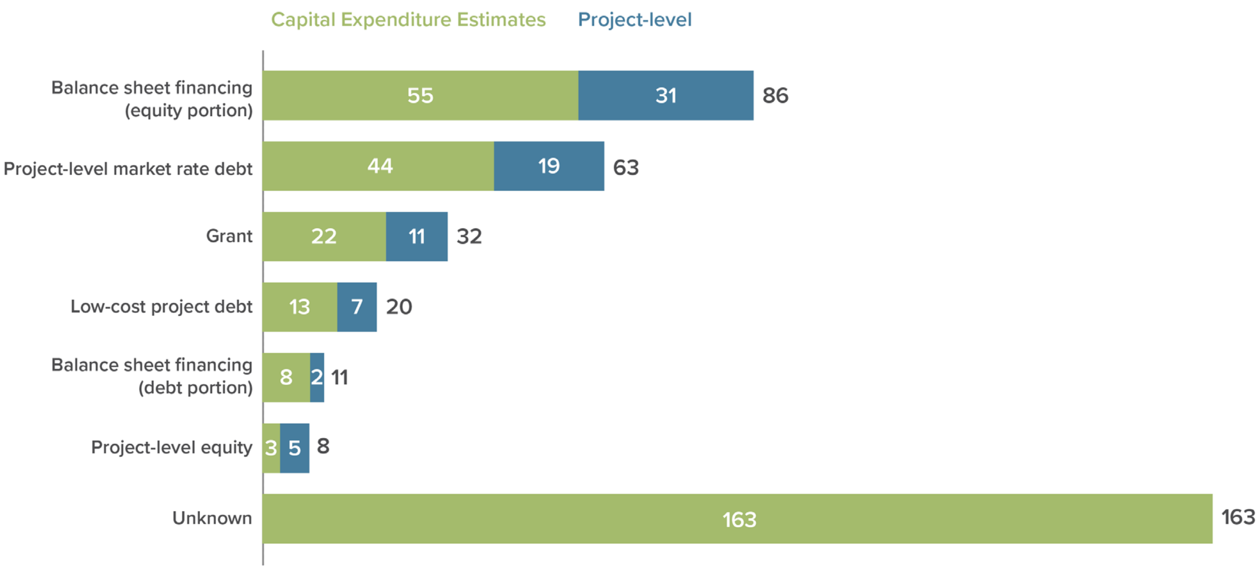
14 The Global Landscape of Climate Finance (CPI, 2020) tracks relatively little private adaptation finance overall, so there was limited private sector finance tracked to either the larger adaptation pool or the narrower urban adaptation finance pool.

6.3 FINANCE INSTRUMENTS USED IN URBAN CLIMATE FINANCE

Of the USD 384 billion in urban climate finance, USD 221 billion was estimated with enough granularity to analyze the financial instruments used to finance climate projects in cities. Estimates for finance employing equity instruments averaged USD 94 billion in 2017-2018, accounting for 43% of flows where the instrument was known (see Figure 16), mainly on private investments. Urban climate finance raised through equity most often figured on the balance sheets of finance providers (USD 86 billion), while a smaller portion was found to be at the project level (USD 8 billion). Household expenditure, which amounted to USD 44 billion, is categorized as balance sheet equity and includes items such as electric vehicles and non-motorized transport purchases and residential building energy efficiency measures.

Urban climate finance funding commitments through debt corresponded to a similarly high total of USD 94 billion in the same period, or 42% of the data estimated granularly for financial instruments. The majority of this corresponded to market rate debt financing (USD 74 billion). Of this, USD 63 billion was committed through project-level market rate lending for items such as large-scale transport projects. USD 11 billion was provided through balance sheet finance. Although not representative of the entire municipal green bonds market, out of this total, USD 0.3 billion was tracked through green bonds post-issuance reporting on proceeds (yet this amount is not representative of the entire municipal bonds market)[15].

Figure 16. Urban climate finance by financial instrument, 2017-2018 (USD billion)



Urban climate finance raised through low-cost project debt, including concessional lending from governments and MDBs, averaged USD 20 billion. Fifty-seven percent of this debt was committed by domestic government agencies, provided at concessional rates lower than market average, for green buildings and estimated through the capital

15 To avoid double counting, green bond use of proceeds that are used to support projects that have already been financed (refinancing) are not included per this report's methodology. For the same reason, the analysis relies on granular and consistent project-level data in post-issuance impact reports, which were not always available (CPI, 2019).

expenditure approach while 19% was invested by multilateral DFIs tracked at the project-level. It is likely that low-cost project debt provided by national and local governments contributed even more significantly to urban climate finance, but this is limited by tracking challenges at the project-level for other sectors. See the next section for a deeper analysis of financing models sought by local governments.

Grants, which typically do not require repayment from recipients, were employed to finance USD 32 billion of urban climate-relevant projects. Project-level data indicate that a large portion of grants were provided by domestic government agencies. In addition, climate funds provided support of urban development and management activities in the form of capacity building and technical assistance in Sub-Saharan Africa and Latin America & the Caribbean. Estimates calculated through the capacity expenditure approach for urban buildings imply that EU funding is a significant source of grants for Western Europe, amounting to an average of USD 9 billion in 2017-2018, while domestic governments' investment averaged USD 6 billion in support of the buildings sector.

As a result of the capital expenditure approach, it was not possible to determine the type of financial instrument for almost half of the total estimated in 2017-2018 (USD 163 billion, or 42% of the total). The majority of this (USD 147 billion) corresponded to urban transport estimates, and most significantly to mass rapid transit infrastructure. While tracked data suggest that urban transport financed primarily through balance sheet equity, it is likely that project debt and bonds play a significant role in financing such large-scale infrastructure. Instruments used for green building financing were similarly unclear (USD 17 billion in 2017-2018), although estimated data indicate that a significant portion would be financed through household expenditure, e.g., to purchase electrical appliances. The following sections go into deeper details on financing mechanisms employed in these sectors.

6.3.1 SPECIAL FOCUS: INNOVATIVE FINANCE MODELS IN URBAN CLIMATE FINANCE

Despite the trillions of dollars available from public, private and institutional sources, many cities, especially in developing economies, cannot access such funding to finance their low carbon and resilient infrastructure. Cities face numerous challenges in accessing finance and implementing innovative financial approaches, particularly through private sector funds. These barriers may include limited or restricted regulations on cities regarding private sector participation, low or no credit rating, limited capacity to structure bankable climate-smart projects, or lack of consistency in policy resulting from changing mayoral election cycles. There is an urgent need to increase access to financing opportunities for cities through addressing these barriers.

One opportunity to address barriers is through use of innovative financial instruments. Potential approaches include pooling projects or investments through aggregation mechanisms; raising finance through bond issuances; or providing new incentives, such as financial guarantees.

For example, in the building sector, financing green buildings in cities can be accomplished through a range of financial instruments, such as green mortgages and green bonds, utility on-bill repayments, and energy savings insurance (Table 1).

Table 1: Financing opportunities for green buildings in cities

Broad changes needed in the buildings sector & target climate outcome	City-level strategies for investment	Financing opportunities and examples
New net-zero buildings	Facilitate widespread design and construction of sustainable buildings by raising access to/use of financing to enable private investment.	Green Mortgages Green Bonds Large-scale public-private partnership (PPP) framework programs (greenfield and brownfield public buildings) Structured financing: EPC/ESCOs/forfeiting (residential, public buildings)
Energy efficiency renovations/retrofitting	Focus on heating and cooling energy efficiency solutions. Enable energy upgrades in public and private buildings	On-bill repayments (OBR) Tax-line financing or property-assessed clean energy bonds (PACE) Energy upgrade financing schemes such as Energy Savings Insurance Cooling as a service provision

In the transport sector, Table 2 presents some potential financial opportunities for green transport in cities, based on the Avoid-Shift-Improve (ASI) model, and including tools such as land value capture, user fees, and leasing models.[16]

16 The Avoid-Shift-Improve (ASI) approach is a widely recognized strategic framework to derive environmental benefits from the greening of urban transport (Bongardt et al. 2019). The approach focuses on managing the demand-side of transport and can be used by cities seeking to embed sustainability into their urban and transport planning and policymaking.

Table 2: Financing opportunities for sustainable transport in cities

Broad changes to transport sector needed (ASI Approach)	City-level strategies	Financing opportunities and examples (instruments & policies)
1. AVOID: Reduce the total volume of transportation activity required by physically locating urban citizens closer to their primary destinations.	Optimal compact urban development Transit-oriented development	Land value capture Public private partnerships
2. SHIFT: Shift transportation activity from high-emitting modes (e.g., private vehicles) to modes that emit fewer GHGs per passenger-mile or ton-mile (e.g., active transport such as walking, cycling).	Invest in public/mass transit systems Invest in active/non-motorized transportation	Green bonds Grants/loans Taxes (sales/property) User fees, charges, and tolls Congestion pricing, parking pricing Civic crowdfunding
3. IMPROVE: Increase the energy efficiency of each mode, or reduce the emissions associated with the use of each unit of energy for a transport mode.	Electrification of vehicles Improve Intelligent Transport Systems to enhance efficiency (MaaS/smart solutions) Greening of fuel sources	Innovative leasing models New models for procurement of electric buses (green public procurement)

Box 9: The work of the Alliance in developing and disseminating Innovative financial tools

The Alliance's Financial Toolbox Action Group (FTAG) facilitates knowledge exchange, advances learnings on the barriers and opportunities in scaling up urban climate finance, and supports the development of innovative financing and funding mechanisms for urban climate smart and resilient infrastructure. The main goal of the FTAG is to collaboratively advance identification and deployment of financial instruments that can help to scale climate finance in cities.

In its first year, the FTAG addressed the challenges of investing in small-to-medium sized projects by focusing on aggregation with the report, Aggregation Interventions to Increase Urban Climate Finance. Aggregated finance and project bundling can help target the barriers investors often face to invest in small- and medium-sized municipal climate projects as they often require much larger investments to justify their due diligence and transaction costs, which are constant regardless of the investment.

The FTAG is now looking to build on previous work by targeting a gap in easy-to-access knowledge of successful financing of urban climate smart and resilient infrastructure in cities. To do so, the group is mapping a wide array of innovative financial instruments and funding mechanisms being utilized for urban climate infrastructure projects. This work will help encourage knowledge exchange and learning through a relevant, shareable, and updateable database, including select case studies. The FTAG is also delineating success factors, enabling conditions, and suitability of particular financial instruments for urban climate.

7. CONCLUSIONS AND RECOMMENDATIONS

There is an urgent need to improve climate finance access for cities and to prioritize the ambitious scale-up of the quantity and availability of urban climate finance. This report estimates that USD 384 billion of climate finance was invested in cities annually, on average, in 2017 and 2018, which indicates that current levels of investment do not correspond to current urban climate finance needs, estimated to cost between 4.5 and 5.4 trillion per year to build low-emission and climate-resilient urban infrastructure (Alliance, 2015). City governments do not have access to sufficient resources to invest in or facilitate investment in the major shift to green infrastructure needed to face the climate emergency. The urban climate finance gap is even more pronounced in regions such as South Asia and Sub-Saharan Africa. Among the main opportunities to increase urban climate finance volumes and access going forward are the following:

- **Planning and intragovernmental cooperation:** Governments and international development finance institutions must have concrete investment strategies and detailed plans on urban climate smart infrastructure and adaptation. Those plans should promote more direct investment in cities and increased support for local governments to identify significant challenges, such as low creditworthiness and insufficient project development mechanisms and highlight solutions to enhance enabling environments and eventually access to capital markets. These plans should be aligned with and contribute to the Nationally Determined Contributions (NDCs) to the Paris Agreement, with national governments creating a process to include city governments in the formulation and design of national climate policy.
- **Project preparation:** DFIs, multilateral development banks and national development banks in particular, should work to expand project preparation support to cities to help them develop concrete pipelines of bankable projects. They can also play a major role in de-risking and providing guarantee mechanisms to support the expansion of private sector investments as well as structural support to enable cities to be involved in blended finance transactions.
- **Private sector engagement:** Private institutions should position themselves to work more proactively with city governments and providers of risk coverage to identify workable solutions from an early stage. The private sector, including households, is currently the largest overall supplier of urban climate finance in our estimates and has a pivotal role to play going forward as urban climate-smart infrastructure often requires substantial capital investment and public sector funding will not be enough. Leveraging private capital investment for cities to improve their service provision in a climate-smart way will be essential to promoting a green transition. Governments should actively engage with the private sector for policy formulation and implementation of plans, including the NDCs.

- **Innovation:** Cities need to diversify and innovate their financing to catalyze and scale up urban climate investment to the levels required to follow a 1.5°C pathway. For instance, cities can promote the aggregation of interventions to pool resources to fund bundles of climate compatible projects in cities which otherwise struggle to access finance due to transaction costs. National development banks can support those changes. New financial structures can also help scale investment as the examples for green transport and buildings show in this report, but financial and technical support to develop new investment solutions is crucial. A toolkit or database for sharing knowledge on how to implement and replicate financial instruments would be a useful resource for cities and their prospective partners, in combination with capacity building, to increase cities' access awareness and knowledge.
- **Adaptation and Resilience:** Governments, DFIs and the private sector should pay particular attention to developing ways to use insurance and other risk transfer mechanisms to address the increasing climate-induced risks faced by cities. This report highlights underfunding of urban climate adaptation and resilience and the dominance of public investments in this area to date. These mechanisms should be increasingly available to local governments and other local actors and adapted to urban risks, particularly in emerging markets where there is a large insurance penetration gap.
- **Best practice exchange:** Private and public investors, city stakeholders, and implementers should enhance efforts to exchange knowledge on urban climate finance investment needs and opportunities, and to collaborate to identify and develop solutions to mitigate risks and foster partnerships. Achieving this coordination and mobilizing more finance is the core mission of the Alliance and its members.

Tracking urban climate finance provides powerful data to underpin policy and investment prioritization by national and subnational policymakers and impact-oriented investors, to highlight progress, gaps, and opportunities surrounding the green transition in cities. Yet there is a clear need to improve urban climate finance tracking and data availability. Among the main priorities for improving urban climate finance tracking going forward are the following:

1. **Donors, development finance institutions (DFIs), local governments, and cities should increase efforts to tag and report urban climate finance projects.** Local governments in particular could benefit from using climate budget tagging to measure progress and inform efforts to better coordinate and mobilize climate finance.
2. **DFIs can lead the way on developing and promoting best practice methods to track and report urban climate finance projects by developing harmonized definitions, taxonomies, and methods.** Inclusion of urban tagging guidance in their joint MDB Climate Finance Tracking Methodologies for adaptation and mitigation would help generate more accurate estimates of urban climate finance investments and provide approaches that can be adopted by other groups of investors.
3. **Cities can stretch their tracking efforts beyond their own budgets to take stock of**

contributions being made by all major public and private actors towards the green transformation across the city and the priority gaps and needs going forward. First studies attempting a comprehensive city-level climate finance tracking are being undertaken by the Alliance and are forthcoming. Such assessments could provide a better understanding of city climate finance flows and providers that cannot be captured in global datasets. Such exercises could also enhance strategies to scale up catalytic financing for local climate investments.

4. **Private financial institutions and corporations should be encouraged to report standardized data on their climate aligned urban investments to a central repository e.g., through the TCFD or the CDP-ICLEI Unified Reporting System.** At present there is no comprehensive nor standardized disclosure from private finance institutions of urban climate related investments and limited exchange among private entities or between public and private entities regarding methods to disclose urban climate related investments.

5. **Researchers can refine approaches to track and estimate investments in specific sectors comprehensively.** This report presents the findings from a first exploratory deep dive into the transport and buildings sectors to estimate investments in these key urban climate mitigation activities using sector installed capacity data and investment cost data. These approaches can be refined and built for other key sectors, such as waste/water management to continue to fill in gaps in understanding about urban climate finance. More research is needed to improve our understanding of adaptation and resilience investment needs and gaps in light of increasing environmental hazards faced by cities. Current levels of preparedness and specific financing needs are not well understood. Expanded tracking at the project level provides the most valuable information to support enhanced monitoring and planning of city climate finance by revealing detailed information on who has invested in what and how. This however depends on improved quality of reporting by various public and private actors.

8. REFERENCES

1. Aspire Partners. 2020. Transport-Oriented Development & Land Value Capture. Available from https://aspire.partners/wp-content/uploads/2020/05/aspire-Land-Value-Capture-Lessons-Capability-MASTER.pdf
2. Bastin, Jean-François & Clark, Emily & Elliott, Thomas & Hart, Simon & van den Hoogen, Johan & Hordijk, Iris & Ma, Haozhi & Majumder, Sabiha & Manoli, Gabriele & Maschler, Julia & Mo, Lidong & Routh, Devin & Yu, Kailiang & Zohner, Constantin & Crowther, Thomas. 2019. Understanding climate change from a global analysis of city analogues. PLoS ONE. 14. e0217592. 10.1371/journal.pone.0217592.
3. Bongardt D, Stiller L, Swart A, Wagner A. 2019. Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I) , Published by: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Available from https://www.transformative-mobility.org/assets/publications/ASI_TUMI_SUTP_iNUA_No-9_April-2019.pdf
4. Buck, M. 2017. Crossrail project: finance, funding and value capture for London's Elizabeth line. https://learninglegacy.crossrail.co.uk/wp-content/uploads/2017/09/1C-002-Finance-Funding-and-Value-Capture.pdf
5. C40, 2021. C40 Cities. Available at: https://www.c40.org/cities
6. C40. 2019a. C40 Cities Annual Report 2019. Available at : https://c40-production-images.s3.amazonaws.com/other_uploads/images/2574_C40_2019_Annual_Report.original.pdf?1587634742
7. C40. 2019b. How to finance the retrofit of municipal buildings. Available at: https://www.c40knowledgehub.org/s/article/How-to-finance-the-retrofit-of-municipal-buildings?language=en_US
8. C40. 2019c. How to make public transport an attractive option in your city: C40 Knowledge Hub. [Cited 2021 Jan 12] Available from https://www.c40knowledgehub.org/s/article/How-to-make-public-transport-an-attractive-option-in-your-city?language=en_US
9. C40, 2019d. Win-Win: Why cities should tackle climate change and air pollution together. Available at: https://www.c40knowledgehub.org/s/article/Win-Win-Why-cities-should-tackle-climate-change-and-air-pollution-together?language=en_US
10. C40.2016. Unlocking Climate Action in Megacities. Available at: https://www.c40.org/researches/unlocking-climate-action-in-megacities
11. C40. 2012. Protecting our Capital. Available at: https://www.c40.org/researches/protecting-our-capital
12. C40, ICLEI & WRI. 2014. Greenhouse Gas Protocol: Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. Available at: https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf

13. C40 & the McKinsey Centre for Business and Environment. 2017. Focused acceleration: A strategic approach to climate action in cities to 2030. Available at: https://www.c40.org/researches/mckinsey-center-for-business-and-environment

14. C40 Cities Climate Leadership Group, ICLEI - Local Governments for Sustainability, CDP, Climate Bonds Initiative, International Cooperative and Mutual Insurance Federation (ICMIF). 2015. [Internet] How to issue a Green City Bond: The green city bonds overview. C40 Knowledge Hub. Available from https://www.c40knowledgehub.org/s/article/How-to-issue-a-Green-City-Bond-The-green-city-bonds-overview?language=en_US

15. CDP Cities. 2018. Cities at risk: dealing with the pressures of climate change. Available at: https://www.cdp.net/en/research/global-reports/cities-at-risk

16. Cervero, Robert & Murakami, Jin. 2009. Rail and Property Development in Hong Kong: Experiences and Extensions. Urban Studies. 46. 2019-2043. 10.1177/0042098009339431.

17. Climate Bonds Initiative, 2020. Green Bonds Global State of the Market 2019.

18. Climate Bonds Initiative. New York Metropolitan Transport Authority. https://www.climatebonds.net/certification/new-york-mta

19. Climate Bonds Initiative. BTS Group. https://www.climatebonds.net/certification/bts-group

20. Cities Climate Finance Leadership Alliance (Alliance). 2021. An urban Analysis of Urban Climate Adaptation Finance. Available at: https://www.citiesclimatefinance.org/wp-content/uploads/2021/02/An-Analysis-of-Urban-Climate-Adaptation-Finance.pdf

21. Cities Climate Finance Leadership Alliance (Alliance). 2020a. Enhancing the Role of National Development Banks in Supporting Climate-Smart Urban Infrastructure. Available at: https://www.citiesclimatefinance.org/2020/08/enhancing-the-role-of-national-development-banks-in-supporting-climate-smart-urban-infrastructure/

22. Cities Climate Finance Leadership Alliance (Alliance). 2020b. Urban Climate Finance in the Wake of Covid-19. Available at: https://www.citiesclimatefinance.org/wp-content/uploads/2020/12/Urban-Climate-Finance-in-the-Wake-of-COVID-19.pdf

23. Cities Climate Finance Leadership Alliance (Alliance). 2018. Summary of Good Practice of Successful Project Preparation Facilities. https://www.citiesclimatefinance.org/wp-content/uploads/2018/07/20180201_PPF_Report_final.pdf

24. Cities Climate Finance Leadership Alliance (Alliance). 2015. State of City Climate Finance 2015. New York. Available at: https://www.citiesclimatefinance.org/2015/12/the-state-of-city-climate-finance-2015-2/

25. The City Fix. 2018. Business Models for Electric Bus Adoption. Available at: https://thecityfixlearn.org/webinar/business-models-electric-bus-adoption

26. Climate Policy Initiative (CPI). 2021. Climate Finance Landscapes. https://www.climatepolicyinitiative.org/the-topics/climate-finance-landscapes/

27. Climate Policy Initiative (CPI). 2020. Updated View of the Global Landscape of Climate Finance 2019. Available at: https://www.climatepolicyinitiative.org/wp-content/uploads/2020/12/Updated-View-on-the-2019-Global-Landscape-of-Climate-Finance-1.pdf

28. Climate Policy Initiative (CPI). 2019. Global Landscape of Climate Finance. Available at: https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2019/

29. Climate-KIC. 2016. Final White Paper Barriers to Investments into Urban Climate Mitigation Projects. https://local.climate-kic.org/wp-content/uploads/2016/02/Final-White-Paper-Barriers-to-Investments-into-Urban-Climate-Mitigation-Projects-020220161.pdf

30. Climate-KIC. 2015. Facsheet Low Carbon Cities . https://local.climate-kic.org/wp-content/uploads/2015/11/Factsheet_Low_Carbon_Investment_Cities.pdf

31. Coalition for Urban Transitions. 2019. Climate Emergency, Urban Opportunity: The unique and crucial roles of national governments. Colenbrander S., Lazar L., Haddaoui C., Godfrey N., Lobo A., Clarkson H., Huxley R., Parnell S., Smith B., Smith S. and Altenburg T.

32. Committee on Climate Change (CCC). 2019. Net Zero – the UK's Contribution to Stopping Global Warming. Available at: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

33. Complete Communities Toolbox. 2021. Transit Oriented Development. Available from https://www.completecommunitiesde.org/planning/complete-streets/tod/

34. Department for Business, Energy & Industrial Strategy (BEIS). 2019. UK Local Authority Carbon Dioxide Emissions Estimates 2017. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812139/Local_authority_2017_greenhouse_gas_emissions_statistical_release.pdf

35. EDF, 2020. On-Bill Repayment spurring clean energy, creating jobs and saving people money. Available from https://www.edf.org/sites/default/files/content/national_obr_fact_sheet_0.pdf

36. Environmental Finance 2020. Green bond of the year, supranational, sub-sovereign and agency (SSA) - Société du Grand Paris. Available at: https://www.environmental-finance.com/content/awards/green-social-and-sustainability-bond-awards-2020/winners/green-bond-of-the-year-supranational-sub-sovereign-and-agency-ssa-societe-du-grand-paris.html

37. ESMAP, Financing Municipal Energy Efficiency Projects. Mayoral Guidance Note 2. World Bank, 2014. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/21307/936740NWP0Box30inancing0KS180140web.pdf?sequence=1

38. Fay, M., Toman, M., Benitez, D., and Csordas, S., 2011. Infrastructure and sustainable development. In Postcrisis Growth and Development: A Development Agenda for the G20. S. Fardoust, Y. Kim, and C. Sepulveda (eds.). World Bank, Washington DC. 329–

382. Available at: https://openknowledge.worldbank.org/handle/10986/2533?locale-attribute=fr

39. Floater, G., Dowling, D., Chan, D., Ulterino, M., Braunstein, J., McMinn, T., 2017. Financing the Urban Transition: Policymakers' Summary. Coalition for Urban Transitions. London and Washington, DC. Available at: http://newclimateeconomy.net/content/cities-working-papers

40. GIZ/Felicity. 2020. Climate Finance for Low-carbon Urban Infrastructure in China. Available at: https://www.sustainable-urbanisation.org/en/publication/climate-finance-for-low-carbon-urban-infrastructure-in-china-study-by-sgup-and-felicity

41. Global Alliance for Buildings and Construction (GABC), International Energy Agency and the United Nations Environment Programme (2019): 2019 global status report for buildings and construction: Towards a zero-emission, efficient and resilient buildings and construction sector. Available at: https://www.worldgbc.org/sites/default/files/2019%20Global%20Status%20Report%20for%20Buildings%20and%20Construction.pdf

42. Global Infrastructure Hub. 2017. Global Infrastructure outlook. Available at: https://cdn.gihub.org/outlook/live/methodology/Global+Infrastructure+Outlook+-+July+2017.pdf

43. Global Innovation Lab for Climate Finance. 2018. Financing for Low-Carbon Auto Rickshaws. Available at: https://www.climatefinancelab.org/project/low-carbon-auto-rickshaws/

44. Global Innovation Lab for Climate Finance. 2018. Proterra Electric Bus Battery Service Agreements. Available at: https://www.climatefinancelab.org/project/proterra-electric-bus-battery-service-agreements/

45. Global Innovation Lab for Climate Finance. 2017. Pay as you Save for Clean Transport. Available at: https://www.climatefinancelab.org/project/pay-save-clean-transport/

46. Global Platform for Sustainable Cities. 2018. TOD Implementation Resources & Tools. 1st ed. Washington, DC: World Bank

47. The Guardian. 2019. How public transport actually turns a profit in Hong Kong. Available at: https://www.theguardian.com/cities/2019/mar/19/how-public-transport-actually-turns-a-profit-in-hong-kong

48. Hallegatte S, Green C, Nicholls RJ, Morlot JC. 2013. Future flood losses in major coastal cities. https://www.nature.com/articles/nclimate1979.pdf

49. Henger R. and Voigtländer, M., 2013. Green investments and green mortgages in Germany.

50. Huston, S., Lahbash, E. 2018. Land Value Capture and Tax Increment Financing: Overview and Considerations for Sustainable Urban Investment. European Journal of Sustainable Development Research. Available at: https://www.ejosdr.com/download/land-value-capture-and-tax-increment-financing-overview-and-considerations-for-sustainable-urban.pdf

51. Inter-American Development Bank (IDB). 2020. Tax Increment Financing for Urban Projects: An Alternative to Fund Infrastructure in Latin American Cities?: The Case of Medellin's Carrera 80 Tram Project. https://publications.iadb.org/publications/english/document/Tax-Increment-Financing-for-Urban-Projects-An-Alternative-to-Fund-Infrastructure-in-Latin-American-Cities-The-Case-of-Medellins-Carrera-80-Tram-Project.pdf

52. Intergovernmental Panel on Climate Change (IPCC). 2018. Summary for Policy Makers: What The IPCC Special Report On Global Warming Of 1.5°C Means For Cities. https://www.ipcc.ch/site/assets/uploads/sites/2/2018/12/SPM-for-cities.pdf

53. Intergovernmental Panel on Climate Change (IPCC). 2014. Fifth Assessment Report - Mitigation of Climate Change. Transport. Sims R., R. Schaeffer, F. Creutzig, X. Cruz-Núñez, M. D'Agosto, D. Dimitriu, M.J. Figueroa Meza, L. Fulton, S. Kobayashi, O. Lah, A. McKinnon, P. Newman, M. Ouyang, J.J. Schauer, D. Sperling, and G. Tiwari, 2014: [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

54. International Energy Agency (IEA). 2020. Tracking Transport 2020. https://www.iea.org/reports/tracking-transport-2020

55. International Finance Corporation (IFC). 2019. Green Buildings. Available at: https://www.ifc.org/wps/wcm/connect/a6e06449-0819-4814-8e75-903d4f564731/59988-IFC-GreenBuildings-report_FINAL_1-30-20.pdf?MOD=AJPERES&CVID=m.TZbMU

56. International Finance Corporation (IFC). 2018. Climate investment opportunities in emerging markets: an IFC analysis (No. 121277, pp. 1-140). Kerr, T., Maheshwari, A., & Sottong, J. D. The World Bank. Available at: un https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/climate+business/resources/cioc-ifc-analysis

57. International Renewable Energy Agency. 2020. Global Landscape of Renewable Energy Finance 2020. Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_CPI_Global_finance_2020.pdf

58. International Mortgage Lenders Association. 2020. Green Mortgages. Available from http://www.imla.org.uk/resources/publications/imla-green-mortgages.pdf

59. Investchile. 2020. Chile has already allocated 24.8% of the US$2,373 million issued in green bonds in 2019. Available from https://blog.investchile.gob.cl/chile-has-already-allocated-24.8-of-the-us2373-million-issued-in-green-bonds-in-2019

60. IRENA. 2018. Global Energy Transformation: A roadmap to 2050, International Renewable Energy Agency, Abu Dhabi. Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Report_GET_2018.pdf

61. Li, X., Castellanos, S. and Maassen, A. 2017. Current trends and innovations affecting the potential for a widespread adoption of electric buses-A comparative case study of 22 cities in the Americas, Asia-Pacific and Europe.

62. Lindholm, M., 2010. A sustainable perspective on urban freight transport: Factors affecting local authorities in the planning procedures. Procedia-Social and Behavioral Sciences, 2(3), pp.6205-6216.

63. Lincoln Institute of Land Policy. 2018. Improving Tax Increment Financing (TIF) for Economic Development. https://www.lincolninst.edu/sites/default/files/pubfiles/improving-tax-increment-financing-full.pdf

64. Lincoln Institute of Land Policy. 2020. Land Value Return Tools To Finance Our Urban Future. Policy Brief. Available from https://www.lincolninst.edu/sites/default/files/pubfiles/land-value-return-policy-brief.pdf

65. Macharis, C. and Melo, S., 2011. City distribution and urban freight transport: multiple perspectives. Edward Elgar Publishing.

66. Multilateral Development Banks (MDBs). 2019. “Joint report on Multilateral Development Banks’ Climate finance 2018”. At: http://www.ebrd.com/2018-joint-report-on-mdbs-climate-finance

67. Mundaca, L. and Kloke, S., 2018. On- Bill Financing Programs to Support Low- Carbon Energy Technologies: An Agent- Oriented Assessment. Review of Policy Research, 35(4), pp.502-534.

68. New Climate Economy (NCE). 2019. Scaling up investment for sustainable urban infrastructure: A guide to national and subnational reform. Ahmad E, Dowling D, Chan D, Colenbrander S, Godfrey N. https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2019/04/CUT2019_Scaling_up_investment_for_sustainable_urban_infrastructure.pdf

69. New Climate Economy (NCE). 2018. Unlocking The Inclusive growth Story Of The 21st Century: Accelerating Climate Action In Urgent Times. https://newclimateeconomy.report/2018/.

70. New Climate Institute. 2019). Assessment of Subnational and Non-State Climate Action. Available at: https://newclimate.org/wp-content/uploads/2019/09/19-9117_Factsheet_Indonesia_Country.pdf

71. Overseas Development Institute (ODI) 2019. Financing the sustainable urban future: Scoping a green cities development bank. Alexander J, Nassiry D, Barnard S, Lindfield M, Teipelke R, Wilder M https://www.odi.org/sites/odi.org.uk/files/resource-documents/12680.pdf

72. Overseas Development Institute (ODI) and Heinrich Böll Foundation (HBF). 2019. Climate Funds Update Database. London; Washington DC: ODI/HBF. At: http://www.climatefundsupdate.org

73. Organisation for Economic Co-operation and Development (OECD). 2020. Cities policy responses. Available at: http://www.oecd.org/coronavirus/policy-responses/cities-policy-responses-fd1053ff/#section-d1e2542

74. Organisation for Economic Co-operation and Development (OECD). 2019. Financing climate objectives in cities and regions to deliver sustainable and inclusive growth.

OECD Environment Policy Papers, No. 17, OECD Publishing, Paris. Available at: https://doi.org/10.1787/ee3ce00b-en.

75. Organisation for Economic Co-operation and Development (OECD). 2018. Climate Related Development Finance at the activity level". Paris: OECD's Development Assistance Committee (DAC). Available at: http://www.oecd.org/dac/stats/climatechange.htm

76. Organisation for Economic Co-operation and Development (OECD) and the European Commission (EU). 2020. Available at: https://www.oecd.org/regional/regional-statistics/Cities-in-the-World-Policy-Highlights.pdf

77. Organisation for Economic Co-operation and Development (OECD). 2013. Mobilising Private Investment in Sustainable Transport: The Case of Land-Based Passenger Transport Infrastructure. OECD Environment Working Papers, No. 56, OECD Publishing. Ang, G. and V. Marchal. http://doi.org/10.1787/5k46hjm8jpmv-en

78. Rai, H.B., Van Lier, T., Meers, D. and Macharis, C., 2017. Improving urban freight transport sustainability: Policy assessment framework and case study. Research in Transportation Economics, 64, pp.26-35.

79. Rapid Transition Alliance (RTA). 2019. Local, civic action is growing a climate revolution from below. https://www.rapidtransition.org/stories/local-civic-action-is-growing-a-climate-revolution-from-below/

80. RenOnBill. 2020. Overview of On-Bill Building Energy Renovation Schemes. Available from https://storage.googleapis.com/renonbill-website.appspot.com/image/multimedia/14_01_2020_11_37/200109_RenOnBill_D2.1_Review_OBS_FINAL_with%20cover_02.pdf

81. Renewable Energy Policy Network for the 21st Century (REN21). 2019. Renewables in Cities Global Status Report. https://www.ren21.net/wp-content/uploads/2019/05/REC-2019-GSR_Full_Report_web.pdf

82. Republic of Chile, Ministry of Finance. 2019. Presentation. Available at: https://www.ndf.fi/sites/default/files/news_attach/chile_presentation_may_2019_27may19_web.pdf

83. SLoCaT. 2018. Transport and Climate Change Global Status Report 2018. Available at: http://slocat.net/tcc-gsr

84. State and Local Energy Efficiency Action Network. 2014. Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators. Lawrence Berkeley National Laboratory. Zimring M., Leventis G., Borgeson M., Thompson P., Hoffmanl.M. and Goldman C.

85. Sustainable Banking Network (SBN). 2018. Creating Green Bond Markets: Insights, Innovations, and Tools from Emerging Markets. Prepared by IFC and the Climate Bonds Initiative (CBI) for the SBN Green Bond Working Group

86. Transformative Urban Mobility Initiative (TUMI). 2019. Avoid Shift Improve – Instruments. Available at: https://www.transformative-mobility.org/publications/avoid-shift-improve-instruments

87. United Nations, Department of Economic and Social Affairs, Population Division. 2019. World Population Prospects 2019: Highlights. ST/ESA/SER.A/423.

88. World Bank. 2019. World Bank Municipal Finance Database

89. World Bank Group (WBG) and United Nations Development Programme (UNDP). 2020. Catalyzing Private Sector Investment in Climate Smart Cities. Invest4Climate Knowledge Series http://documents1.worldbank.org/curated/en/179101596519553908/pdf/Catalyzing-Private-Sector-Investment-in-Climate-Smart-Cities.pdf

90. United Nations Development Program. 2016. Green Bonds.

91. United Nations Environment Programme (UNEP). 2019. Air Pollution And Climate Change: Two Sides Of The Same Coin. https://www.unep.org/news-and-stories/story/air-pollution-and-climate-change-two-sides-same-coin

92. United Nations Environment Programme (UNEP). 2015. Resilience and Resource Efficiency in Cities. https://wedocs.unep.org/bitstream/handle/20.500.11822/20629/Resilience_resource_efficiency_cities.pdf?sequence=1&isAllowed=y

93. UNCRD. 2017. Green Freight and Logistics in the Context of Sustainable Development Goals (SDGs) (Background Paper for EST Plenary Session-11) Intergovernmental Tenth Regional Environmentally Sustainable Transport (Est) Forum In Asia, 14-16 March 2017, Vientiane, Lao People's Democratic Republic. Sehlleier F, Imboden A, Gota S, Hagge K.

94. UN Environment & International Energy Agency. 2019. Global Status Report for Buildings and Construction. Available at: https://www.worldgbc.org/news-media/2019-global-status-report-buildings-and-construction

95. UN Habitat. 2020 UN-Habitat Covid-19 Response Plan. Available at: https://unhabitat.org/sites/default/files/2020/04/final_un-habitat_covid-19_response_plan.pdf

96. UN-Habitat. 2017. Finance for City leaders Handbook: Improving Municipal Finance to Deliver Better Services. https://unhabitat.org/sites/default/files/2021/01/fcl_2017_2nd_ed_lowres_2.pdf

97. UN Habitat. 2011. Cities and Climate Change: Global Report on Human Settlements, 2011. https://unhabitat.org/sites/default/files/download-manager-files/Cities%20and%20Climate%20Change%20Global%20Report%20on%20Human%20Settlements%202011.pdf

98. United Nations Framework Convention on Climate Change (UNFCCC). 2019. 2019 Forum of the Standing Committee on Finance: Climate finance and sustainable cities. https://unfccc.int/sites/default/files/resource/SCF%20Forum%202019%20report_final.pdf

99. World Bank. 2020. Blog: How do we define cities, towns, and rural areas? Available at: https://blogs.worldbank.org/sustainablecities/how-do-we-define-cities-towns-and-rural-areas

100. World Bank. 2019. Innovative Finance Solutions For Climate-Smart infrastructure: New Perspectives On result-Based Blended Finance For Cities. https://www.gprba.org/sites/gpoba/files/publication/downloads/2019-07/new-perspectives-results-based-blended-finance-cities-innovative-finance.pdf

101. World Bank. 2018a. 2017 Survey of National Development Banks. Washington, DC: The World Bank. Available at: http://documents.worldbank.org/curated/en/977821525438071799/pdf/125958-WP-PUBLIC-WorldBankGlobalReportNationalDevelopmentBanksVFull.pdf

102. World Bank. 2018b. Transit-Oriented Development Implementation Resources and Tools. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/31121 License: CC BY 3.0 IGO

103. World Bank, 2015. Financing Transit-oriented Development with Land Values. Available at: https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000MfDJ/SUlrU5Z15NTx4ozRlGAV.jDG1_duZo.p0lhO.9kxy84

104. World Bank. 2013. Financing Sustainable Cities: How We're Helping Africa's Cities Raise Their Credit Ratings. Hogg J. https://www.worldbank.org/en/news/feature/2013/10/24/financing-sustainable-cities-africa-creditworthy

105. World Bank. 2012. How Close Is Your Government to Its People? Worldwide Indicators on Localization and Decentralization. Ivanyna M, Shah A. http://documents1.worldbank.org/curated/en/534401468340175192/pdf/WPS6138.pdf

106. World Economic Forum (WEF). 2019. Climate change: won or lost in cities or by cities? Harman O. https://www.weforum.org/agenda/2019/09/climate-change-won-or-lost-in-cities-or-by-cities/

107. World Green Building Council. 2017. Creating an energy efficient mortgage for Europe, A Review of Building Performance Indicators that Impact Mortgage Credit Risk. Richardson S., & Drinkwater J. Available at: https://www.worldgbc.org/sites/default/files/EeMAP%20Technical%20Report%20on%20Building%20Performance%20Indicators%20that%20Impact%20Mortgage%20Credit%20Risk_0.pdf

108. World Habitat. 2016. Sustainable Housing in Mexico and Latin America: the Green Mortgage Winner, World Habitat Award. Available from https://www.world-habitat.org/wp-content/uploads/2016/03/Green-Mortgage-report-WEB-3.5MB.pdf

109. World Resources Institute (WRI). 2019. Everything You Need to Know About the Fastest-Growing Source of Global Emissions: Transport. Wang S., & Ge M. https://www.wri.org/blog/2019/10/everything-you-need-know-about-fastest-growing-source-global-emissions-transport

110. World Resources Institute (WRI). 2020. Urban Land Value Capture in Sao Paulo, Addis Adaba and Hyperabad: Differing Interpretations, Equity Impacts, and Enabling

Conditions. https://files.wri.org/s3fs-public/urban-land-value-capture-sao-paulo-addis-ababa-and-hyderabad.pdf?9yIA9Pc7WREobX1iAIe805ghET8U1CnB

111. World Health Organization (WHO). 2018. 9 Out Of 10 People Worldwide Breathe Polluted Air, But More Countries Are Taking Action. Available at: https://www.who.int/news/item/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action

112. World Wildlife Fund (WWF). 2015. Financing The Transition: Sustainable Infrastructure in Cities. http://awsassets.panda.org/downloads/summary_financing_the_transition_sustainable_ifrastructure_in_cities_1.pdf

9. ANNEX: METHODS FOR ESTIMATING URBAN CLIMATE FINANCE

The following methodology note outlines the approaches adopted in this report to estimate the urban climate finance numbers reported in this 2021 State of Cities Climate Finance Report, particularly this Landscape of Urban Climate Finance paper. This covers:

- The definition of urban climate finance and physical boundaries (Section 1.1)
- Taxonomy and activities, urban inclusion rules by sector and activity (Section 1.2)
- A summary of data sources (Section 1.3)
- The methodology used to calculate capital expenditure estimates for the transport and building sectors (Section 1.4)

DEFINITIONS AND PHYSICAL BOUNDARIES

CLIMATE FINANCE DEFINITION AND SECTORAL BOUNDARIES

This report adopts the climate finance definition developed by Climate Policy Initiative (CPI), which is based on the tracking and reporting methodologies developed by the joint group of Multilateral Development Banks (MDBs), members of the International Development Finance Club (IDFC), the OECD's Development Assistance Committee (DAC) and the group of Multilateral Climate Funds that reports commitments through the Climate Funds Update (MDB, 2020; OECD, 2018; ODI & HBF, 2020). See CPI's Global Landscape methodology for more details on the approach adopted (CPI, 2019).

The definition of urban climate finance is adapted from a global to a subnational context, where the delimitation for urban relevance is loosely tied to climate finance committed to benefit city dwellers exclusively or almost exclusively.

For climate mitigation activities, the sectoral boundaries applied correspond to those used by the Global Protocol for Community-scale GHG Emissions Inventories (GPC), which is used by regional governments for greenhouse gas emission accounting (C40, WRI, ICLEI, 2014). In practice, this means that activities that could not be proven to be relevant to the livelihood of city dwellers exclusively were excluded. The largest consequence of this is that power generation was largely excluded from the final dataset (except for some embedded renewable energy projects, for example rooftop solar PV projects that were included as building energy efficiency measures), whether or not these were geographically located within a city's physical boundaries since it was not possible to determine the portion of new power generation capacity that would be for the benefit of urban versus rural areas.

More generally, we included sectors for which cities are empowered to act through subnational investment and catalyzing private sector co-financing. Local governments often have low control over utilities and grid networks, which are often under control of national departments of energy (WBG and UNDP, 2020). Thus, it was decided to avoid estimating a proportion of "city relevance" of grid-connected power plants, based on the lack of clear perspective on proportion of power generation actually dedicated to city-level energy consumption. Local governments vary considerably in decision making authority over sectors, particularly energy generation (compared to other sectors such as waste, transport, and buildings). Some power generation projects located within urban boundaries may be relevant for the livelihood of people outside this urban area, and conversely projects developed far from the city could be relevant to city dwellers, made it challenging to define an inclusion rule for the sector.

An exception to this were waste-to-energy projects. Cogeneration, consisting of burning biomass for the production of both electricity and heating, was included if the plant was either located within a city's physical boundary or if it could be deduced, from the project description, that the waste treated is produced within the physical boundary of a city. Furthermore, project documentation indicated that the energy generated by waste was used in close proximity, and even more so for heating.

For **climate adaptation activities**, urban relevance of an activity depends on whether it aims to address an identified climate risk or hazard faced by the city. In practice, data is collected and included if the activity financed targets an urban climate risk and 1) affects the city and urban communities directly and/or 2) occurs within the city boundary. See the background paper on Urban Adaptation published in this series of the State of Cities Climate Finance report for more details on methodologies regarding urban adaptation.

DEFINING CITIES AND PHYSICAL BOUNDARIES[17]

Spanning demographic, geographic and economic characteristics, there is no universal consensus on what defines a city. While outside the scope of this report, defining what a city is and what physical boundaries are is necessary for data collection and identification of urban-relevant investment. Often categorized by population, the cutoff points used to categorize cities varies across countries. To unify the definitions, the UN Statistical Commission has recently endorsed a new method for classifying territories referred to "the degree of urbanization" (World Bank, 2020a). This method classifies 1km2 grid cells by population density, contiguity of these cells as well as population: for example, urban centers, which corresponded to the most highly dense clusters, are classified based on contiguous cells with 1,500 or more inhabitants per km2, as well as a population of 50,000 or more (EC, 2021).

17 Please note that definitions between Part 1 and Part 2 of this report may vary slightly given the differing focus and perspectives. In particular, Part 1 of the report considers the term "city" from the perspective of climate finance flows into urban areas, irrespective of its source and is therefore more closely linked to the built environment and urban geographic area. Part 2 on the other hand considers the term "city" from the perspective of the city government (or mayor) and is therefore more closely linked to the jurisdictional boundary and agency of the city government, unless expressed otherwise. Both parts of the report adopt the same definition for urban climate finance, as developed by CPI and CCFLA.

This report refers to cities as geographically and juridically delimited subnational entities, using the notion of Functional Urban Areas (FUAs), which uses the "degree of urbanization" (OECD/EC, 2020). We consider physical boundaries that are officially locally defined by the city government in question, which, depending on the context, may include less urbanized areas such as peri-urban commuting zones. This approach is used throughout the 2021 State of Urban Climate Finance report when discussing the role and power of city governments. For projects slightly outside the city's juridic delimitation, we employ the notion of Functional Urban Areas (FUAs) developed by the OECD and the EU Commission (2020), where grid density is paired with economic and commute time analysis to determine urban areas and their wider FUAs. As FUAs are potentially urban-relevant or residential places on which a city's activity depends, they are included when data collection requires localizing projects. For example, rooftop solar or building energy efficiency projects that could be shown to be located within a city's FUAs were included as urban-relevant in our analysis.

Numbers presented throughout this report refer to urban climate finance rather than city climate finance as we track investment that can be qualified as relevant for city-dwellers, as considered in our urban climate finance definition. In addition to relying on the "degree of urbanization" classification, the urban climate finance term is both broad and clear. While urban climate finance includes capital raised by cities, we indeed also account for investment provided by other actors such as international private and public institutions, and thus use the term "urban" as a more general delineating term.

SECTOR AND ACTIVITY TAXONOMY: URBAN INCLUSION RULES

Our taxonomy below lists activities that qualify as climate mitigation and adaptation finance, based on the categorization used by CPI in the Global Landscape of Climate Finance (CPI, 2019) as well as IPCC and EU Taxonomy categorizations for the urban transport and buildings sectors (IPCC, 2014; EU TEG, 2020).

To qualify as urban climate finance, the urban inclusion rule provides the reasoning used to determine whether identified projects could be considered as exclusively urban-relevant, as stated in our definition of urban climate finance. **For mitigation**, the urban inclusion rule is either 1) the project must provide service to the city exclusively (in the case of waste, this implies for waste produced by activities occurring in the city), or 2) if located within the city boundary. **For adaptation**, the rule is either 1) if affecting the city, or 2) if located within the city boundary (see the background paper, An Analysis of Urban Climate Adaptation Finance, for more details). We used these rules, which were built from sector interviews as well as the Global Protocol for Community-scale GHG Emissions Inventories (GPC) (C40, WRI, ICLEI, 2014), to tag project-level data for urban relevance.

CLIMATE MITIGATION

Table 1. Climate mitigation activities and urban inclusion rules

ACTIVITY	SUB-ACTIVITY	URBAN INCLUSION RULE
TRANSPORT		
Railway (passenger/ freight)	Supporting infrastructure for electrified rail ensuring a modal shift of transport from road or air to rail	Must provide service to the city. Can include partial urban to rural area, as they may benefit some of the urban area. Inter-urban transport, from city to city, is excluded
	Urban mass transit (tram, metro, light rail) for urban transport modal change	
	New rolling stock and vehicles for electrified public transport (rail, trams, trolleybuses, cable cars)	
	Retrofit of existing rail fleet with low-carbon technologies	
	New rolling stock, vehicles and recharging/refueling infrastructure for potentially zero emission propulsion e.g., hydrogen-powered vehicles	
Buses	Supporting infrastructure for bus rapid transit, ensuring a modal shift from a more carbon intensive mode of transport	Must provide service to the city. Can include partial urban to rural area, as they may benefit some of the urban area, or be operated or owned by city authority
	Recharging infrastructure for electric buses and refueling infrastructure for hydrogen buses”	
	New bus fleet, electric or hydrogen	
	Retrofit of existing bus fleet with low-carbon technologies	
Waterways (passenger/ cargo)	Supporting infrastructure for waterway transport, ensuring a modal shift from a higher carbon mode of transport	Must provide service to the city. Can include partial urban to rural area, as they may benefit some of the urban area, or be operated or owned by city authority
	Recharging infrastructure for electric vessels and refueling infrastructure for hydrogen vessels	
	New boat fleet with zero emission propulsion systems	
	Retrofit of existing boat fleet with low-carbon technologies	
Private vehicles (passenger/ freight cars/vans)	Retrofit of existing vehicles with low-carbon technologies	If providing exclusive service to the city. For passengers residing or freight operating significant portion of time within urban physical boundary. For example, proving that private vehicle is registered in city jurisdictions
	New electric and hydrogen powered vehicles	
	Recharging infrastructure for electric vehicles and refueling infrastructure for hydrogen vehicles	
Non-motorized transport	Cycling schemes and purchase of bicycles, including electric bicycles, for use as an urban mode of transport (rather than for leisure)	If used for transport/commute within or to urban physical boundary area. Pedestrian and cycling infrastructure to be partially or fully geographically located within the urban physical boundary
	Supporting infrastructure for non-motorized transport modes: infrastructure for pedestrians (including pedestrianization and car free zones) and cyclists (cycle lanes), and supporting activities	
Transport management	ICT that improves asset utilization, flow and modal shift, regardless of transport mode (public transport information, car-sharing schemes, smart cards, road charging systems, relevant apps such as ride-sharing apps and mobility service apps, which integrate travel info, payment and ticketing, etc.)	If providing exclusive service to the city (for intra-urban transit, for example), for example by proving that private vehicle are registered in city jurisdictions
	Intermodal freight facilities and freight consolidation facilities, and smart freight logistics	
	Intermodal passenger terminals (for example, to improve journey times)	

BUILDINGS		
Existing residential, commercial, and public buildings	Energy efficiency of envelopes: technological energy efficiency improvements and other building site measures resulting in energy savings	If the building is located within the city's physical urban boundary
	Energy efficiency of heating and cooling buildings systems including water heating if integrated: technical improvement of HVAC buildings systems, utilization of waste heat for building system and cooling, active and passive management and operation of buildings	
	Renewable energy -based heating and cooling buildings systems, including water heating if integrated: replacement of heating and cooling systems with those using solar, sustainable biomass, geothermal or other low-carbon energy	
	Energy efficiency through digitalization, resulting in CO2 emission reduction of operation of existing buildings	
	Installation of on-site renewable electricity producing technologies: solar, wind, biogas energy	
Construction of residential, commercial, and public buildings	Energy efficiency of envelopes: use of highly efficient architectural designs, building techniques and materials, reducing emissions during the building operation phase	If the building is located within the city's physical urban boundary
	Reduction of embodies emissions: use of low carbon building material	
	Installation of energy efficient heating and cooling buildings systems, excluding RE: installation of HVAC buildings systems, utilization of waste heat for building system and cooling, active and passive management and operation of buildings. Includes water heating if integrated	
	Renewable energy -based heating and cooling buildings systems, the measure includes water heating if integrated: installation of heating and cooling systems with those using solar, sustainable biomass, geothermal or other low-carbon energy	
	Energy efficiency through digitalization, resulting in CO2 emission reduction of operation of existing buildings	
	Installation of on-site renewable electricity producing technologies: solar, wind, biogas energy	
Domestic efficient appliances, office equipment, and lights including street lighting and traffic lighting infrastructure	Energy efficient domestic appliances: exchange of electric and not electric appliances with appliances exceeding MEPS	If the building is located within the city's physical urban boundary
	Cooking domestic appliances: exchange of cooking appliances with more efficient and/or low carbon	
	Energy efficient commercial equipment including office equipment and process equipment: exchange of commercial equipment with that exceeding MEPs	
	Street lighting infrastructure and traffic light infrastructure: retrofit of existing street lighting infrastructure and traffic light infrastructure with advanced elements, installation of new advanced street lighting and traffic lighting infrastructure, exchange of lighting technologies with more efficient and/or low carbon	
	Reduction of CFCs, HCFCs and HFCs emissions: exchange of appliances with those resulting in less non-co2 GHG emissions	
Measures promoting behavioral changes including sufficiency	Measures towards behavioral change: measures enabling flexible comfort requirements	If the building is located within the city's physical urban boundary
	Measures promoting a circular economy approach: measures contributing to reuse of buildings, materials and equipment	
	Shared economy approach applied to buildings: sufficiency measures which include sharing economy approaches	
	Digitalization for sufficiency: promotion of digitalization which results in the reduction of unnecessary operation of buildings and therefore emission reduction	
	Sector coupling approaches: measures towards synergy between sectors reducing energy consumption and emissions of buildings	

WASTE AND WASTEWATER		
Wastewater treatment	Wastewater collection networks	If exclusively for waste produced by activities located within city physical boundaries. We assume this is the case if the facility itself is located within city physical boundaries
	Wastewater treatment facilities	
Solid waste management	Landfill with gas capture	If exclusively for waste produced by activities located within city physical boundaries. We assume this is the case if the facility itself is located within city physical boundaries
	Waste-to-energy projects: production of electricity or heat as a by-product (e.g., incineration, gasification, pyrolysis and plasma)	
	Biological treatment facilities: anaerobic digestion facilities for the production of biogas from organic waste, composting facilities for the production of compost from organic waste	
	Waste collection, reusing and recycling projects: preparation, consisting of collection, sorting and material recovery; reusing, consisting of refurbishing, repairing, cleaning components or products to re-use in their original form; recycling of metals, plastics, glass (except aggregate) and paper to be used as inputs into new products or as a resource	
ENERGY		
Electricity generation	Renewable energy generation: wind, solar, geothermal, biomass/ biogas, ocean power, hydropower, biofuels	If can be shown or assumed to be for city dwellers' use exclusively. As explained above, this is likely to be limited to integrated renewable energy systems and waste-to-energy
Heat production, cooling or other energy application	Production of heating and/or cooling using renewable energy: thermal applications (solar including water heating, geothermal, sustainably produced bioenergy, ocean power); wind-driven pumping systems, cooling facilities (ocean and bioenergy); combined heat and power (CHP)	If can be shown or assumed to be for city dwellers' use exclusively
Transmission and Distribution	Renewable energy: new, expanded and improved/upgraded transmission and distribution lines for renewable energy integration; undergrounding of lines where exposed to climate risks; ICT technologies like smart grid & mini grid (Controls, computers, automation, sensors, smart meters, ICT platforms and technology that is dedicated to smart systems)	Only if transmission and distribution can be shown to be exclusively for city distribution
	Retrofit of transmission lines to reduce energy use and/or technical losses	
Storage systems	Battery, mechanical, pumped storage, capacitors, compressed air storage and flywheels	If can be shown or assumed to be for city dwellers' use exclusively
Energy Efficiency	Retrofitting of existing renewable energy plant retrofits	If can be shown or assumed to be for city dwellers' use exclusively
URBAN DEVELOPMENT AND MANAGEMENT / OTHER		
Urban agriculture	Reduction in energy use in agricultural processes, improvement of existing carbon pools, reduction of non-CO2 GHG emissions from agricultural practices and technologies, and supporting infrastructure	If the area is located within the city's physical urban boundary
	Afforestation and reforestation, sustainable forest management activities that increase carbon stocks or reduce the impact of forestry activities	
Information and Communication Technologies	Projects producing components, equipment, or infrastructure dedicated to the renewable and energy efficiency sectors, or low-carbon technologies, for example, data hubs including data storage centers	If geographically located in the city boundary
	Research and development of renewable-energy or energy-efficiency technologies, or low-carbon technologies	Only if for urban-relevant technologies exclusively

Policy and National Budget Support & Capacity Building	Polices and planning: national, sectoral or territorial policies/planning/ action plans/planning/ institutions dedicated to mitigation such as NDCs, NAMAs and plans for scaling up renewable energy; sectoral regulations leading to climate change mitigation or energy efficiency standards or certification schemes, for example	If exclusively for the benefit of city dwellers, usually under local government control but also national
	Systems of monitoring the emission of greenhouse gases	
	Pricing: efficient pricing of fuels and electricity (such as subsidy rationalization, efficient end-user tariffs, and efficient regulations on electricity generation, transmission or distribution, and on carbon pricing)	
	Capacity building: education, training, capacity-building and awareness-raising on climate change mitigation or sustainable energy or urban transport; mitigation research	

CLIMATE ADAPTATION

Table 2. Climate adaptation activities and urban inclusion rules

ACTIVITY	SUB-ACTIVITY	URBAN INCLUSION RULE
WASTE AND WASTEWATER		
Water supply and treatment	Wastewater collection: expansion of reservoirs, boreholes and tubewells; household water safe storage, rainwater collection from ground surfaces-small reservoirs and microcatchments, rainwater harvesting from roofs, stormwater retention and detention systems, stormwater drainage, pump stations, dam construction	If affecting the city
	Wastewater collection: reinforcement of river basins, well flood resilience	If located within city physical boundaries
	Water treatment: water reuse, water reclamation, construction and/ or upgrade of water treatment plant, renewable energy solutions for water treatment, household water treatment, desalination	If affecting the city
	Water supply: construction and/or upgrade of water distribution networks; leakage management, detection, and repair in piped systems; creating water pricing and risk transfer/insurance schemes to help manage water supply and demand cycles; increased use of water efficient fixtures and appliances; establishing financial mechanisms in river watersheds	If affecting the city
Wastewater collection and treatment	Wastewater collection networks: construction and/or upgrade of sewer systems, raw water supply	If affecting the city
	Wastewater treatment facilities: reuse of sludge, brine discharge, anaerobic digestion of sewage sludge, anaerobic digestion of bio-waste, composting of bio-waste, construction and/or upgrade of wastewater treatment plants, renewable energy solutions for water treatment, pumped marine outfalls	If affecting the city. For pumped marine outfalls, if located within city physical boundaries
AGRICULTURE, FORESTRY, LAND USE, AND NATURAL RESOURCE MANAGEMENT		
Forestry	Afforestation: early warning systems and wildfire control measures including thinning measures; regeneration material less sensitive to strong wind	If located within city physical boundaries
	Rehabilitation and restoration: use of species less susceptible to drought; diversification of species and ecotypes	
	Reforestation: growing of coppice, pulpwood and firewood and the operation for forest tree nurseries	
	Existing forest management: maintain biodiversity, productivity, and regeneration capacity of forests	

Agriculture and natural resource management	Growing of perennial crops: development and planting of perennial crops including grains with deep and dense root systems	If located within city physical boundaries
	Land management: improved management of slopes and basins to avoid/reduce the impacts caused by increased soil erosion; identification of protected areas and establishment of migration corridors to maintain or increase climate resilience of ecosystems	
	Water management: enhance the resilience of existing agricultural production systems, including water control and management measures; increased water availability and efficient use through water harvesting and irrigation technologies	
	Growing of non-perennial crops: planting of non-perennial that do not last for more than two growing seasons; provision of information on crop diversification options to farmers; use of crops/varieties less susceptible to temperature related diseases and pests and to frost; controlled agriculture, vertical farming; use of integrated pest control measures; use of multi-functional field margins; enhancement of soil retention; improved land drainage	
	Livestock/aquaculture production: increased production of fodder crops to supplement rangeland diet affected by climate change; adoption of sustainable aquaculture techniques to address changes in fish stocks resulting from climate change impacts and supplement local fish supplies, etc.; increased resilience of shepherds and small ruminants to climate change through sustainable rangeland management	
INFRASTRUCTURE, ENERGY AND OTHER BUILT ENVIRONMENT		
Adaptation in projects to improve climate resilience of existing infrastructure	Existing infrastructure adaptation: operation of transmission systems that convey the electricity from the generation facility to the distribution system; improving the resilience of electricity transmission also increases the resilience of operations that depend on electricity; improving the resilience of gas transmission and distribution networks for safety and energy system resilience purposes	If affecting the city
	Existing infrastructure adaptation: flood protection of riverine infrastructure, canals and associated infrastructure; flood protection for human settlements; heat and flood resilience building of existing transport infrastructure	If located within city physical boundaries
Building resilience into new infrastructure such as protection systems	New infrastructure resilience: protection systems for dams to reduce extreme weather vulnerability; improving the climate resilience of new renewable electricity generation to improve the climate resilience of other sectors that rely on electricity	If affecting the city
	New infrastructure resilience: district heating and cooling networks; green spaces and corridors in urban areas that provide urban ventilation and reduce urban heat island effect; urban farming and gardening (thereby increasing water infiltration capacity of the soil and providing additional shading)	If located within city physical boundaries
(OTHER) DISASTER RISK MANAGEMENT		
Disaster risk management	Monitoring and warning systems: early warning / emergency response systems to adapt to increased occurrence of extreme events by improving disaster prevention, preparedness and management and reducing potentially related loss and damage; monitoring of disease outbreaks and development of a national response plan (to adapt to changing patterns of diseases that are caused by changing climatic conditions); ICT data-driven systems for monitoring, early warning and emergency response systems (Data processing, hosting and related activities) and development of data processing methods, especially machine learning and statistical approaches	If affecting the city
	Infrastructure: construction or improvement of drainage systems to adapt to an increase in the frequency or severity of floods	If located within city physical boundaries
COASTAL PROTECTION		
Coastal protection	Grey infrastructure: building of improved or new dykes to protect infrastructure and to enhance the climate resilience to increased storms and coastal flooding, and sea level rise	If located within city physical boundaries. For rehabilitating coral reefs and seagrass areas, it must target a risk affecting the city
	Nature-based solutions: Mangrove planting to build natural barriers to adapt to increased coastal erosion and to limit saltwater intrusion into soils caused by sea level rise; additional or improvements in coastal and riverine infrastructures (including built flood protection infrastructure) in response to increased flood risks; rehabilitating coral reefs and seagrass areas	

INDUSTRY, EXTRACTIVE INDUSTRIES, MANUFACTURING & TRADE		
Industry, extractive industries, manufacturing & trade	Manufacturing: manufacturing (e.g., design of climate-resilient equipment)	If affecting the city
	Processing and distribution: use of increased cooling requirement in food processing distribution & retail resulting from more extreme heat events (e.g., increased water-efficiency in processing)	
	Extractive industries: climate resilience investments or programs in extractive industries (oil, gas, mining, etc.)	
POLICY AND NATIONAL BUDGET SUPPORT & CAPACITY BUILDING		
Dedicated budget support to national or local authorities	Capacity building: develop technical and institutional capacity of government and civil society (private sector, local communities, NGOs) to address increasing climatic risk in climate change adaptation planning	If located within city physical boundaries
	Knowledge sharing/awareness raising: knowledge dissemination of lessons learned on climate-smart agriculture and adaptation planning; climate index insurance initiated, policy influenced, and lessons learned and shared through a knowledge management system	
	Policies: water restrictions and consumption cuts	
	Knowledge creation: development of climate models, and research for reducing uncertainty on climate change projections and impact assessments; Scientific research on and development of methodologies for the evaluation of potential, effectiveness and efficiency of implemented adaptation solutions; scientific research on and development of adaptation technologies and solutions (incl. introduction of pilot studies/ early warning systems etc.)	If affecting the city
OTHERS / CROSS-SECTORAL		
Financial services	Establishing a microfinance credit system; insurance against climate-related hazard against climate-related hazards; incentivizing adaptation behavior, requiring minimum building standards, or adherence to build-back-better principles	If located within city physical boundaries
Other	Health systems' adaptation to changes in disease vectors or other climate change health impacts (e.g., development of a national response plan for diseases outbreaks)	If affecting the city
	Cross-sector activities such as financial services like incorporation of climate risk assessment in ministerial investment appraisal processes (if not included in the categories above); retreat from high risk areas	If located within city physical boundaries

Outside of the sectoral taxonomy, the 2021 State of Cities Climate Finance Report follows the same scope of accounting of financial instruments, financial providers, and geographies as the Global Landscape of Climate Finance (CPI, 2019).

DATA SOURCES AND SPECIFIC METHODS

The data sources listed below were used to track USD 75 billion of urban climate finance, representing 20% of the total USD 384 billion (on average in 2017-2018) estimated and reported. The USD 75 billion of project-level data tracked using CPI's database of global climate finance corresponds to approximately 1,030 tracked projects.[18] In contrast with data estimated through the capital expenditure approach, this project-level data provides granular information on the type of finance provider, the financial instrument used, as well as the sector and activities that attracted this capital.

18 Numbers in this report may not add up completely due to rounding. As project financing is sometimes tracked in an aggregate manner, e.g., for some DFIs surveyed for this report, the exact number of projects tracked is likely higher.

With the exception of MDB surveys, which correspond to urban climate finance specifically, other data sources provide general climate finance data. To extrapolate the urban relevance, specific keyword searches were used, including a list of the 500 highest emitting cities as well as words such as ‘urban’, ‘cities’, ‘metro’, for example. Furthermore, each adaptation project was analyzed individually to determine urban relevance. Relatively smaller (less than USD 1 million) projects that were deemed partially relevant to cities (for example, if the program had both urban and rural objectives) were included, while larger projects with unclear descriptions were excluded for conservativeness. The projects included that were partially relevant for urban climate finance represent less than 3% of total project-level data.

As with the Global Landscape of Climate Finance (CPI, 2019), project-level data only includes primary investment. This excludes secondary market transactions as they do not constitute new capital mobilized for climate-specific objectives. Similarly, revenue-sharing mechanism like subsidies are excluded to mitigate for the risk of double counting. At the project-level, we remove potential double counting between different sources of data when consolidating the inventory of urban climate finance, by selecting the most granular and high-quality data (for example, favoring DFI-provided surveys over the same project information in the OECD DAC CRS database).

To address potential double counting between project-level data and capital expenditure estimates, we exclude the latter and keep the more granular entries. We do this by removing the exact corresponding quantity by sub-sector types (for example, for railway metro or trams) in the capital expenditure estimates.

Figure 21. Landscape of urban climate finance 2017-2018 (project-level data only), USD billion

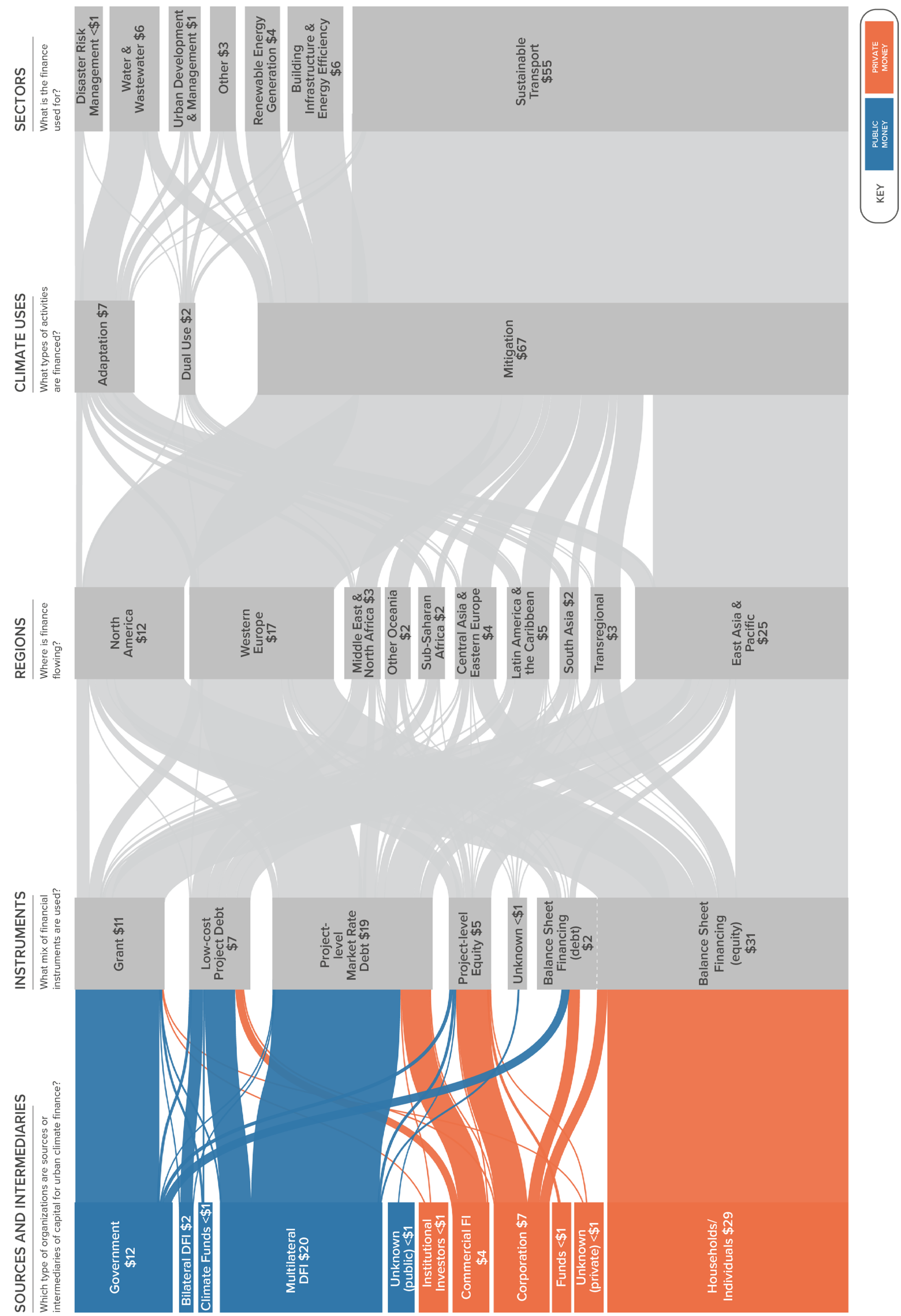


Table 3. Sources and approaches for project-level data

Data source	Description	Sector/type of finance	Approach or comments
Organisation for Economic Cooperation and Development (OECD)	The OECD DAC Credit Reporting System (CRS) provides data on international project and market support from bilateral and multilateral donors	International public finance/ all sectors; project-level	As there is no urban-relevance tag beyond the *urban development and management* sector category, a keyword search was performed to identify urban climate finance
Climate Funds Update	Data on bilateral and multilateral Climate Funds' commitments	International public finance/ all sectors; project-level	A keyword search was performed to identify urban climate finance
Bloomberg New Energy Finance	Asset finance database for grid-connected renewable energy, as well as off-grid solar	International and domestic private finance/electricity generation; project-level	A keyword search was performed to identify urban climate finance. In addition, assets could be localized and identified as located within city physical boundaries, which was used in conjunction with the keyword "rooftop" to identify rooftop solar projects in cities
Climate Bonds Initiative	Climate Bonds Initiative (CBI) develops a green bonds' post-issuance reporting	Domestic public and private finance/all sectors; project-level	A keyword search was performed to identify urban climate finance
MDB surveys	Surveys were sent to multilateral development banks (MDBs) for them to report their urban-relevant climate finance commitments for 2017 and 2018	International public finance/ all sectors; project-level and aggregate	Some investment data was provided at the project-level and some at the aggregate level, depending on the reporting institution
World Bank PPI	The World Bank Private Participation in Infrastructure (PPI) database covers private sector flows for activities with over 20% private participation	Domestic private and public finance/all sectors; project-level	A keyword search was performed to identify urban climate finance

METHOD FOR ESTIMATING TRANSPORT AND BUILDINGS INVESTMENT BASED ON CAPACITY ADDITIONS

While the project-level commitments tracked by CPI relies on data points that capture details along the finance lifecycle of the project, the granularity required can lead to the underestimation of investment in some sectors. In this report we integrate project-level tracking of transactions, with estimates based on new capacity additions, for two key urban sectors: buildings and transport. To calculate this, we conducted background research on unit costs to estimate expenditure in those sectors. This approach differs from the CPI's usual approach to estimating climate finance at the project-level, as it effectively estimates the finance that has been spent in order to deliver the observed deployment of vehicles and infrastructure each year, rather than capturing commitments to financing a project. While commitments and expenditure are very different, the goal of this exercise is to provide as comprehensive as possible of an assessment of the magnitude and nature of investment flows. Potential double counting between capital expenditure and project-level data was addressed by removing specific project-level data (for example, rail infrastructure).

The two chosen sectors for this exercise, urban transport and buildings, were selected as they respectively contribute 30% and 40% of emissions in C40 cities (C40 & McKinsey, 2017). While there is crucial market opportunity in the two sectors – respectively USD 2.1 trillion and USD 216 billion annually for emerging markets only (IFC, 2018) – it is likely that a large portion is not reflected in the project-level data that can be tracked more granularly. Data gaps in project-level data are particularly significant for domestic public finance providers, like national and subnational government bodies, as well as both domestic and international private finance providers, which are likely to be significant sources of data for both the transport and building sectors. The primary aim of this exercise is to provide a comprehensive market sizing estimate of investment for the two sectors.

TRANSPORT

DEFINING SUSTAINABLE URBAN TRANSPORT

Urban transport is the movement of people and goods within urban areas. Such movement frequently occurs in combination with transport outside of urban areas, such as passengers arriving in a city by inter-urban rail or freight arriving by lorry to logistics centers for distribution within a city. Hence, the borderline between what might be considered urban transport, and what should not, is less clear cut than at first it might seem. The approach that was taken in this report was to focus on the vehicles, infrastructure and projects that had the potential to contribute to a climate-neutral economy, based on our urban climate finance definition and taxonomy.

Hence, the focus was on railways, public transport, waterway transport and private transport in urban areas, where the respective trains, buses, boats, cars and vans used electricity or hydrogen, and the infrastructure that these vehicles use, including the infrastructure needed for recharging or refuelling these vehicles. We also considered non-motorised transport, i.e. walking and cycling, as well as other projects that were focused on the development of urban transport infrastructure and the systems that supported the use of these vehicles.

The above activities focus on the mitigation of climate change. Adaptation is likely to be built into many infrastructure projects as an integral element, rather than as a separate line of finance that can be easily identified – adaptation finance is therefore not estimated for the sector using the capital expenditure approach.

METHODOLOGY FOR ESTIMATING URBAN TRANSPORT CLIMATE FINANCE

Investment numbers for urban transport were estimated using a capital expenditure approach by mode of transport, with the aim to identify the number of vehicles sold in 2017-2018 and the amount of relevant new infrastructure added in those years, and estimate finance on the basis of the identification of relevant unit costs[19].

Table 4. Methodology for transport capital expenditure estimates calculations

TRANSPORT AREA	METHODOLOGY AND RATIONALE
Railways	
New metro infrastructure New tram infrastructure	1) Identification of the length of lines opened in 2017-2018 from UITP data (UITP, 2019), which included regional breakdowns from 2017 that were used to estimate those for 2018; 2) Unit costs (USD per km of metro/tram line) were taken from an Institute for Transportation and Development Policy (ITDP) guide on bus rapid transit (BRT) (ITDP, 2020). Unit costs take account of all elements of the infrastructure that are needed, e.g. metro stations and the means of delivering the electricity to the vehicles, so additional estimates for these were not included;[20] 3) Overall estimated expenditure for urban railway infrastructure was estimated by multiplying the length of lines by unit costs.
New metro vehicles	1) Annual expenditure was estimated on metro vehicles was based on an estimate that identified the number of vehicles that were sold over a five-year period, and assuming that one fifth of these were sold in each of 2017 and 2018 (International Railway Journal, 2020). 2) The unit cost of a metro was based on costs from a number of sources, from which a lower estimate was chosen;[21] 3) Overall estimated expenditure for new urban metro vehicles was estimated by multiplying the estimate of the number of new metros by unit costs.
New tram vehicles	1) It was not possible to find information on the number of trams that were sold in 2017 and 2018. It was derived an estimate for the number of trams that were needed for tram lines, which was that there was one new vehicle per km of track. This approach gives a conservative estimate for the number of new trams, as it does not take account of new vehicles that were purchased for existing lines; 2) The unit cost of new trams was taken from the ITDP report on BRT (ITDP, 2020); 3) Overall estimated expenditure for new urban tram vehicles was estimated by multiplying the estimate of the number of new trams by unit costs.
New infrastructure for trolley buses and cable cars New trolley bus and cable car vehicles	Data were less readily available. This type of infrastructure is less common and less expensive, so omission does not result in a significant gap.
Retrofitting diesel locomotives or railcars with electricity, battery electric or hydrogen	More relevant to 'other' rail, as metros and trams tend to be electric; although 'other' urban rail are not covered. However, as battery electric and hydrogen technology for trains are still relatively new, thus likely represents a small gap.
Waterways	
Urban ferries Refuelling and recharging infrastructure for urban ferries	Few new ferries are procured annually, and even fewer of these would operate on electricity or hydrogen, as both are relatively new technologies for ferries. No data gathered.
Buses	

19 It is worth noting that although unit costs will vary around the world – as they depend on a wide range of factors, including differences in the ease of constructing infrastructure in different locations, the cost of labour and resources and the administrative costs associated with the developments – conservative estimates of unit costs were used wherever possible.
20 Conservative cost estimates were taken by using the unit costs for tracks from the ITDP's estimates of costs for lower income countries.
21 A figure for Brisbane (Australia) was used here (USD 2.3 million per vehicle), where 60 vehicles cost AUD 190 million (Brisbane Times, 2020). This was slightly more than the estimate for Washington DC, although much lower than figures derived for Singapore and Bucharest (Railway Gazette International 2020a & 2020b; Alstom, 2020).

Electric buses	1) Registrations for new electric buses were taken from an IEA report (IEA, 2019a); 2) For the unit cost of an electric bus, the price of a Yutong electric bus was used, which had a 37% market share. This would be a conservative figure, as the costs of buses in Europe tend to be higher (Sustainable Bus, 2020); 3) It was assumed that 90% of electric buses will be in used urban areas, in line with the figure for electric cars (see below). It was not possible to find any information to confirm this, although it might be expected that it was even more likely for electric buses to be used in cities than electric cars. First, electric buses are often introduced for air quality purposes, which is more of a concern to cites, and second, electric buses are more expensive than their diesel equivalents, and so will be more likely to be introduced first in cities with more resources. 4) Overall estimated expenditure for new urban electric buses was estimated by multiplying the number of new electric buses by unit costs and by the share of urban electric buses.
Hydrogen buses	1) An estimate of registrations of new hydrogen buses in 2018 was made based on information in another IEA report (IEA, 2019b). This demonstrates the novelty of hydrogen as a transport fuel, as data were not available to allow an estimate of the number of new hydrogen buses sold in 2017 to be made. Indeed, the 2018 figure itself was an estimate as assumptions had to be made to arrive at a figure for buses, as only figures for hydrogen cars and hydrogen vehicles in total were provided (which could include some lorries). The majority of 'other' fuel cell vehicles were from China and the majority of these were buses. Hence, a ratio was derived from the Chinese bus/lorry fuel cell vehicle stock to estimate how many of these additional fuel cell vehicles might be buses in 2018. 2) For the unit cost of a hydrogen bus, we used a projected cost provided in an EU project, which would clearly be a conservative estimate (E4Tech, 2018). 3) For the same reasons as for electric buses, the same figure of 90% was used to determine the proportion of vehicles that were registered in urban areas. 4) Overall estimated expenditure for new urban hydrogen buses was estimated by multiplying the number of new hydrogen buses by unit costs and by the share of urban hydrogen buses.
Electric bus recharging points	1) As suggested by IEA (IEA, 2019a), typically one recharging point was installed per electric bus, so this ratio was applied to the number of new buses (as identified above). 2) The unit cost of an electric vehicle charging point was taken from an ICCT report (ICCT, 2019), from which the lowest cost of a charger of the power that buses typically use was taken. 3) Overall estimated expenditure for electric bus recharging points was estimated by multiplying the estimate of recharging points by the unit cost of an electric vehicle charging point.
Hydrogen bus refuelling stations	It was not possible to identify information on hydrogen refuelling infrastructure for buses that was separate from that for other vehicles. Hence, the finance for refueling infrastructure for hydrogen buses is included in the figure provided for hydrogen cars (see below).
Retrofitting diesel buses with battery electric or hydrogen	Some information on the costs of retrofitting buses was identified, although this was not concerned with retrofitting diesel buses with electricity or hydrogen technology, but retrofitting older diesel buses with newer diesel technology. Depending on the age of the diesel technology, such retrofitting could have benefits in terms of air pollutant emissions, as well as in relation to CO2 emissions. Yet, this does not fall within the scope of the activities that were considered to be climate finance in the context of the taxonomy that was used in this report. Furthermore, retrofitting diesel buses to use electricity or hydrogen is not that widespread. In addition, as with the retrofitting of other types of vehicles, there is still the challenge of identifying global figures, or figures that could be scaled up to the global level. Hence, no estimate of the finance used for retrofitting buses was made.

Private vehicles	
Electric cars[22]	1) Figures for global sales of electric cars, tracked in CPI's Global Landscape using IEA data with detail on geographic, types of finance providers as well as financial instrument breakdowns (CPI, 2019), were used; 2) To determine what proportion of the finance for electric cars related to urban areas, a percentage of 90% was applied to global sales. For these, we were only able to identify a figure for the UK and Norway, where similar levels of electric vehicle drivers live in urban areas, i.e. 90% (Brook Lyndhurst, 2015). It might indeed be anticipated that the uptake of these vehicles would be mainly in urban areas, as they contribute to improving air quality and early models of electric cars have a range that is more suitable to urban areas. 3) Overall estimated expenditure for electric cars was estimated by multiplying the estimate of global sales by the proportion of urban electric cars.
Electric vans	1) Data on the global sales of electric vans were taken from an IEA report, which also estimated that 68% of these were in the Asia-Pacific region and 31% in Europe, with the remainder elsewhere (IEA, 2019a); 2) Unit costs used corresponded to the price of a Renault Kangoo electric van (Renault, 2020), which is the market leader in Europe; 3) In order to identify the proportion of these that should be considered to be 'urban', we used the same figure for electric cars (see above). 4) Overall estimated expenditure for electric vans was estimated by multiplying the estimate of global sales by unit costs and the proportion of urban electric vans.
Hydrogen cars	1) Data on the global sales of hydrogen powered cars was estimated using figures from separate IEA reports (IEA, 2018; 2019a) and a report from the US National Renewable Energy Laboratory (NREL, 2017a), from which the number of fuel cars in operation at the end of 2018, 2017 and 2016 were taken; 2) Unit costs used corresponded to the price of the most popular model of hydrogen car (Green Car Congress, 2020), the Toyota Mirai (Green Car Reports, 2020); 3) Early hydrogen cars do not suffer from the same concerns over range – i.e. the distance that can be travelled on a single charge/refuel – as early electric cars. It was assumed that hydrogen cars were distributed between urban and rural areas in the same way as the population in the areas. In California and Japan, where fuel cell cars are mainly bought (IEA, 2018), at least 90% of the population is urban (World Bank, 2020b; Iowa State University, 2020), so '90%' was used for the proportion of hydrogen cars that were relevant to urban areas. 4) Overall estimated expenditure for hydrogen electric vans was estimated by multiplying the estimate of global sales by unit costs and the proportion of urban hydrogen vans.
Hydrogen vans	These are not common so were not included.
Electric and hydrogen lorries	These are not yet common and would probably not be considered to be exclusively 'urban'.
Electric vehicle recharging infrastructure	1) Similarly to electric vehicles, we used figures tracked in CPI's Global Landscape using IEA data with detail on geographic, types of finance providers as well as financial instrument breakdowns (CPI, 2019); 2) In order to identify the proportion of these that should be considered to be 'urban', we used the same figure for electric cars (see above). 3) Overall estimated expenditure for electric vehicle recharging infrastructure was estimated by multiplying the estimate of investment by the proportion of urban electric cars.

22 While listed in this methodological section, private vehicle and charging infrastructure investments are categorized as project-level data throughout the report, as data points are granular along the finance lifecycle, as estimated by CPI using IEA data (CPI, 2019). In this report, the urban relevance of this investment has been estimated in the ways described in the table.

Hydrogen refuelling infrastructure (all vehicles)	1) The number of hydrogen refuelling stations constructed in 2017 and 2018 was taken from IEA reports (IEA, 2018; 2019a) and a news article (CIO, 2020), which includes hydrogen refuelling stations covering all vehicles, so buses, cars and lorries (as noted above); 2) The unit cost of a hydrogen refuelling station was taken from a report for the US National Renewable Energy Laboratory (NREL, 2017b). 3) In order to identify the proportion of these that should be considered to be 'urban', we used the same figure for hydrogen cars (see above). 4) Overall estimated expenditure for hydrogen refuelling infrastructure was estimated by multiplying the estimate of investment by the proportion of urban hydrogen cars.
Retrofitting diesel and petrol cars with battery electric or hydrogen	For private cars, it seems that retrofitting tends not to be economically viable, whereas for vans and lorries the focus currently is on retrofitting to fossil fuel LPG or biofuels. Finance for these is not considered to be climate finance, according to the taxonomy on which this report is based, and so no estimate of the finance of the retrofit of private vehicles was made, as this was expected to be low.
Non-motorized modes	
Bicycles	1) Global market value was identified for 2017 and 2018 (Grand View Research, 2018; Maximize Market Research, 2020) 2) However, these market values included bicycles that would largely be used for leisure purposes rather than transport. Market reports suggest that around half of the bicycles sold globally in 2017 and 2018 were road bikes, which were assumed to be used for the purpose of transport. In addition, it was assumed that only around half of these are used in urban areas, as around half the global population lives in urban areas, according to UN figures (UN, 2020). Hence, 25% of the market value from these reports was assumed to be 'urban'. 3) Overall estimated expenditure for bicycles was estimated by multiplying the estimate of investment by the proportion of urban bicycles.
Electric bicycles	The same approach was adopted for non-electric bicycles, by estimating global market value (AMR, 2020; Research and Markets, 2019)
Dedicated cycle lanes Cycle parking Pedestrian infrastructure	Infrastructure for cycling includes cycling lanes and cycling parking facilities, which range from a few cycle racks to dedicated cycle parking that contains hundreds of racks. It is possible to identify projects that have been completed and their costs, e.g., Gdansk's creation of a "cycle-friendly street", a 2.7km section that cost €250,000 to implement. However, scaling these up to a global finance figure was challenging without a global report that contained the length of cycling tracks implemented, or the number of cycle racks or bicycle parking stations installed, or a regional report (e.g., for Europe) that might be scaled up. Hence, an estimate of the amount of finance for cycling infrastructure has not been included. Similarly, estimating the finance for infrastructure for pedestrians was also a challenge. Even more so than for cycling infrastructure, pedestrian infrastructure is often provided as part of larger transport schemes. The proportion of this that finances the pedestrian infrastructure would be difficult to identify, even within a particular scheme. While there are some schemes, such as the pedestrianization of a square or road, that are unambiguously pedestrian infrastructure, the challenge was how to scale up any figures identified to a global level. Hence, an estimate of the finance for pedestrian infrastructure has also not been included.
Other transport schemes and developments	
Sharing schemes, access restrictions, ICT in support of transport	As a result of the challenges of identifying costs that have not already been covered in the above estimates, and the challenges of scaling these up.

BUILDINGS

This section assesses expenditure on climate mitigation in urban residential, commercial and public buildings[23], which are considered to be urban-relevant when they are physically situated within the geographical borders of the urban area. Climate mitigation activities in urban buildings are those "improving abilities of urban buildings to reduce greenhouse gas emissions" (Rosenzweig et al., 2015).

23 In contrast, industrial buildings are typically on the balance of the industry sector. Activities which relate to water and wastewater in buildings are also typically on the balance of "other" and "waste" sectors.

ESTIMATING URBAN BUILDINGS: METHODOLOGY

The expenditure on climate mitigation and climate adaptation activities in urban buildings include incremental capital expenditure to acquire physical assets - e.g., high-performance buildings and durable goods; energy-efficient appliances; as well as expenditure on climate-friendly practices; capacity-building activities; development and implementation of policies and measures.

Whenever possible, the expenditure was broken down more granularly using region-level assumptions (listed below), into finance providers (sources or intermediaries), instruments used, and measures. The measures include energy efficiency in new buildings (high performance construction), energy efficiency in existing buildings (retrofits), energy efficiency of appliances/office equipment/commercial processes/lights, renewable heat installations in buildings, and renewable electricity installations in buildings. The assessment used a hybrid approach, matching the information available at a global/regional level to complement data provided at the technology level.

STEP 1. IDENTIFICATION OF BUILDINGS-RELATED EXPENDITURE BASED ON IEA AND FS UNEP/BNEF

First, we use expenditure on climate actions in urban buildings, which implies the identification of activity and its incremental cost, with a follow up breakdown into sources of expenditure and instrument.

The expenditure figures for urban buildings, for 2017 and 2018, are based on estimates provided by IEA's World Energy Investment 2020 (IEA, 2020c) for energy efficiency and renewable heat in the buildings sector, as well as by the FS UNEP Centre/BNEF (2019) for small-scale distributed renewable electricity, which could be attributed to the buildings sector. The IEA's estimates were structured in four geographical jurisdictions: China, Europe, USA, and Other (the rest of the world), and our estimates followed this structure. FS UNEP Centre/BNEF 2019 reported the estimates for several individual countries, and we arranged this around the IEA breakdown.

STEP 2. BREAKDOWN OF EXPENDITURE INTO URBAN, MEASURES, FINANCE SOURCES, INSTRUMENTS

Based on data from census, publications, interviews, and our definition of urban climate finance, estimates are broken down into urban and rural. Urban figures are then broken down into types of measures, finance providers, and instruments. See Table 5 for a list of sources and assumptions used for both steps, for each region estimated.

Table 5. Methodology for buildings capital expenditure estimates (assumptions and data sources)

Jurisdiction	Steps
China	**Energy efficiency** 1. Take China's incremental buildings' energy efficiency investment from the IEA's World Energy Investment 2020 (IEA, 2020a; IEA, 2020c). 2. Break it down into urban and rural, assuming urban is 90% of investment: even though the urban/rural population is 45%/55% (UN, 2018), nearly the whole potential is being realized in cities (Zhou et al., 2018) due to the dedicated support of public support programs as well as a very high income difference between urban and rural households (150%-200%) (National Bureau of Statistics of China, 2019). 3. Break down the investment into construction of new buildings, retrofit of existing buildings, and energy efficiency of appliances/equipment/lights based on several publications (GIZ/FELICITY, 2020), calibrating the results to the most known investment in green certified new buildings. The latter was calculated multiplying the new floor area, the share of green buildings in it, and a representative estimate of incremental costs of green buildings (Mohurd, 2019; Shen et al., 2020; Sun et al., 2019; Berkelmans and Wang, 2012). The investment in retrofit was estimated from the ratios between volumes of loans for construction of new buildings and retrofit of existing buildings issued by banks, these flows are discussed in the next point. A difference between the total volume in energy efficiency of the buildings sector and the volumes flowing in the construction of new buildings and retrofit of existing buildings are assumed as the expenditure on the purchase of appliances/equipment/light. 4. Simultaneously with step 3, break down the construction and retrofit investment into finance providers and financial instruments based on GIZ/FELICITY (2020). The publications provided information on climate-related expenditure from the public budget and green loans disbursed from 21 major domestic banks. The information was either sector or program-specific and it covered new buildings and retrofits. 5. The investment in energy efficiency of appliances, equipment and lights is assumed to flow fully from household self-finance (balance sheet equity portion). **Renewable heat** 1. Take China's spending on renewable heat sources from the IEA's World Energy Investment 2020 (IEA, 2020b; IEA, 2020c). 2. Break it down into urban and rural as above, assuming urban is 90% of investment. 3. Break it down into finance providers and instrument based on GIZ/FELICITY (2020), as above. **Renewable electricity** 1. Take China's total investment in small-scale distributed solar from UNEP Centre/BNEF 2018 (2019), assume it is all located in urban areas based on (Zhou et al, 2018). 2. Break it down into finance provider and instrument based on GIZ/FELICITY (2020).

Europe	**Energy efficiency** 1. Take Europe's incremental buildings' energy efficiency investment from IEA data (IEA, 2020a; IEA, 2020c). 2. Break it down into urban and rural investment, assuming urban is 70% of investment assuming investment between rural and urban areas are more or less equally distributed. This is because urban buildings contribute 72% to the total European buildings stock (EC, 2016), an income difference between urban and rural population is relatively low (urban households in the EU have on average 20% higher disposable income that rural households). Retrofits occupy a high share of the total investment volumes. It is more difficult and expensive to conduct energy efficiency renovation works in urban areas than in rural due to the lock in land-use patterns, infrastructure, higher share of multi-residential buildings, and national heritage protection rules that cumulatively offset the advantage of having higher income. 3. Take the landscapes of climate finance for German buildings (Novikova et al., 2016) and Czech buildings (Valentová et al., 2017), calculate. a. the average breakdowns of investment into new buildings, retrofit of existing buildings, and energy efficiency of appliances/equipment/lights. b. the average breakdown into finance providers (public private) c. the average breakdown into financial instruments 4. Apply the proportions calculated to the urban incremental volume of Step 2 **Renewable heat** 1. All the same procedures as for energy efficiency. **Renewable electricity** 1. Calculate the ratio of (total) renewable electricity investment to (incremental) energy efficiency investment for Czechia and Germany; assume for Europe a figure between these two, but closer to Czechia (30%). 2. Calculate the average breakdown into finance providers (public-private) and the average breakdown into financial instruments for Czechia and Germany. 3. Apply these proportions to the investment volume calculated in Step 1.

USA	**Energy efficiency** 1. Take USA's incremental buildings' energy efficiency investment from the IEA's World Energy Investment 2020 (IEA 2020). 2. Break it down into urban and rural investment, assuming urban is 80% of investment. Urban buildings contribute slightly more than 80% to the total US buildings stock, and the disposable income difference between urban and rural households in the US is only 5%, this that allowed assuming that the investment between rural and urban areas are more or less equally distributed (US Census Bureau, 2016). 3. Calculate incremental investment volumes into new and retrofitted green certified buildings (LEED, BREEAM, EDGE, and others) based on (GRESB, 2019; Freehling and Stickles, 2016; Katz Kusman, 2011; USGBC, 2019; USGBC, 2018). 4. Apply to it the share of debt based on Freehling and Stickles (2016). The paper examined the energy efficiency finance market in the United States, offering recent trends, lessons learned, remaining gaps, and recommendations. Based on the interviews and expert judgment, the paper provides the grounds to assume a 65% lending rate for advanced new buildings. 5. Apply to it the share of public/private finance providers calculated from Deason et al. (2016). The latter paper characterized the energy efficiency financing market, focusing on the sources of capital and instruments. It provided the assessment of on-bill programs; other utility financing programs; property assessed clean energy (PACE) programs; state energy office (SEO) revolving loan funds (RLF); and energy savings performance contracting (ESPC) programs. The majority of programs covered the building retrofits and building equipment i.e., HVAC. The paper allowed concluding that lending covered 80% of the investment volume for building retrofits, with less than ¼ of lending flows from public sources, with the rest being provided by private sources. Based on this information, it was also concluded that the lending for the construction of buildings was provided from private sources. It was assumed that the volume that is not addressed by lending is provided by balance sheet financing (equity portion) 6. Calculate investment volumes into of appliances/equipment/lights deducting incremental investment volumes into new and retrofitted green certified buildings from the incremental buildings' energy efficiency investment. 7. Break down appliances/equipment/lights into instruments assuming the market-rate debt/balance sheet equity portion as to retrofit of existing buildings, based on Deason et al. (2016), which also covered equipment, as discussed in point 5. Assume all lending is from private sources, because the lending sources from public sources were allocated to the retrofit of existing buildings and no funding from public sources was identified for equipment and appliances (the public support for them is mostly provided as tax incentives that represent a secondary flow and thus are not in the scope of our analysis). **Renewable heat** 1. Take USA's spending on renewable heat sources from the IEA's World Energy Investment 2020 (IEA, 2020b; IEA, 2020c). 2. Break it down into urban and rural as above. 3. Break it down into instrument assuming the market-rate debt/balance sheet equity portion as to retrofit of existing buildings; assume all lending is from private sources. **Renewable electricity** 1. Take USA's total investment in small-scale distributed solar from UNEP Centre/BNEF (2019).

Rest of the world	**Energy efficiency** 1. Take incremental buildings' energy efficiency investment for the "Other" region from the IEA data (IEA, 2020c). 2. Break it down into Africa, Latin America, and Asia based on the ratio of such flows in the CPI urban climate finance database (20%, 40%, 40%). 3. Break the investment down into urban and rural investment, assuming urban is 80% based on UN 2018 and the fact that most energy efficiency investment (except for energy access) in developing countries occurs in cities (similar to China). 4. Calculate incremental investment volumes into new green certified buildings (LEED, BREEAM, EDGE, CASBEE, BCA, WELL, Green Star and others) based on (GRESB, 2019; USGBC, 2019; USGBC, 2018) for floor area, (Turner and Downsend, 2019) for construction cost, and (GBCSA, 2017; ELLA, 2013) for incremental share of being "green". Assume all green construction takes place in cities. Assume for all investment into green construction in Africa, Latin America, and Asia as project-level equity of private investors (no instruments recorded). 5. Based on CDP-ICLEI Unified Reporting System database, assume the share of retrofits in the total investment volume as 5% for Asia, 1% for Africa, and 1% for Latin America. Assume these investments as grants in Africa and Latin America (pilots recorded) and unknown in Asia. 6. Calculate investment volumes into appliances/equipment/lights deducting incremental investment volumes into new and retrofitted buildings from the incremental buildings' energy efficiency investment. Assume the instrument for these flows is unknown. **Renewable heat** 1. Take spending on renewable heat sources for the "Other" region from the IEA's World Energy Investment 2020 (IEA, 2020b; IEA, 2020c). 2. Break it down into continents as well as into urban and rural as above. 3. Assume the instrument for these flows is unknown. **Renewable electricity** 1. Calculate total investment in small-scale distributed solar from UNEP Centre/BNEF (2019). a. Asia: Japan (assume 90% urban) + Australia (assume 90% urban) + India (assume 10% urban, 90% is for energy access in rural). b. Latin America: Brazil (assume 10% urban, 90% is for energy access) + for the rest LA as in Brazil urban assumption. c. Africa: assume 10% rural (90% is for energy access). 2. Assume the instrument for these flows is unknown.

ANNEX REFERENCES

1. Allied Market Research (AMR). 2020. Electric Bike Market by Product. Available at: https://www.alliedmarketresearch.com/electric-bikes-market
2. Alstom. 2020. Alstom to provide new Metropolis trains for Bucharest Metro Line 5. Available at: https://www.alstom.com/press-releases-news/2020/11/alstom-provide-new-metropolis-trains-bucharest-metro-line-5
3. Berkelmans, Leon and Wang, Hao. (2012). Chinese Urban Residential Construction. Available at: https://www.rba.gov.au/publications/bulletin/2012/sep/3.html
4. Brisbane Times. 2020. Metro's electric vehicles revealed as Labor backs light rail. Retrieved from https://www.brisbanetimes.com.au/national/queensland/metro-s-electric-vehicles-revealed-as-labor-backs-light-rail-20191124-p53dkr.html
5. Brook Lyndhurst. 2015. Uptake of Ultra Low Emission Vehicles in the UK – A Rapid Evidence Assessment for the Department of Transport. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/464763/uptake-of-ulev-uk.pdf
6. C40, ICLEI & WRI. 2014. Greenhouse Gas Protocol: Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. Available at: https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf
7. C40 & the McKinsey Centre for Business and Environment. 2017. Focused acceleration: A strategic approach to climate action in cities to 2030. Available at: https://www.c40.org/researches/mckinsey-center-for-business-and-environment
8. CIO. 2020. Hydrogen refuelling stations for cars to reach 5,000 by 2032. Retrieved from https://www.cio.com/article/3159680/hydrogen-refueling-stations-for-cars-to-reach-5000-by-2032.html
9. Climate Policy Initiative (CPI). 2019. Global Landscape of Climate Finance. Available at: https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2019/
10. Deason, Jeff, Greg Leventis, Charles A Goldman, and Juan Pablo Carvallo. 2016. Energy Efficiency Program Financing: Where it comes from, where it goes, and how it gets there. Available at: https://eta-publications.lbl.gov/sites/default/files/lbnl-1005754.pdf
11. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) – Financing Energy for Low-carbon Investment – Cities Advisory Facility (FELICITY). 2020. Climate Finance for Low-Carbon Urban Infrastructure in China. Available at: https://www.sustainable-urbanisation.org/sites/sgup/files/publications/felicity_climate_finance_for_low_carbon_urban_infrastructure_final_en-20200217-komprimiert.pdf

12. E4Tech. 2018. Fuel Cell Industry Review. Available at: http://www.fuelcellindustryreview.com/archive/TheFuelCellIndustryReview2018.pdf

13. ELLA. 2013. Policy Brief: Green Building In Latin America. Available at : https://assets.publishing.service.gov.uk/media/57a08a07e5274a31e00003aa/131106_ENV_TheGreEco_BRIEF1.pdf

14. European Commission (EC). 2021. GHSL - Global Human Settlement Layer: The classes of the Degree of Urbanisation. Available at: https://ghsl.jrc.ec.europa.eu/degurbaDefinitions.php

15. European Commission (EC). 2016. EU Buildings Factsheets. https://ec.europa.eu/energy/eu-buildings-factsheets_en

16. European Union Technical Expert Group (EU TEG). 2020. https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf

17. Frankfurt School-UNEP Centre/BNEF. 2019. Global Trends in Renewable Energy Investment 2019. Available at: http://www.fs-unep-centre.org

18. Freehling, J., Stickles, B. 2016. Energy Efficiency Finance: A Market Reassessment. Available at: https://www.aceee.org/sites/default/files/market-reassessment-0216.pdf

19. Green Building Council South Africa (GBCSA). 2017. Green Building in South Africa: Guide to Costs and Trends Report. Available at: https://gbcsa.org.za/building-green-costs-on-average-only-5-more-than-conventional-building-study/

20. Green Car Congress. 2020. Information Trends – 6,500 hydrogen fuel cell vehicles have been sold globally; more than 50% in California. Retrieved from https://www.greencarcongress.com/2018/02/20180208-it.html

21. Green Car Reports. 2020. 2017 Toyota Mirai price stays same, fuel-cell car adds new color. Retrieved from https://www.greencarreports.com/news/1106238_2017-toyota-mirai-price-stays-same-fuel-cell-car-adds-new-color

22. Green View Research. 2018. Bicycle Market Size & Share, Global Industry Trends Report, 2018-2025. Available at: https://www.grandviewresearch.com/industry-analysis/bicycle-market

23. GRESB. 2019. Real Estate Results. Available at: https://gresb.com/2019-real-estate-results/

24. Institute for Transportation and Development Policy (ITDP). 2020. BRT Planning Guide – Section 2.2 Costs. Retrieved from https://brtguide.itdp.org/branch/master/guide/why-brt/costs#capital-costs

25. International Association of Public Transport (UITP). 2019. New Urban Rail Infrastructure 2018. Available at: https://cms.uitp.org/wp/wp-content/uploads/2020/06/Statistics-Brief-NEW-URBAN-RAIL-INFRASTRUCTURE-2018.pdf

26. International Council on Clean Transportation (ICCT). 2019. Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas.

Available at https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

27. International Energy Agency (IEA). 2020a. Buildings energy efficiency investments in selected regions and countries, 2014-2019. Available at: https://www.iea.org/data-and-statistics/charts/buildings-energy-efficiency-investments-in-selected-regions-and-countries-2014-2019

28. International Energy Agency (IEA). 2020b, Spending on renewable heat sources for buildings in selected regions and countries, 2015-2019. Available at: https://www.iea.org/data-and-statistics/charts/spending-on-renewable-heat-sources-for-buildings-in-selected-regions-and-countries-2015-2019

29. International Energy Agency (IEA). 2020c. World Energy Investment 2020. Available at: https://www.iea.org/reports/world-energy-investment-2020

30. International Energy Agency (IEA). 2019a. Global EV Outlook 2019 – Scaling up the transition to electric mobility. Available at: https://www.iea.org/reports/global-ev-outlook-2019

31. International Energy Agency (IEA). 2019b. The Future of Hydrogen – Seizing today's opportunities. Available at https://www.iea.org/reports/the-future-of-hydrogen

32. International Energy Agency (IEA). 2018. Global EV Outlook 2018 – 3 million and counting. Available at https://www.iea.org/reports/global-ev-outlook-2018

33. International Finance Corporation (IFC). 2018. Climate investment opportunities in emerging markets: an IFC analysis (No. 121277, pp. 1-140). Kerr, T., Maheshwari, A., & Sottong, J. D. The World Bank. Available at: un https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/climate+business/resources/cioc-ifc-analysis

34. Intergovernmental Panel on Climate Change (IPCC). 2014. Fifth Assessment Report - Mitigation of Climate Change. Buildings. Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter9.pdf

35. International Railway Journal. 2020. Strong metro car growth forecast for Europe. Retrieved from https://www.railjournal.com/news/strong-metro-car-growth-forecast-for-europe/

36. Iowa State University. 2020. Urban Percentage of the Population for States, Historical. Retrieved from https://www.icip.iastate.edu/tables/population/urban-pct-states

37. Katz Kusman, Ashley. 2011. Square Footage of LEED-Certified Existing Buildings Surpasses New Construction. Available at: https://www.usgbc.org/articles/square-footage-leed-certified-existing-buildings-surpasses-new-construction

38. Maximize Market Research. 2020. Global Bicycle Market – Industry Analysis and Forecast (2019-2026). Available at: https://www.maximizemarketresearch.com/market-report/global-bicycle-market/20033/

39. Mohurd. 2019. Standards for building carbon emissions measurement. (GBT 51366-2019). Beijing: Ministry of Housing, Urban-Rural Development of the PRC. http://download.mohurd.gov.cn/bzgg/gjbz/GBT%2051366-2019%20

40. Multilateral Development Banks (MDBs). 2020. Joint report on Multilateral Development Banks' Climate finance 2019. Available at: https://www.eib.org/attachments/press/1257-joint-report-on-mdbs-climate-finance-2019.pdf

41. National Bureau of Statistics of China. 2019. Households' Income and Consumption Expenditure in 2019. http://www.stats.gov.cn/english/PressRelease/202001/t20200119_1723719.html

42. National Renewable Energy Laboratory (NREL). 2017a. National Hydrogen Scenarios: How Many Stations, Where, and When? Prepared by the National Renewable Energy Laboratory for the H2 USA Locations Roadmap Working Group. Available at: https://www.nrel.gov/docs/fy18osti/71083.pdf

43. National Renewable Energy Laboratory (NREL). 2017b. Comparison of conventional vs. modular hydrogen refueling stations, and on-site production vs. delivery. Prepared for the National Renewable Energy Laboratory, H2First and H2USA by the Sandia National Laboratories. Available at: https://www.energy.gov/sites/prod/files/2017/03/f34/fcto-h2first-reference-station-phase2-2017.pdf

44. Novikova, A., Stelmakh, K., Klinge, A., Stamo I. Climate and energy investment map of Germany. Status Report 2016. Institut für Klimaschutz, Energie und Mobilität (IKEM). Available at: https://www.ikem.de/wp-content/uploads/2019/05/IKEM_ANovikova-et-al_2019_Climate_Energy_Investment_Map_Germany2016_Full-report.pdf

45. Organisation for Economic Co-operation and Development (OECD). 2018. "Climate Related Development Finance at the activity level". Paris: OECD's Development Assistance Committee (DAC). At: http://www.oecd.org/dac/stats/climatechange.htm

46. Organisation for Economic Co-operation and Development (OECD) and the European Commission (EC). 2020. Cities in the World: A new perspective on urbanisation. Available at: https://www.oecd.org/regional/regional-statistics/Cities-in-the-World-Policy-Highlights.pdf

47. Overseas Development Institute (ODI) and Heinrich Böll Foundation (HBF). 2019. "Climate Funds Update Database" London; Washington DC: ODI/HBF. At: http://www.climatefundsupdate.org

48. Railway Gazette International. 2020a. Kawasaki preferred bidder for Washington metro. Available at: https://www.railwaygazette.com/kawasaki-preferred-bidder-for-washington-metro/34872.article

49. Railway Gazette International. 2020b. Singapore LTA orders more trains to standardise NSEWL fleet. Available at: https://www.railwaygazette.com/vehicles/singapore-lta-orders-more-trains-to-standardise-nsewl-fleet/57477.article

50. Renault. 2020. Renault Kangoo. Available at: https://www.renault.co.uk/vans/kangoo.html

51. Research and Markets. 2019. E-Bike Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2019-2024. Available at: https://www.researchandmarkets.com/reports/4856263/e-bike-market-global-industry-trends-share?utm_source=dynamic&utm_medium=BW&utm_code=c39zg4&utm_campaign=1321622+-+Global+E-Bike+Market%3a+Industry+Trends%2c+Share%2c+Size%2c+Growth%2c+Opportunity+and+Forecast%2c+2019-2024&utm_exec=anwr281bwd

52. Rosenzweig C., W. Solecki, P. Romero-Lankao, S. Mehrotra, S. Dhakal, T. Bowman, and S. Ali Ibrahim. 2015. ARC3.2 Summary for City Leaders. Urban Climate Change Research Network. Columbia University. New York.

53. Shen, Y., Faure, M. 2020. Green building in China. Int Environ Agreements. Available at: https://link.springer.com/article/10.1007/s10784-020-09495-3#citeas

54. Sun, C.-Y.; Chen, Y.-G.; Wang, R.-J.; Lo, S.-C.; Yau, J.-T.; Wu, Y.-W. 2019. Construction Cost of Green Building Certified Residence: A Case Study in Taiwan. Available at https://www.mdpi.com/2071-1050/11/8/2195

55. Sustainable Bus. 2020. 100 Yutong electric buses delivered in Kazakhstan's capital; Nur-Sultan. Available at: https://www.sustainable-bus.com/electric-bus/100-yutong-electric-buses-delivered-in-kazakhstans-capital-city-nur-sultan/

56. Turner and Downsend. 2019. International construction market survey 2019. Available at : https://www1.bca.gov.sg/docs/default-source/docs-corp-form/icms_2019.pdf?sfvrsn=e744aa53_2

57. United Nations (UN). 2020. 68% of the world projected to live in urban areas by 2050, says UN. Available at : https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

58. United Nations (UN). 2018. World Urbanization Prospects: The 2018 Revision, Online Edition. Available at: https://population.un.org/wup/

59. United States Census Bureau. 2016. Homes on the Range: Homeownership Rates Are Higher in Rural America. Available at: https://www.census.gov/newsroom/blogs/random-samplings/2016/12/homes_on_the_range.html

60. USGBC. 2019. Top 10 countries and regions for LEED 2018. Available at : https://www.usgbc.org/articles/infographic-2018-top-10-countries-and-regions-leed

61. USGBC. 2018. Top 10 countries and regions for LEED 2017. Available at : https://www.usgbc.org/articles/infographic-top-10-countries-and-regions-leed-2017

62. Valentová, M., Knápek, J., Novikova, A. 2019. Climate and energy investment map – Czechia. Status Report 2017: buildings and renewable energy supply and infrastructure. Prague: Czech Technical University in Prague. Available at: https://www.ikem.de/wp-content/uploads/2019/12/CVUT_MValentova-et-al_2019_Climate_Energy_Investment_Map_Czechia_2017_Full-report.pdf

63. World Bank. 2020a. Blog: How do we define cities, towns, and rural areas? Available at: https://blogs.worldbank.org/sustainablecities/how-do-we-define-cities-towns-and-rural-areas

64. World Bank. 2020b. Urban population (% of population) – Japan. Retrieved from https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=JP

65. World Bank Group (WBG) and United Nations Development Programme (UNDP). 2020. Catalyzing Private Sector Investment In Climate-Smart Cities. Available at: https://www.undp.org/content/undp/en/home/librarypage/poverty-reduction/private_sector/catalyzing-private-sector-investment-in-climate-smart-cities.html

66. Zhou, N., Khanna, N., Feng, W. et al. 2018. Scenarios of energy efficiency and CO2 emissions reduction potential in the buildings sector in China to year 2050. Nat Energy 3, 978–984. https://doi.org/10.1038/s41560-018-0253-6

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