COALITION FOR URBAN TRANSITIONS

SEIZING THE URBAN OPPORTUNITY

HOW NATIONAL GOVERNMENTS CAN RECOVER FROM COVID-19, TACKLE THE CLIMATE CRISIS AND SECURE SHARED PROSPERITY THROUGH CITIES

INSIGHTS FROM SIX EMERGING ECONOMIES

About this report

This report, a collaborative effort by more than 36 organisations across five continents brought together by the Coalition for Urban Transitions, is being launched in March 2021 as a call to action ahead of COP26 in Glasgow. Our aim is to provide insights from six emerging economies demonstrating how fostering zero-carbon, resilient and inclusive cities can advance national economic priorities for shared prosperity for all.

The Coalition for Urban Transitions is a global initiative to support national governments in transforming cities to accelerate economic development and tackle dangerous climate change. Collectively, the contributors hope this report will provide the evidence and confidence that national governments need to submit more ambitious Nationally Determined Contributions in 2021 and to propel inclusive, zero-carbon cities to the heart of their COVID-19 economic recovery and development strategies.

Disclaimer

The analysis, arguments and conclusions presented here are a synthesis of the diverse views of the authors, contributors and reviewers and is an 18-month research effort building on the Coalition's 2019 *Climate Emergency, Urban Opportunity* report. The Coalition takes responsibility for selecting the areas of research. It guarantees its authors and researchers freedom of inquiry, while soliciting and responding to the guidance of advisory panels and expert reviewers. Coalition partners, some as organisations and others as individuals, endorse the general thrust of the arguments, findings and recommendations made in this report, but the text does not necessarily reflect the personal views or official policies of any of the contributors or their members.

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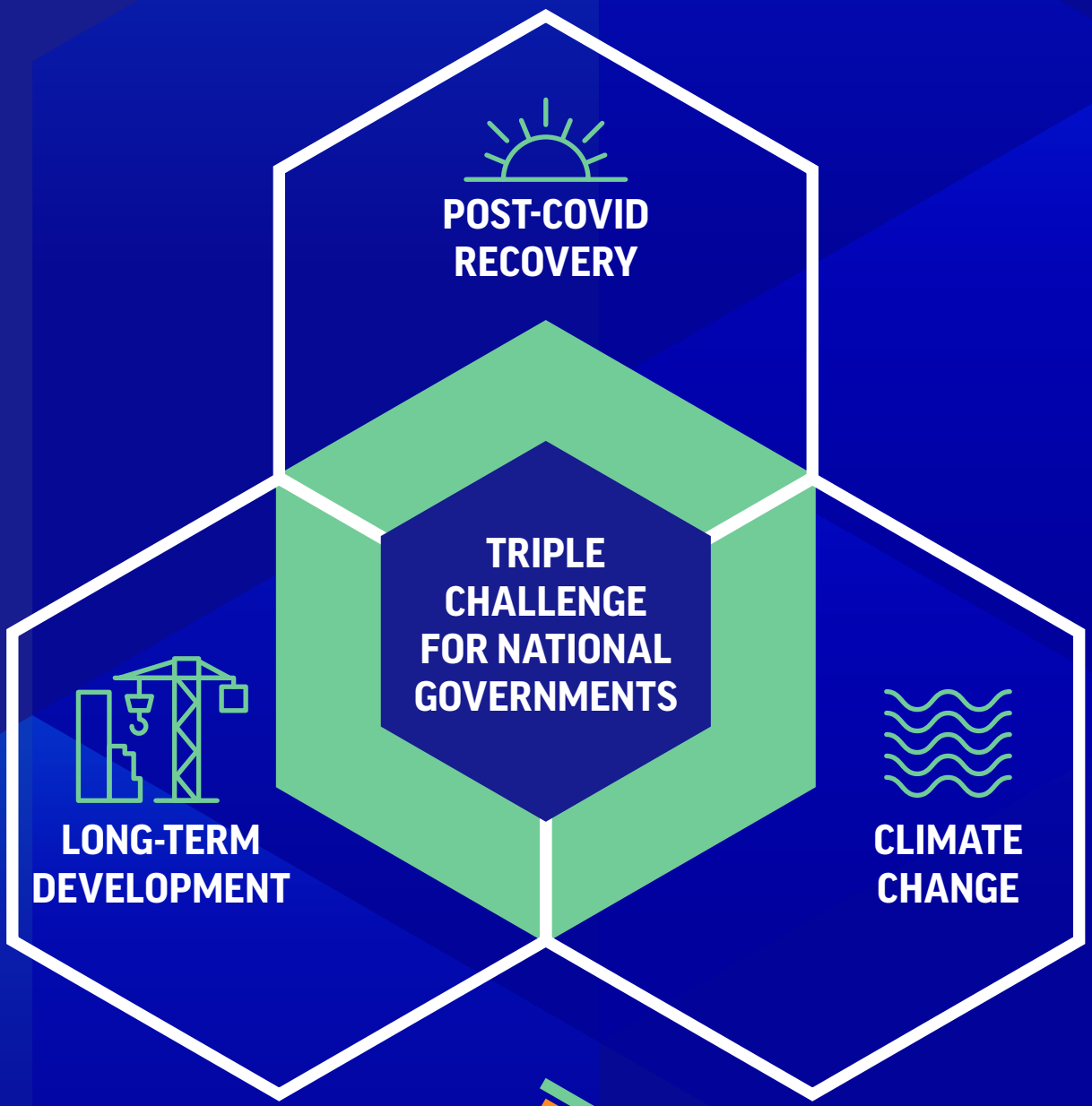
National governments face a triple challenge right now: ensuring a successful recovery from the devastation of COVID-19, pushing forward their longer-term vision for development, and addressing the enormous threats posed by climate change. The pandemic has pushed millions of people into extreme poverty, deepened existing inequalities, and highlighted the urgency of building resilience to a wide range of shocks, especially the growing impacts of climate change.

Cities, as economic engines and population hubs, are at the centre of that triple challenge. Urban areas produce 80% of global GDP, and as of 2020, were home to about 56% of humankind. But cities have also been particularly hard-hit by the pandemic, which will almost certainly change them in lasting ways. Still, we expect cities to remain central to countries' economic vitality and sustainable development. It is thus crucial that national recovery strategies and long-term visions post-COVID put cities front and centre. Cities can't bounce back, much less realise their full potential as engines of sustainable, inclusive growth, without national leadership and support. As outlined in *Climate Emergency, Urban Opportunity*, only national governments can mobilise resources at the scale needed, and they control or drive key policy realms – from energy, to transport, to social programmes.

Recognising that developing and emerging economies face particularly complex challenges, exacerbated by the pandemic, the Coalition is focusing on six key countries in the lead-up to COP26 in Glasgow: China, India, Indonesia, Brazil, Mexico and South Africa. Together, they produce about a third of global GDP and 41% of CO_2 emissions from fossil fuel use. They are also home to 42% of the world's urban population. The extent to which these six major emerging economies can unleash the power of cities to catalyse sustainable, inclusive and resilient growth is therefore critical not only for their future trajectory, but for the whole planet.



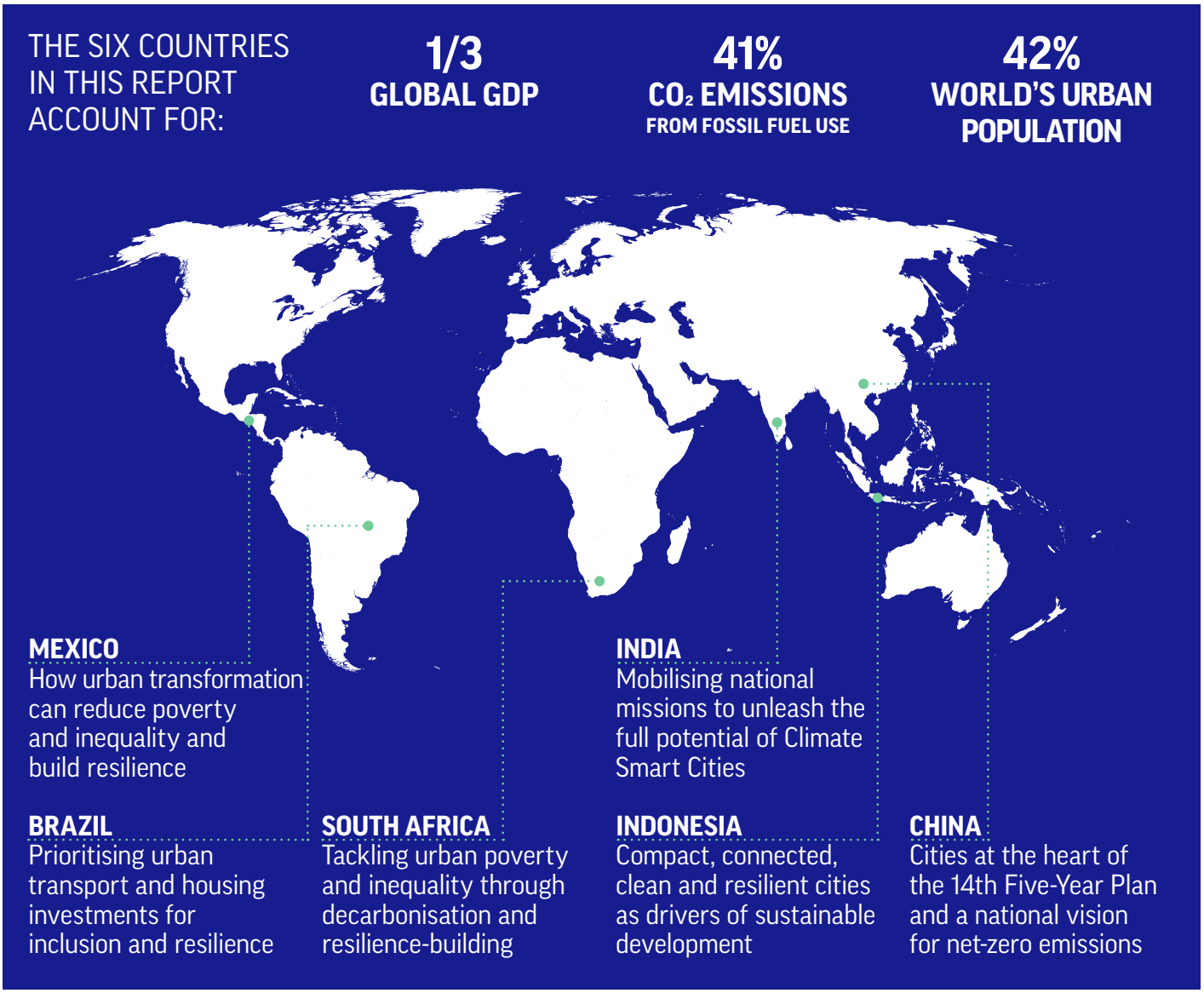
CITIES PRODUCE 80%
OF GLOBAL GDP

ARE HOME TO AN
ESTIMATED 56%
OF HUMANKIND

Powering the recovery and long-term sustainable growth through cities

Climate Emergency, Urban Opportunity showed that a bundle of technically feasible low-carbon measures could cut emissions from urban buildings, transport, materials use and waste by almost 90% by 2050; support 87 million jobs in 2030 and 45 million jobs in 2050, and generate a return of at least US$23.9 trillion by 2050.

Compact, connected, clean and resilient cities also have broader economic, social and environmental benefits – and with deliberate attention to equity and inclusion, can help lift people out of poverty and improve living conditions for all. This means that investing in urban decarbonisation and resilience-building can significantly contribute both to meeting national commitments under the Paris Agreement, and to achieving the Sustainable Development Goals. With climate hazards escalating rapidly, urban climate action is more urgent than ever.



The economic devastation of COVID-19 has mobilised historic levels of public spending in many countries – but national governments have not yet seized key opportunities in cities. Local leaders continue to raise their ambition, from embracing the concept of "15-minute cities" where people can get almost anything they need within a 15-minute walk or bike ride, to joining the Cities Race to Zero, pledging to reach net-zero carbon emissions by mid-century or sooner.

Aiming to inform and inspire national leaders in the lead-up to COP26, this report aims to answer three questions:

1. How can national governments in these six key economies leverage cities to build shared prosperity while decarbonising and building resilience?

2. How can they make the most of the potential for compact, connected, clean and inclusive cities to drive the COVID-19 recovery?

3. How can insights from these six countries inform efforts by other national governments, development partners and financial institutions to support a shift towards low-carbon, inclusive and resilient cities?

Three themes emerge clearly from our analysis:

1. **A low-carbon urban transformation is within reach, with broad benefits.** National governments can significantly accelerate decarbonisation by investing in compact, connected, clean and inclusive cities – and reap substantial economic, social and environmental benefits.

2. **Building resilience to climate change is as urgent as decarbonisation.** In all six countries, climate risks are immediate and severe, especially for the urban poor. But there are also many opportunities to build resilience: from addressing climate risks in all infrastructure investments, to making urban systems and services more robust to climate hazards, to addressing socio-economic drivers of vulnerability and empowering poor and marginalised people.

3. **There are many ways to foster low-carbon, resilient and inclusive cities.** National governments have a wide range of options to choose from, including low-cost and immediate opportunities, and there are many synergies between decarbonisation, resilience-building, COVID recovery efforts and development programmes.

Those themes play out in different ways across the six countries, though with many commonalities.

China

China's economic success story is built on cities, which are home to three-fifths of the population and produce 90% of GDP. But Chinese cities also struggle with congestion, air pollution and sprawl, and some are already experiencing severe climate change impacts – from deadly floods, to extreme heat. China has taken major steps to reduce air, water and land pollution and to build resilience through programmes such as "Sponge Cities". Recommended actions include putting sustainable cities at the heart of the implementation of the14th Five-Year Plan annual investment plan and China's updated Nationally Determined Contributions (NDCs); prioritising energy-efficient buildings; supporting small and mid-sized cities to become more sustainable and resilient; and incorporating climate objectives in national urban design and regeneration strategies.

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

	NEW JOBS	REDUCTION IN GHG EMISSIONS
2030	15.2m	48% (1,926 Mt CO_2-e)
2050	3.5m	89% (3,372 Mt CO_2-e)

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$5.5 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$7.7 TRILLION **BASED ON COST SAVINGS ALONE***.

India

India's cities are home to 461 million people and growing fast. By 2030, they are expected to produce 75% of GDP. Yet many have struggled to provide housing, services and jobs for all their residents, especially the poor. Indian cities also face urgent climate threats, including extreme heat, an intensifying water crisis and severe flooding. Key national programmes – most notably the ClimateSmart Cities Assessment Framework – are helping India's cities become more resilient, sustainable and inclusive and offer key entry points for urban transformation. Recommended actions include aligning national infrastructure and urban development policies, programmes and investments with the vision of ClimateSmart Cities, stepping up investments in sustainable transport, and scaling up urban energy efficiency and clean energy initiatives.

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

	NEW JOBS	REDUCTION IN GHG EMISSIONS
2030	8.2m	53% (640 Mt CO_2-e)
2050	3.0m	89% (1,784 Mt CO_2-e)

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$3.6 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$1.6 TRILLION **BASED ON COST SAVINGS ALONE**.*

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Indonesia

Indonesia is urbanising rapidly, with about 55% of its population in cities in 2018, projected to rise to almost three-quarters by 2050. Urban areas generated nearly 60% of Indonesia's GDP between 2010 and 2016. Yet many residents lack basic services such as piped water and modern sanitation, and traffic congestion and air pollution are severe. The government is building millions of homes to try to close a large housing gap. Flood risks due to land subsidence and climate change are a particularly urgent concern. Recommended actions include investing in sustainable urban mobility, scaling up ecosystems restoration in and around cities, accelerating the transition to clean electricity, and leveraging the Smart Cities movement, which already includes 100 cities, to advance sustainability, resilience-building and inclusion.

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

	NEW JOBS	REDUCTION IN GHG EMISSIONS
2030	2.3m	50% (253 Mt CO_2-e)
2050	0.9m	96% (790 Mt CO_2-e)

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$1.0 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$2.7 TRILLION **BASED ON COST SAVINGS ALONE***.

Brazil

Brazil's cities were home to 87% of the population as of 2018, and the 25 largest urban areas generate 63% of GDP. In the past two decades, however, urban population growth has been greatest in small cities with limited capacity for planning or service delivery. Brazil has been widely recognised for its urban innovation, from pioneering bus rapid transit (BRT), to participatory budgeting and planning. But the urban poor remain concentrated on cities' peripheries, and national housing investments have exacerbated this pattern. Recommended actions include supporting metropolitan governance to foster integrated and sustainable urban development, prioritising low-carbon transport investments, revamping national housing programmes and policies to ensure compact and connected development, and expanding finance for urban decarbonisation and resilience-building projects.

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

	NEW JOBS	REDUCTION IN GHG EMISSIONS
2030	4.5m	35% (75 Mt CO_2-e)
2050	1.3m	88% (238 Mt CO_2-e)

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$1.7 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$370 BILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Mexico

Mexico is highly urbanised, with 80% of its population in cities and nearly 90% of gross value added produced in urban areas. It also has serious challenges with urban sprawl, traffic congestion and air pollution. Building resilience – both by addressing physical and systemic risks, and by tackling poverty and inequality – is an urgent priority. Important reforms are already underway, including a proposed National Strategy of Territorial Planning 2020–2040 and a revamped National Housing Programme. Recommended actions include supporting the creation of metropolitan authorities for integrated land use and transport planning, expanding the supply of affordable and well-situated housing connected to public transport, and prioritising a just transition to zero-carbon cities, with special attention to poor and marginalised people.

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

	NEW JOBS	REDUCTION IN GHG EMISSIONS
2030	0.5m	34% (98 Mt CO_2-e)
2050	0.1m	87% (284 Mt CO_2-e)

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$960 BILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$210 BILLION **BASED ON COST SAVINGS ALONE***.

South Africa

South Africa's cities are home to 66% of the population and powerful economic engines, but deeply unequal. Some municipalities struggle to keep up with demand for urban housing, sanitation and electrification, and public transport is inadequate. Water scarcity is a growing concern, exacerbated by climate change. Cities figure prominently in South Africa's Long-Term Low Emissions Development Strategy (SA-LEDS), which aims to reach net-zero GHGs by 2050, and an important recent policy reform could enable cities to accelerate the transition to clean electricity. Recommended actions include strengthening municipalities' ability to purchase their own power, putting pro-poor urban measures at the heart SA-LEDS implementation, prioritising improved mobility for lower-income urban residents, and protecting and restoring ecosystems in and around cities.

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

	NEW JOBS	REDUCTION IN GHG EMISSIONS
2030	0.7m	54% (81 Mt CO_2-e)
2050	0.3m	92% (146 Mt CO_2-e)

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$270 BILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$220 BILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

A global call to action

Our report offers recommendations tailored to each country's specific context. But even as we work with stakeholders in China, India, Indonesia, Brazil, Mexico and South Africa to seize the opportunities we have identified, we urge leaders in other countries, as well as the broader development community, to rise to this historic moment.

Building on *Climate Emergency, Urban Opportunity*, we urge **national leaders** to:

- Develop an overarching strategy to deliver shared prosperity while reaching net-zero emissions – and place cities at its heart. China's 14th Five-Year Plan and South Africa's SA-LEDS, for example, offer prime opportunities to do this.
- Develop and implement national policies to support compact, connected, clean and inclusive cities.
- Fund and finance sustainable and resilient urban infrastructure. India, for instance, has pledged to mobilise US$1.5–2 trillion in public and private finance through a National Infrastructure Pipeline, which could be truly transformative.
- Supporting local climate action in cities through governance and fiscal reforms that empower local governments and facilitate collaboration.
- Proactively plan for a just and resilient urban transition by prioritising measures that build resilience and expand economic opportunities for the urban poor. Cities in Indonesia and Mexico, for example, are pioneering participatory urban planning and budgeting.
- Work in partnership with the private sector to help finance urban transformation and build key capacities.

Urban leaders continue to innovate and raise their ambition. We urge them to:

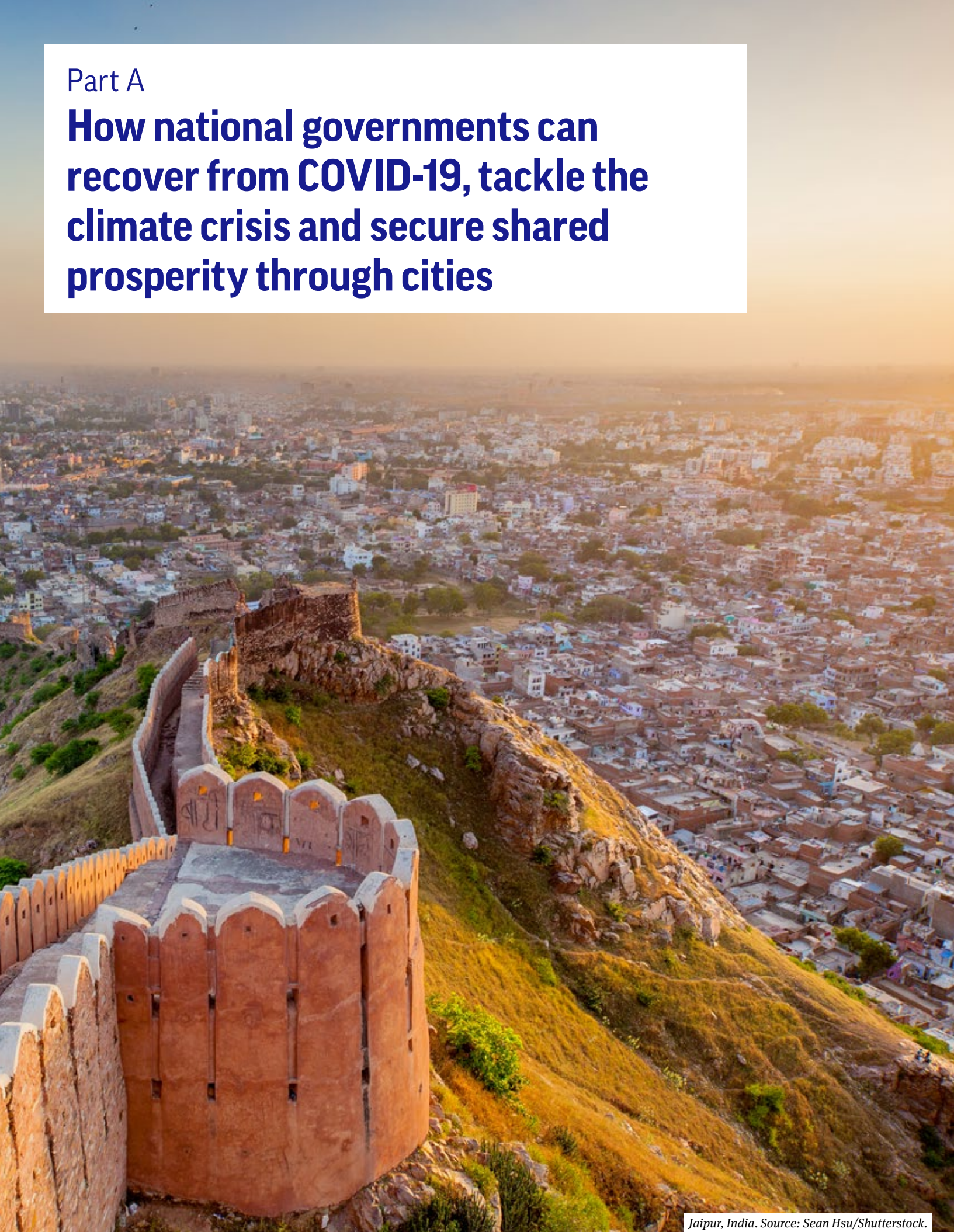
- Work hand in hand with national governments to urge and support their efforts to prioritise compact, connected, clean and inclusive cities.
- Keep innovating and raising local ambitions – from pilot projects in major cities that can be emulated by communities nationwide, to joining the Cities Race to Zero.
- Strengthen the role of communities in cities, especially poor and marginalised people, in planning and decision-making processes that affect their lives.
- Raise awareness about the need to seize the urban opportunity.

Financial institutions and the **broader development community** also have key roles to play in realising cities' potential to drive sustainable and inclusive growth, build resilience and ensure a successful recovery from the COVID-19 crisis. We urge them to:

- Build a multilateral system that fosters inclusive, resilient, zero-carbon cities by making urban action a priority in climate and development finance, especially in countries that are urbanising rapidly and face significant challenges in meeting city residents' needs.
- Work with national governments to redirect development assistance and concessional finance away from investments that exacerbate climate risks – especially major infrastructure built to last many decades – and towards urban transformation.
- Support low-carbon and resilience-building investments with longer payback times, such as building retrofits and new construction to maximise energy efficiency, and ecosystems restoration to reduce flooding and coastal storm-surge risks.

Part A

How national governments can recover from COVID-19, tackle the climate crisis and secure shared prosperity through cities



Jaipur, India. Source: Sean Hsu/Shutterstock.

National governments face a triple challenge right now: ensuring a successful recovery from the devastation of COVID-19, pushing forward on their longer-term vision for development, and addressing the enormous threats posed by climate change. Even with many people now being vaccinated, COVID-19 continues to pose a major public health threat around the world, and its economic impacts will still be felt for years. The World Bank warns that the pandemic could push as many as 150 million people into extreme poverty;[1] it has also deepened pre-existing inequalities.[2] All this makes governments' agendas for inclusive growth and poverty reduction more urgent than ever. At the same time, the impacts of climate change keep worsening, highlighting the need to reduce carbon emissions and build resilience to a wide range of shocks and stresses.

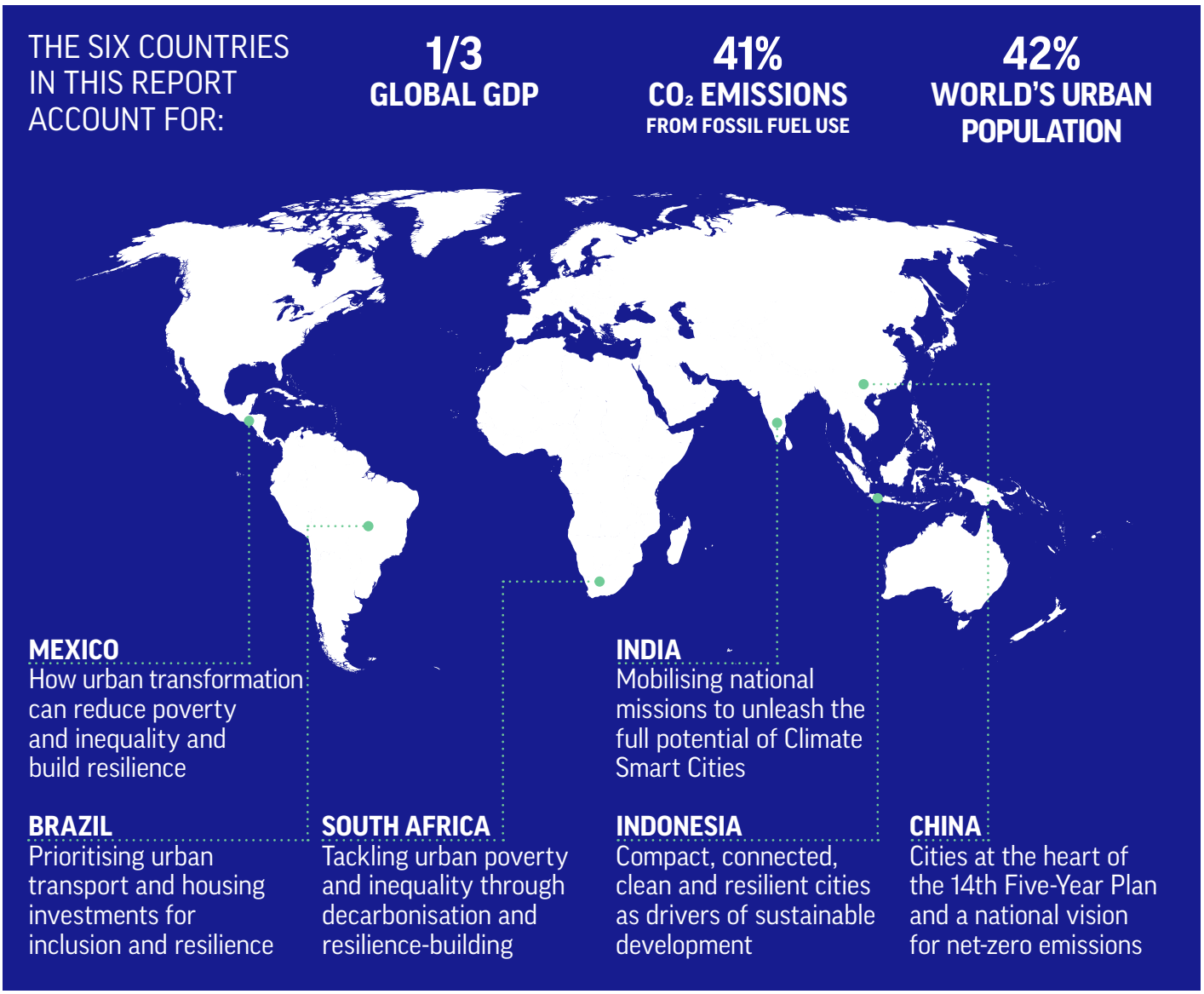
Cities, as economic engines and population hubs, are at the centre of that triple challenge. Urban areas produce 80% of global GDP and, as of 2020, they were home to an estimated 56% of humankind.[3] But cities are also where the pandemic first took hold, accounting for more than 90% of cases as of June 2020.[4] Urban hospitals were overwhelmed, households went into lockdown, and entire economic sectors were decimated. Cities also proved to have unique strengths that helped them manage the pandemic and its socio-economic impacts – from social cohesion (including grassroots mutual-aid efforts), to well-run social protection systems, to key infrastructure and efficiencies of scale.[5] Still, the urban poor, especially, have suffered enormously, and millions remain jobless.[6] The International Monetary Fund (IMF) expects it will take the global economy a few years to return to pre-pandemic levels,[7] with profound implications for cities as well.

COVID-19 will almost certainly change cities, but they're likely to remain central to countries' economic growth, global competitiveness and long-term sustainable development. More than a year into the pandemic, city centres are still eerily quiet, public transport ridership remains low, and most people who can work remotely continue to do so. Municipal finances are also badly strained.[8] Yet as hard as many cities have been hit by COVID-19, and as devastating as the pandemic has been in crowded low-income housing and slums,[9] there is growing evidence that urban density itself does not increase infection risks.[10] Many expect work and mobility patterns changes to persist,[11] but cities' core strengths remain: the wealth of economic opportunities they offer, their resilience and adaptability, their diversity. Indeed, many cities have invested in pedestrian areas and bike lanes, green space, digital infrastructure, and other improvements that will boost their appeal.[12] Targeted measures to tackle inequalities, support marginalised communities, and ensure a green and resilient recovery could ultimately make cities even stronger and more inclusive, with particular benefits for the most vulnerable populations.[13]

Given the social and economic importance of urban areas, it is crucial that national recovery strategies and long-term visions post-COVID put cities front and centre. Cities can't bounce back, much less realise their full potential as engines of sustainable, inclusive growth, without national policies and funding to

support them. As outlined in *Climate Emergency, Urban Opportunity*, only national governments can mobilise resources at the scale needed to truly transform cities;[14] they also provide vital political leadership and support to local leaders. And they control many of the relevant policy realms, from climate commitments, to energy, transport and land use policies, to social safety net programmes.

This report examines how national governments can drive urban transformation in six major emerging economies: China, India, Indonesia, Brazil, Mexico and South Africa. Collectively, these countries produce about a third of global GDP[15] and 41% of CO_2 emissions from fossil fuel use.[16] As of 2018, they were also home to 42% of the world's urban population.[17] By looking up-close at these six countries, we highlight the challenges and opportunities of this historic moment, recognising the particular concerns of developing and emerging economies.[18] National urban strategies must be tailored to each country's social, political and economic context, and though our analysis shows many commonalities among the six countries, it is clear that each has a different set of tools and opportunities to unleash the power of zero-carbon and resilient cities.



Powering the recovery and long-term sustainable growth through cities

Globally, investing in sustainable, inclusive cities is an enormous economic opportunity, with a net present value of US$24 trillion by 2050. *Climate Emergency, Urban Opportunity* laid out the economic case for urban climate action:[19] the report showed that a bundle of technically feasible low-carbon measures could cut emissions from buildings, transport, materials use and waste by almost 90% by 2050; support 87 million jobs in 2030 and 45 million jobs in 2050, and generate energy and material savings worth US$23.9 trillion by 2050. Though these estimates are indicative only, and do not yet account for potential changes due to COVID-19, they are a powerful reminder of the economic benefits of decarbonising cities.

***Climate Emergency, Urban Opportunity* showed that a bundle of technically feasible low-carbon measures could:**

Cut emissions from urban buildings, transport, materials use and waste by **almost 90% by 2050**

Support **87 million jobs** in 2030 and **45 million jobs** in 2050

Generate a **return of at least US$23.9 trillion** by 2050

Transforming cities would also bring significant wider economic, social and environmental benefits. *Climate Emergency, Urban Opportunity* describes in detail how transforming cities to be compact, connected, clean and resilient – through the measures modelled in the report as well as through broader policy interventions – would advance many top priorities for national governments. Cleaner air, better cycling and pedestrian infrastructure, and more open space would make people healthier and safer. Cities' and countries' economic competitiveness would benefit from higher density, agglomeration effects, good connectivity and a better quality of life. With deliberate attention to equity and inclusion, urban climate action can also help lift people out of poverty, empower marginalised communities and build social resilience. And by avoiding urban sprawl, countries can protect agricultural land and natural ecosystems around cities, with benefits for food security and resilience. If countries are committed to Sustainable Development Goal 11,[20] to "make cities and human settlements inclusive, safe, resilient and sustainable", this is how to achieve it.

National leadership is crucial to transforming cities. As noted above, national governments hold the keys both to cities' successful recovery from the COVID crisis, and to their long-term transformation. As shown in *Climate Emergency, Urban Opportunity*, national or other higher-tier governments have primary authority over the measures required to achieve two-thirds of the global urban abatement potential, including decarbonisation of electricity.[21] New analysis for the Coalition, based on expert inputs, suggests that across the six countries, at least half the primary responsibility for urban mitigation sits with national or higher tiers of government. In China and India, the share is about 80%. The power of the purse is also critical: municipalities, especially smaller ones, and especially in developing and emerging economies, simply don't have the fiscal capacity to build the necessary infrastructure or create major new services or programmes.[22]

The economic devastation of COVID-19 has mobilised historic levels of public spending in many countries – but national governments have not yet seized key opportunities in cities. In the past, cost has been a major barrier to decarbonising cities. In response to the pandemic, however, governments have mobilised trillions of dollars in economic stimulus, showing the power of a shared sense of urgency. Climate change, too, demands an urgent response, with devastating impacts even during the COVID crisis. The good news is that many low-carbon urban measures have strong stimulus potential.[23] There are immediate opportunities in green construction and retrofits, clean mobility, active transport, clean energy, waste and circular economy measures, and nature-based solutions that can create jobs, support marginalised and vulnerable groups, and yield lasting benefits. A February 2021 analysis for the Coalition found only 14% (US$2 trillion) of the total stimulus in G20 and 10 other major economies had gone to sectors relevant for cities (energy, transport and waste) and only 27% (US$544 billion) of that stimulus was green.[24] It is time to do better.

As of February 2021, only 14% of the total stimulus in G20 and 10 other major economies had gone to sectors relevant for cities (energy, transport and waste) and only 27% of that stimulus was green.

Many cities are innovating and raising their climate ambition even during the pandemic. From Paris, to Wuhan, to Mexico City, for example, temporary bike lanes are making it easier to get around safely during the pandemic.[25] Several Chinese cities, including Shanghai and Guangzhou, are embracing the concept of "15-minute cities", joining Paris, Milan and other major urban hubs in striving to create neighbourhoods where people can get almost anything they need within a 15-minute walk or bike ride.[26] And hundreds of cities, including São Paulo, Kolkata, Jakarta, Chengdu, Mexico City and Johannesburg, have joined the Cities Race to Zero, pledging to reach net-zero carbon emissions by mid-century or sooner, with solid plans and yearly reporting.[27]

There is growing momentum to raise climate ambition in the lead-up to COP26 in Glasgow – but practical, scalable solutions are key. Many countries have already stepped up, with enhanced Nationally Determined Contributions (NDCs) and commitments to reach net-zero emissions. But much of the discussion on cities' role in achieving those goals, and in building back better post-COVID, still focuses on high-income countries. To fully realise cities' potential, we need to better understand the challenges of low- and middle-income countries, which together are home to 84% of the world's population,[28] and provide evidence-based solutions tailored to their needs. The six countries featured in this report are leaders in their regions – China especially is a global powerhouse – but they face many of the same challenges as their neighbours: from poverty alleviation, to building resilience to a fast-changing climate and worsening disasters. Insights from our analysis should thus be of value not only to policy-makers in those countries, but to governments and development partners worldwide.

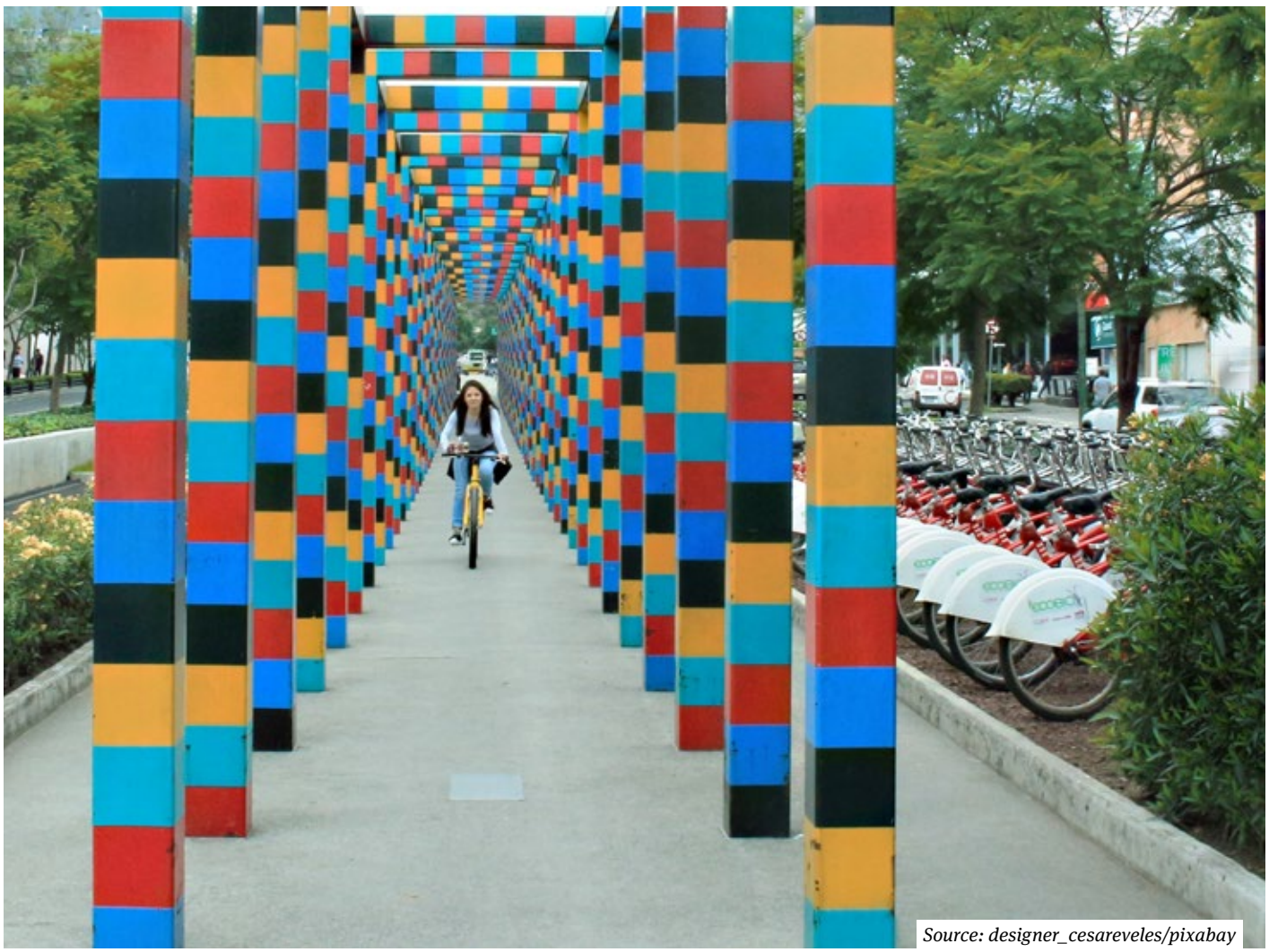
We focus on three key questions:

1. How can national governments in these six key economies leverage cities to build shared prosperity while decarbonising – and building resilience – in alignment with the Paris Agreement's goals?

2. How can national governments in these countries make the most of the potential for compact, connected, clean and resilient cities to drive the COVID-19 recovery?

3. How can insights from the challenges and opportunities found in these six countries inform efforts by other national governments, development partners and financial institutions to support a shift towards low-carbon, inclusive and resilient cities?

In the next two pages, we provide an overview of our methodology.



Source: designer_cesareveles/pixabay

How we built our analysis

This report combines original climate and economic modelling, spatial analysis, policy research and analysis, and country-specific insights gathered by consulting iteratively with urban, energy and climate policy experts in China, India, Indonesia, Brazil, Mexico and South Africa.

First, the Stockholm Environment Institute (SEI) modelled the urban greenhouse gas abatement potential in six countries, using a bottom-up assessment of mitigation options in residential and commercial buildings, road transport, waste management, and materials for urban buildings and transport infrastructure.

The model covers CO_2 emissions from energy consumption, process emissions from the production of cement and aluminium used in urban infrastructure, and methane (CH_4) emissions from landfills. It is important to note that emissions from industries within cities are not included. Thus, the urban share of emissions may appear smaller than in other studies. It is also important to note that this analysis was undertaken prior to the full impacts of COVID-19 being known. Hence, the baseline scenario, for example, does not factor in the potential economic impacts of COVID-19 on emissions pathways. Any planned future analysis will be adjusted to take this into account.

The baseline scenario reflects countries' commitments in their first round of Nationally Determined Contributions (NDCs) under the Paris Agreement, but not the latest updates. This means the abatement potential between 2020 and 2050 identified in the analysis is all additional to the first NDCs. For details on data sources, measure-specific assumptions and analytical steps, see *Annex 1*.

Second, Vivid Economics modelled the incremental investments through 2050 – that is, investments beyond baseline levels – needed to realise the abatement potential identified by SEI, using existing technologies and practices, and accounting for learning that would reduce costs over time. They also modelled the cumulative returns on those investments through 2050. Across all countries, the estimates presented in this report are net returns (i.e. net present value, or the extent to which

benefits exceed costs over the period to 2050), discounted at 3.5% per year, assuming a 2.5% annual increase in real energy prices from 2014 levels. That is the central scenario in the analysis; for a comparison of results with different assumptions, see *Annex 2*, Part 3. Note that the economic returns estimate only considers direct energy and material cost savings and is thus partial. The returns would be higher if factors such as time savings from avoided congestion, increased productivity, improved health and environmental quality, and avoided climate change impacts were taken into account.

Finally, the Vivid analysis estimates the direct, indirect and induced jobs (full-time equivalent) that the modelled measures could support in 2030 and 2050, taking into account technology-specific labour productivity factors and adjusted to reflect typical differences in labour productivity between OECD and non-OECD countries. The estimates are based on uniform labour productivity assumptions for the six countries and provide indicative job numbers. Further work should collect more country-specific information to refine the results. The job numbers reflect an estimate of net jobs by comparing green investment with an equivalent investment in fossil fuel projects, while fully recognising the uncertainties in such counterfactuals. In all of these categories, we provide overall numbers as well as selected sector- and measure-specific estimates. For details on data sources and the full methodology, see *Annex 2*.

The third modelling exercise that informed our analysis was by the Marron Institute of Urban Management at New York University, which examined the scale and composition of the conversion of land to urban purposes in each of the six countries in the period 2000–2014. The results show not only how much cities' collective footprint grew in that time, but also what they displaced: farmland, built-up rural areas, forests, grassland, etc. For a detailed methodology, see *Annex 3*.

Finally, recognising that coastal populations are particularly exposed to climate change impacts, including sea-level rise, storm surges and other hazards, **we drew on the work of the Institute for Demographic Research at City University of New York, the Center for International Earth Science Information Network at Columbia University, and the Institute of Development Studies** to estimate the share of each country's population living in coastal zones at less than 10 metres above sea level, and the urban share of that population. While a detailed mapping of coastal climate risks in the six countries is beyond the scope of this report, this analysis provides some indication of the extent of the risk. For a detailed methodology, see *Annex 4*.

The four modelling exercises inform analysis in this synthesis report and forthcoming country reports, based on detailed literature reviews (including policy documents, peer-reviewed studies, grey literature and media coverage) and close collaboration with experts in the six countries, with additional input from a wide range of Coalition partners. The resulting recommendations are meant as illustrative examples, and should not be seen as an exhaustive list of options for national policy-makers in each country.

Seizing the urban opportunity in six major emerging economies: Key findings

The national contexts of China, India, Indonesia, Brazil, Mexico and South Africa are quite different, but three themes emerge very clearly from our analysis across the six countries:

1. A low-carbon urban transformation is within reach, with broad benefits. National governments can significantly accelerate decarbonisation by investing in compact, connected, clean and resilient cities – and reap substantial economic, social and environmental benefits.

2. Building resilience to climate change is as urgent as decarbonisation. In all six countries, climate risks are immediate and severe, especially for the urban poor. Resilience-building is a multifaceted challenge: from embedding climate resilience in infrastructure and urban development, to adopting new technologies and practices to reduce climate risks, to addressing the socio-economic drivers of vulnerability.

3. There are many ways to foster low-carbon, resilient and inclusive cities. National governments have a wide range of options to choose from, including low-cost and immediate opportunities, and there are many synergies between decarbonisation, resilience-building, COVID recovery efforts and development programmes.

1. A low-carbon urban transformation is within reach, with multiple benefits

By implementing a bundle of currently available technologies and practices, the six countries could cut annual emissions from key urban sectors by 87–96% by 2050 beyond their initial NDCs.[29] This means cities can significantly contribute to efforts to reach net-zero emissions by mid-century,[30] in line with the long-term vision of the Paris Agreement. The modelling shows significant abatement potential even by 2030: from 34% in Mexico, to 54% in South Africa. Notably, the analysis focuses only CO_2 emissions from energy consumption in the buildings and transport sectors, process emissions from the production of cement and aluminium used in urban infrastructure, and methane (CH_4) emissions from landfills, as well as the impact of decarbonising electricity across those sectors. This means there is further scope for reducing emissions by tackling other areas, such as carbon-intensive industry and degraded urban ecosystems.

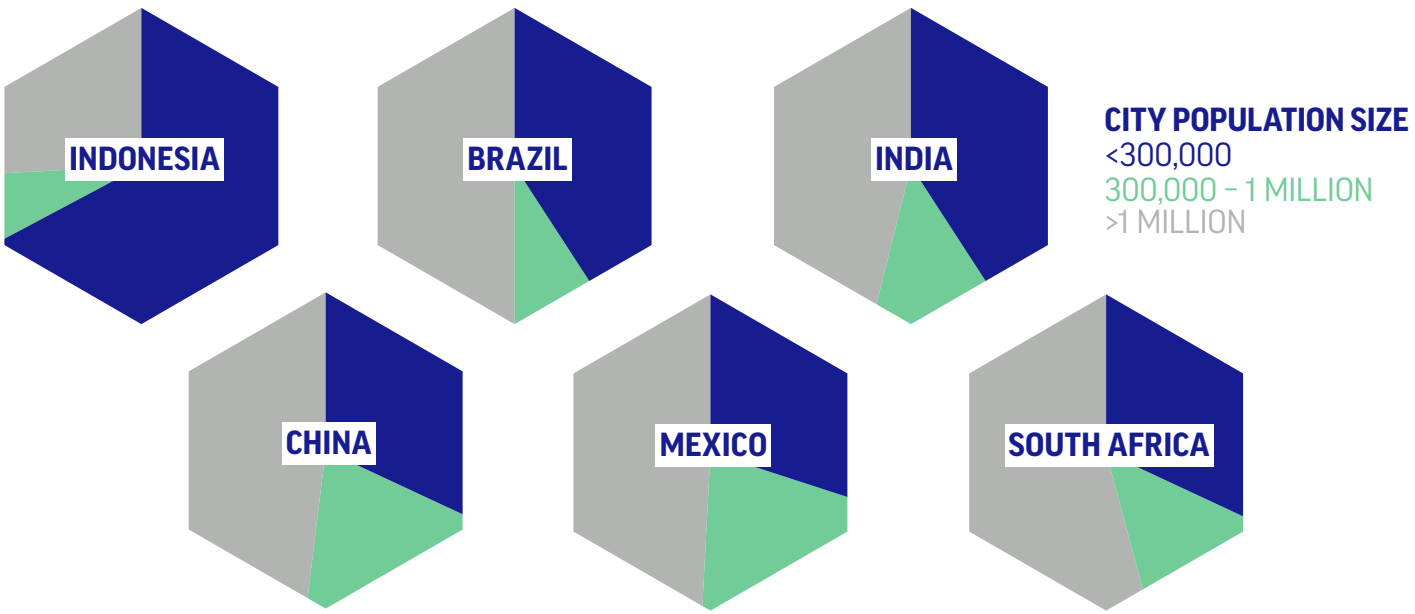
The urban abatement potential is significant in all six countries, but they are starting from different points, which affects how urban action "bends the curve" of their overall emissions. In absolute terms, China has by far the greatest urban abatement potential in the modelled sectors: 3.4 Gt CO_2-e in 2050, and a cumulative 71.8 Gt CO_2-e in 2020–2050. Mexico, meanwhile, has the largest share of its total greenhouse gas (GHG) emissions in those sectors: 38% in 2015,[31] compared with 26% in China and 10% in Indonesia. But in both Indonesia and Brazil, 42% of energy-related emissions were produced by those urban sectors. The main factor at play here is that both countries have substantial land-based emissions as well. In China and South Africa, meanwhile, emissions from energy made up 89% and 92% of total GHGs in 2015; however, a large share of those emissions came not from the modelled sectors, but from heavy industries. Although not modelled, many of these emissions are likely to be located in or close to urban centres. It is also important to note that these estimates do not account for the critical role that cities play in indirectly driving carbon emissions through consumption patterns.

In countries that rely heavily on fossil-fuelled power, decarbonising electricity can dramatically increase the urban emission reduction potential. This is because widespread electrification of building and transport energy is key to achieving large-scale GHG reductions. In South Africa, Indonesia and India, where 88%, 84% and 76% of the electricity, respectively, came from fossil fuels in 2019,[32] roughly half the urban abatement potential depends on decarbonising electricity.[33] In China, where 68% of the power came from fossil fuels in 2019,[34] decarbonising the power supply would achieve more than a quarter of the urban abatement potential – and could also contribute significantly to decarbonising materials production. In Brazil, however, where only 15% of the power came from fossil fuels in 2019, only 14% of the urban abatement potential depends on switching to clean electricity. That said, climate change is reducing the reliability of Brazil's hydropower supply[35] – so to meet future needs, other renewables will need to be scaled up.

Small and mid-size cities hold a large share of the urban abatement potential in all six countries. In Indonesia, the modelling shows 68% of the cumulative potential to 2050 is in cities that had fewer than 300,000 residents as of 2018. In both Brazil and India, it's 42%, and in China, Mexico and South Africa, about a third. Only in South Africa is the potential greater in cities with over 1 million residents than in smaller urban areas – though major cities in all six countries also hold significant abatement potential. National support, including technical assistance, funding and governance reforms to facilitate metropolitan-scale collaboration, will be particularly crucial for small and mid-size cities. Many are still taking shape and haven't yet become locked into harmful patterns; early action can ensure they grow to be compact, connected, clean and resilient.

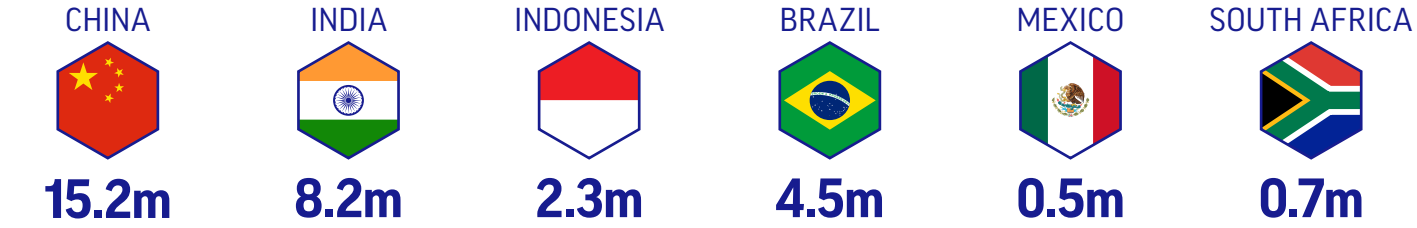
There are large investment needs, but there is also potential for substantial economic benefits. New analysis for this report by Vivid Economics shows that in China, achieving the abatement outlined above would require investing US$5.5 trillion between now and 2050. But by 2050, the investments would not only pay for themselves, but yield returns with a net present value of US$7.7 trillion, based on direct energy and materials savings alone.[36] The outlook for Indonesia is similarly attractive: US$1 trillion in investments through 2050, with cumulative returns by 2050 with a net present value of US$2.7 trillion. The returns are less generous in the other four countries, but in all six, there are net gains. Some investments have long payoff times, however, so relatively "patient" capital will be needed.

FIGURE 1: PROPORTION OF MITIGATION POTENTIAL IN CITIES IN 2050, BY COUNTRY AND CITY SIZE



Source: Stockholm Environment Institute for the Coalition for Urban Transitions. These are indicative estimates based on modelling by SEI – please refer to Annex 1 for further details.

FIGURE 2: ESTIMATED JOB CREATION POTENTIAL IN 2030 OF LOW-CARBON MEASURES MODELLED



Source: Vivid Economics analysis. These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.

Decarbonising cities can create millions of jobs, and could thus contribute to a just transition. Analysis by Vivid Economics for this report shows that adopting the low-carbon measures modelled could support about 15.2 million new jobs in China in 2030, 8.2 million in India, 4.5 million in Brazil, 2.3 million in Indonesia, 700,000 in South Africa, and 500,000 in Mexico. That is only a modest portion of total employment in those countries, of course, but it is an important consideration for policy-makers worried about job losses from phasing out fossil fuels and high-carbon industries. Notably, as detailed in the Coalition's report on COVID-19 recovery, most of these jobs are tied to local communities and do not require advanced skills.[37] From building retrofits, to rooftop solar installations, to improving green spaces, low-carbon urban measures can create more jobs than grey/brown industries – an estimated 8–21 jobs per US$1 million spent in energy efficiency, for example, versus three in the fossil fuel sector.

Investing in compact, connected, clean and resilient cities would also have broad benefits for sustainable development, poverty reduction and equity. As noted earlier, urban transformation would advance numerous development priorities, from economic competitiveness, to improved public health, to higher living standards. Across the six countries, for instance, urban sprawl is a major barrier to municipal service provision, as cities simply can't keep up with the growing demand in peripheral areas, where the poor are often concentrated. Promoting compact development closer to urban cores would create greater efficiencies, making it easier to close critical service gaps. Similarly, improving public transport would connect millions of urban dwellers to better jobs and educational opportunities, while reducing the traffic congestion and air pollution that plague many cities. Compact, connected, clean and resilient cities can also be more attractive to global talent and investors, offering a higher quality of life and a better value proposition overall.[38]

2. Building resilience to climate change is as urgent as decarbonisation

Cities across all six countries are already feeling the impacts of climate change. Climate-related disasters are on the rise around the world, particularly severe storms and floods,[39] and urban areas, with their high concentrations of people and property, are disproportionately affected. Historic monsoon floods in China in June to September 2020, for instance, took 280 lives and caused an estimated US$35 billion in damage.[40]

By late August, the Yangtze River had flooded the megacity of Chongqing five times.[41] The floods' impact was mitigated, however, by large-scale floodplain restoration and reforestation efforts that had improved flood retention capacity; in 1998, similarly severe floods had killed more than 4,000 people.[42] Extreme heat is another growing threat to many cities. In India, where heat waves have reached deadly extremes,[43] over 100 cities and districts have developed Heat Action Plans, with expert guidance and support from the national government.[44] The plans include early warning systems, public cooling centres and shaded spaces, cool roofs and new green infrastructure, among other measures. Ahmedabad's 2013 plan, which has served as a model for many Indian cities, is estimated to have saved almost 1,200 lives per year.[45]

The urban poor are disproportionately at risk. From Delhi, to Jakarta, to Cape Town, poor and marginalised people living on the outskirts of the cities face deadly risks during torrential rains and floods. Many informal settlements are built on unsafe sites, such as landslide-prone slopes and floodplains, with substandard materials. Households often lack basic necessities; in Indonesia, for instance, only 9% of households in the poorest quintile have access to piped water supply, and only 36% have access to improved sanitation facilities.[46] The precarity of these poor urban communities makes them highly vulnerable to a wide range of shocks – not just climate impacts or other disasters, but also disease outbreaks, as the COVID-19 pandemic has made painfully clear.

Many major cities are in low-lying coastal areas threatened by sea-level rise. Coastal cities contribute a third of China's GDP,[47] and modelling for this report shows more than 194 million people in China live in coastal zones less than 10 metres above sea level, 92% of them in urban or quasi-urban areas. Sea-level rise and storm surges could cut the GDP of China's coastal regions by 11% by 2050 – in some cities by as much as 20%.[48] Shenzhen could experience sea-level rise of 0.3–0.5 metres by 2050 and 0.9–2.1 metres by 2100. As an archipelago nation, Indonesia has a particularly large share of its population in low-lying coastal zones: 57.7 million people, 82% of them in urban or quasi-urban areas. In Brazil, the modelling shows 15.4 million people live in coastal zones at less than 10 metres above sea level – 86% of them in urban and quasi-urban areas, including Rio de Janeiro, Salvador, Fortaleza and Recife.[49] Kolkata, home to 15 million people, already faces frequent flooding, and by 2050, much of the city could lie in the annual coastal flood risk zone;[50] Mumbai also faces serious risks.[51]

Flood threats are especially severe in coastal areas where protective ecosystems have been lost. Jakarta is sinking by almost 20 cm per year, due mainly to excessive groundwater abstractions.[52] Semarang is sinking by 7–11 cm per year.[53] In South Africa, Cape Town and eThekwini (Durban), which each account for about a quarter of South Africa's coastal urban land,[54] are both heavily built up, with only 55% and 44% of natural land cover remaining, respectively. This has left them with little protection from erosion and floods. India's coastal communities face similar problems, so a US$43 billion coastal resilience initiative launched in 2019, backed by the Green Climate Fund and the United Nations Development Programme,[55] prioritises ecosystem restoration, which will also reduce GHG emissions.

MAP 1: COASTAL DEVELOPMENT BETWEEN 1986 AND 2021 IN SEMARANG, INDONESIA

Large projects continue to be built in low-lying coastal areas, at enormous cost, in investments that typically have lifespans of 50 years or longer. In Semarang, for instance, a major expansion of Tanjung Emas Port announced in 2017 involves reclaiming more than 100 hectares of coastal land to build storage tanks, docks, warehouses and other facilities. Governments risk spending public funds on assets that may become stranded due to sea level rise, frequent floods, major changes in precipitation, or other climate hazards.

1986

2021

Source: Google Earth, Image© 2021 Maxar Technologies. Image © 2021 TerraMetrics. Data SIO, NOAA, U.S. Navy, NGA, GEBCO

It is crucial to embed climate resilience in all urban infrastructure investments, building standards, and urban revitalisation programmes. Major infrastructure can have a lifespan of 50 years or longer.[56] Governments cannot afford to spend precious public funds on assets that may become stranded due to sea-level rise, frequent floods, major changes in precipitation, or other climate hazards. And even projects designed to be able to withstand coastal flooding, for example, may create new vulnerabilities by "hardening" the shoreline, so the risk shifts up or down the coast, or by damaging or eliminating protective ecosystems, such as marshes or mangroves. In Semarang, Indonesia, for example, a port expansion is reclaiming over 100 hectares of coastal land,[57] and a new airport terminal was built on a reclaimed marsh.[58] Similar development is occurring in parts of China, but the national government has also set a goal of having 80% of urban built-up areas meet its "Sponge Cities" flood resilience standards by 2030.[59] China is also revitalising tens of thousands of urban settlements; by incorporating both decarbonisation and resilience, it could make an enormous impact.[60]

3. There are many ways to foster low-carbon, resilient and inclusive cities

In each country, we identified multiple ways for national governments to support urban transformation, often with strong synergies with development objectives. They can put a new vision for cities at the heart of their national climate and development policies and strategies. They can adopt governance reforms to promote cross-sectoral planning, facilitate metropolitan-scale collaboration and empower local governments. They can adopt fiscal reforms to remove harmful subsidies and raise revenue for infrastructure and new services – directly or by boosting cities' own-source revenues. They can invest in clean energy, electric vehicles, public transport, transit-oriented development, bike and pedestrian infrastructure and urban green space, and the revitalisation of urban cores. They can realign land use policies, housing programmes and funding streams to expand the supply of affordable housing within cities. They can protect and restore vital ecosystems and use nature-based solutions to build urban resilience. They can prioritise investments that improve living conditions and create economic opportunities for poor and marginalised people, including informal workers. And most immediately, they can put cities front and centre in their COVID-19 recovery efforts.

There are many ways to build urban resilience while also reducing GHG emissions. Nature-based solutions are a prime example. Restoring and protecting mangroves near coastal cities from Brazil, to China, to Indonesia, to South Africa, would reduce those cities' vulnerability to storms by providing natural buffers – and boost carbon storage, as mangroves are powerful carbon sinks.[61] Similarly, restoring and protecting coastal peatlands in Indonesia would not only reduce land subsidence and flood risks, but also avoid large amounts of GHG emissions[62] and air pollution from fires.[63] Indeed, after devastating fires in 2015, the Indonesian government established a Peatland Restoration Agency in 2016, aiming to restore 2 million hectares within five years.[64]

Compact, connected, clean and resilient urban development itself can also boost resilience. As noted earlier, millions of people in cities across the six countries are living in precarious conditions that make them deeply vulnerable not only to climate change, but to a wide range of shocks. A key way to address this problem is to invest in well-situated, high-quality social housing, connected to public transport and key urban services. Many low-carbon measures can also directly boost resilience; for instance, rooftop solar panels can provide more reliable power in areas with frequent outages and also reduce energy bills. In South Africa, Durban has actively promoted solar photovoltaics (PV), creating a mapping tool to help residents and businesses estimate their potential energy cost savings, and installing 300 kW of rooftop panels on city buildings to lead by example.[65] Cycling infrastructure, which has kept people and goods moving safely across cities through the COVID-19 pandemic,[66] can also provide a lifeline during climate-related disasters that shut down roads and public transport.

Engaging and empowering poor and marginalised people can build social resilience, improve living conditions and promote sustainability. In Mexico, for example, the 2019–2024 National Housing Programme seeks to provide homes that are not only affordable, but truly meet residents' needs.[67] To help achieve this, it is helping low-income communities to build or upgrade their own housing and to shape their own neighbourhoods – a concept known as "social production of habitat".[68] In Indonesia, where for generations, residents of kampungs (informal settlements) in flood-prone areas were forcibly relocated, efforts are now being made in several cities to work with local residents to manage flood risks, protect ecosystems, and build capacity for both climate change adaptation and mitigation.[69] Along with physical improvements, the programmes in both countries are laying the groundwork for transformative change in these communities, which is essential for long-term resilience and sustainability.[70]

Transforming cities will take time, but national governments can start making an impact right away. In each country, we identified measures that fit well with COVID-19 stimulus packages, as well as options that do not require significant budget commitments. We highlighted opportunities to build on existing policies or incorporate urban strategies in key national plans. And we identified the sectors with the most cost-effective emission reduction potential, as well as the ones in which the most jobs could be created. For example, in Mexico, the transport sector holds 28% of the identified urban abatement potential but requires only 8% of the total estimated investments needed through 2050. Building energy-efficient housing and retrofitting existing structures, on the other hand, is a larger investment with a longer payback time, but it is a good way to create jobs: the modelling shows that by 2030, it could support half a million new jobs. By offering a wide array of options for each country, our goal is to help national policy-makers seize immediate opportunities, support urban leaders and embrace a long-term vision to transform cities.

IN MEXICO, THE TRANSPORT SECTOR HOLDS 28% OF THE IDENTIFIED URBAN ABATEMENT POTENTIAL, BUT REQUIRES ONLY 8%OF THE TOTAL ESTIMATED INVESTMENTS NEEDED THROUGH 2050

Part B

A closer look at the urban opportunity and challenges in six major emerging economies

In-depth country analyses are the heart of this project. To complement the synthesis of major themes in the preceding section, here we present summaries of our findings in each of the six countries, including illustrative recommendations for national policy-makers. The summaries offer a preview of forthcoming country reports that delve deeper into the topics discussed and offer a broader perspective, steeped in the knowledge of country experts in urban, climate and energy policy and informed by the Coalition's broader network.

Jakarta, Indonesia. Source: Asia Travel/Shutterstock

China

Cities at the heart of the 14th Five-Year Plan and a national vision for net-zero emissions

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

2030

15.2 MILLION JOBS

48% (1,926 MT CO_2-e) REDUCTION IN GHG EMISSIONS

2050

3.5 MILLION JOBS

89% (3,372 MT CO_2-e) REDUCTION IN GHG EMISSIONS

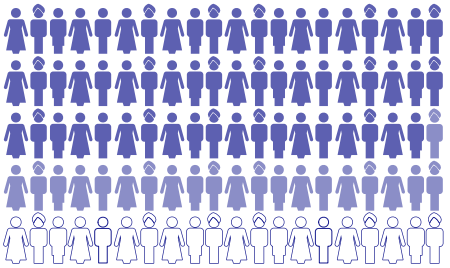
WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$5.5 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$7.7 TRILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Taizhou, China. Image: used with permission of Turenscape

China's economic success story is built on cities, which produce 90% of its GDP.[71] From 2000 to 2018 alone, as the urban population nearly doubled to 837 million (59% of the total),[72] GDP grew almost fivefold.[73] The share of people in extreme poverty has plummeted, from 40.3% in 1999 to 0.5% in 2016.[74] And urbanisation continues apace; by 2050, four in five Chinese are expected to live in cities.[75]

CHINA IS URBANISING FAST – SHARE OF POPULATION IN URBAN AREAS:



2018 59%
2050 (PROJECTED) 80%

Yet even before the COVID-19 pandemic, China's cities faced major challenges. Though CO_2 emissions from energy use have plateaued,[76] they remain high, mainly due to heavy reliance on coal, which made up 61.9% of the total energy supply in 2018.[77] China also has 23 of the 50 cities with the worst air pollution,[78] which was linked to an estimated 1.2 million premature deaths nationwide in 2017.[79] Traffic congestion cuts into productivity; in 2018, Beijing, the most congested city in China, lost about CNY 180 billion, or about 6% of its GDP on daily commutes.[80] And urban sprawl is severe: modelling for the Coalition shows that Chinese cities expanded by 35,380 km² between 2000 and 2014,[81] with some failed projects resulting in ghost towns and empty industrial parks.[82]

23 OF THE 50 CITIES WITH THE WORST AIR POLLUTION ARE IN CHINA, LINKED TO 1.2 MILLION PREMATURE DEATHS IN 2017

IN 2018 BEIJING LOST CNY 180 BILLION ON DAILY COMMUTES

Income inequality is a problem both within and across cities. While China's Gini index, 38.5 in 2016,[83] is below that of many developing and emerging economies, as of 2018, urban households in the wealthiest quintile had 5.9 times the disposable income of those in the poorest quintile.[84] Households in Shanghai, in turn, had 95% more disposable income, on average, than those in Chongqing, and 127% more than those in Gansu.[85] Major fiscal liabilities have also left many cities deep in debt, jeopardising the delivery of local services.[86]

Climate change poses growing threats as well. A study of major cities found average summer temperatures in Shanghai and Chongqing are already dangerously high and rising.[87] Life-threatening floods are alarmingly common, with a record 21 large-scale floods in 2020;[88] altogether, 280 lives were lost and damages reached US$35 billion.[89] Coastal cities, which contribute a third of China's GDP,[90] are in particular peril from floods, storm surges and sea-level rise. By one estimate, in 2050, Guangzhou will face annual average losses exceeding US$13 billion (CNY 89.8 billion), making it the most vulnerable among 136 of the world's largest coastal cities.[91]

Cities in northern China, most notably Beijing, face severe water scarcity, exacerbated by water pollution. Subsidence due to overdrawn aquifers threatens over 50 cities;[92] before the South-to-North Water Diversion Project helped ease water stress, parts of Beijing were sinking by over 10 cm per year.[93] Continued development in high-risk areas is also creating new vulnerabilities.

For example, major urban expansion in the Shenzhen region is occurring at sea level, exposing high-value (and high-carbon) infrastructure – ports, airports, business districts – to becoming stranded assets.[94]

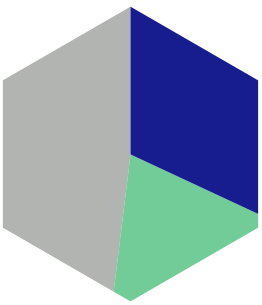
China has taken major steps to address its environmental challenges. In 2013, President Xi Jinping laid out a vision for an "ecological civilisation" (shengtai wenming)[95] with harmony between people and nature, cleaner industries, green technological innovation and ecosystems protection. China has taken actions to reduce air, water and land pollution and strengthened enforcement, spurring greater compliance.[96] It has embraced nature-based solutions to build resilience, from reforestation, to the pioneering Sponge City Programme.[97] And it has pledged to peak CO_2 emissions before 2030[98] and to reach carbon neutrality by 2060[99]– though the new 14th Five-Year Plan does not yet raise climate ambition accordingly.[100]

The benefits of pursuing compact, connected, clean and inclusive cities

New analysis for this report shows that China could reduce GHG emissions from its cities by 48% in 2030 (1.94 Gt CO_2-e) and 89% in 2050 (3.37 Gt CO_2-e), relative to a baseline scenario, using proven low-carbon measures. More than a quarter of the abatement potential (27.5%) depends on decarbonising the electricity supply – 68% of which came from fossil fuels in 2019.[101]

These low-carbon measures would require incremental investments of US$5.5 trillion but yield returns with a net present value of at least US$7.7 trillion by 2050. Notably, 53% of China's urban abatement potential is in cities that now have fewer than a million residents, which may still be taking shape and could greatly benefit from low-carbon investments. Another 23% of the potential is in cities with over 5 million residents, and 25% is in cities with 1–5 million residents.

A SIGNIFICANT PERCENTAGE OF CHINA'S MITIGATION POTENTIAL IS IN SMALLER CITIES



ABATEMENT POTENTIAL BY CITY SIZE
<300,000
300,000 – 1 MILLION
>1 MILLION

Modelling for this report shows many economically attractive options: from residential lighting efficiency improvements in cities, which require only US$3.78 billion in incremental investments but could yield savings with a net present value of US$94.78 billion, to fostering a shift to public transport, which would require US$172.48 billion in incremental investments, but yield savings with a net present value of US$3.35 trillion by 2050. Investing in energy-efficient passenger and freight vehicles could also yield particularly large economic benefits.

Almost half of China's urban abatement potential (48%), the modelling shows, is in the buildings sector: improving the efficiency of heating and cooling, appliances and lighting, cooking and water heating, and using clean energy. This is also where the greatest job-creation potential lies: the modelling shows new construction and deep retrofits to maximise energy efficiency could support 10.1 million new jobs in the residential sector and 3.6 million in the commercial sector in 2030.

Unlocking the potential of China's cities

China's vigorous response to the COVID-19 pandemic has kept mortality remarkably low[102] and enabled the country to grow its GDP by 2.3% in 2020 while other major economies shrank.[103] Per capita income also grew, though urban households' expenditure dropped by 6% in real terms.[104]

US$729 BILLION
FISCAL STIMULUS IN CHINA AS OF FEBRUARY 2021

As of February 2021, China had approved US$729 billion in fiscal stimulus, including investments in electric vehicles and EV infrastructure, building renovations, railway infrastructure, and the country's Green Development Fund.[105] However, China has also provided strong support to carbon-intensive industries, relaxed some environmental reporting, streamlined permits for coal mining, and extended subsidies for fossil fuel vehicles. There is scope to do much more to foster compact, connected, clean and inclusive cities and to build climate resilience.

This is a pivotal time for China, with the 14th Five-Year Plan now unveiled and an updated NDC in the works. In this context, four key opportunities for impact at the national level are:

Put sustainable cities at the heart of the implementation of the 14th Five-Year Plan, annual investment plans, and the new NDC, aiming to peak emissions in all urban areas (or at least a large share of them) by 2025. The 14th FYP will mobilise massive new investments and shape China's economic, social and environmental trajectory for years to come. This is a chance to transform cities and enable them to lead the way to a carbon-neutral future. Highlighting urban action in the NDC and requiring cities to peak emissions and issue carbon-neutrality roadmaps by 2025 – with central government support – could greatly accelerate urban climate action. Many of these investments also align well with China's competitive advantages. For instance, as production of EVs (cars, buses and other vehicles) scales up, robust EV charging infrastructure in cities can accelerate uptake, with benefits for the economy and for urban air quality.

This is a pivotal time for China, with the 14th Five-Year Plan now unveiled and an updated NDC in the works.

Prioritise energy-efficient buildings – new construction and retrofits – in future stimulus packages and other spending. This is a prime opportunity to create large numbers of jobs in cities and slow the rise in electricity demand – which nearly doubled, in per capita terms, from 2008 to 2018[106] – even as China continues its impressive renewable energy deployment.

Support small and mid-sized cities to enable them to drive compact, connected, clean and resilient urbanisation. With more than half of China's urban abatement potential in cities with less than a million residents, and growing interest in improving economic opportunities in smaller and inland cities,[107] this is a chance to foster sustainable development, transform mobility and accessibility, and improve inter-regional equity. Along with direct investment and technical expertise, cities would benefit from fiscal reforms to enable them to generate more own-source revenues.

Incorporate decarbonisation and resilience objectives, including nature-based solutions, in national urban design and regeneration strategies. The Sponge City programme, for instance, has been scaled up, with a goal of 80% of urban built-up areas meeting its standards by 2030.[108] Overall, efforts to build flood resilience have already saved lives and avoided major economic losses, improved groundwater recharge and made cities healthier.[109] It is crucial to keep scaling up those efforts and incorporate equally ambitious decarbonisation measures in urban renewal projects. The potential is enormous: in 2020 alone, China's government set out to renovate 39,000 aging settlements, at a cost of about CNY 4 trillion (about US$600 billion).[110]

Aerial view of Shenzhen, China. Source: Shutterstock

India

Mobilising national missions to unleash the full potential of Climate Smart Cities

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

2030
8.2 MILLION JOBS
53% (640 MT CO_2-e) REDUCTION IN GHG EMISSIONS

2050
3 MILLION JOBS
89% (1,784 MT CO_2-e) REDUCTION IN GHG EMISSIONS

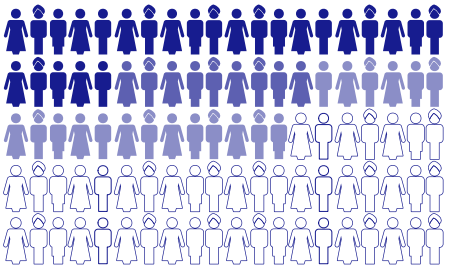
WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$3.6 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$1.6 TRILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Solar panel installation, New Delhi, India. Source: iStock.

India is urbanising very fast. As recently as 1990, just over a quarter of Indians – 220 million – lived in urban areas; by 2018, it was 34%, or 461 million.[111] By 2050, the urban share is expected to rise to almost 53%, or 877 million. Providing decent housing, public services and job opportunities for so many people in such a short time, and doing so equitably and sustainably, is a daunting challenge.

INDIA IS URBANISING FAST – SHARE OF POPULATION IN URBAN AREAS:



1990 25%
2018 34%
2050 (PROJECTED) 53%

India's cities are already economic powerhouses, contributing 63% of GDP in 2011 and a projected 75% by 2030.[112] An analysis of urban GDP growth to 2035 found all 10 of the fastest-growing cities in the world would be in India, with Surat, Agra and Bangalore topping the list.[113] Between young people joining the labour force and migrants from rural areas, however, demand for work is so high that McKinsey estimates India will need to create 12 million non-farm jobs per year through 2030.[114] The vast majority of Indian workers are either in the informal sector, or employed as contract or casual labour.[115] After the country was locked down due to COVID-19, 44% of informal workers were jobless.[116] The economic distress in cities led to the largest mass migration since the Partition in 1947.[117]

Still, India's path to broad-based prosperity clearly starts in the cities. So the focus now is on how to improve living conditions, especially for people in dense informal housing or slums, and address long-standing social, health and environmental challenges.[118] Transforming urbanisation will also be crucial to realising India's ambitions for economic growth, poverty reduction and climate action.

Housing development is a priority. One study found India's cities need to add 25 million affordable housing units by 2030.[119] And meeting that demand through home-building, combined with mass transit, water infrastructure and property services, could create 30 million jobs. The first challenge is to provide the necessary land, which may require updating land use regulations and land market structures that now encourage sprawl.[120] Ahmedabad, for example, has used effective planning, including land aggregation, to grow compactly and strategically.[121] Overall, however, new analysis for the Coalition shows that India's urban footprint expanded by 9,822 km² between 2000 and 2014 – about 1.5 times the size of the Mumbai Metropolitan Region.[122] And with too little housing available, large informal settlements have developed on the edges of cities.

India also urgently needs to build climate resilience. Heat waves in several cities have created deadly conditions,[123] and a study of major cities found average summer temperatures in Mumbai, Kolkata and Delhi are already dangerously high and rising.[124] With guidance and support from the national government, more than 100 cities and districts have developed Heat Action Plans,[125] including early warning systems, public cooling centres, cool roofs and new green infrastructure.

Climate change threatens to exacerbate India's daunting water crisis as well,[126] with 354 million people projected to face severe water stress with even 1.5°C of warming.[127] Floods are another growing threat, causing an estimated US$79.5 billion in damages across India between 1998 and 2017.[128] Kolkata, home to 15 million people, already faces frequent flooding, and by 2050, much of the city could lie in the annual coastal flood risk zone.[129] Mumbai also faces major flood risks.[130]

FLOODS CAUSED AN ESTIMATED **US$79.5 BILLION** IN DAMAGES ACROSS INDIA BETWEEN 1998 AND 2017

Several major national programmes are helping India's cities become more resilient, sustainable and inclusive. The Pradhan Mantri Awas Yojana (PMAY) Housing for All scheme,[131] for example, aims to close the urban housing gap by building more than 11 million units by 2022. The Atal Mission for Rejuvenation and Transformation is improving basic services and amenities in 500 cities.[132] Rajiv Awas Yojana envisions a "slum-free India".[133] And the Smart Cities Mission is harnessing technology to drive growth and improve resource management, urban mobility and a wide range of services.[134]

The ClimateSmart Cities Assessment Framework, launched in 2019 under the Smart Cities Mission, provides a powerful new tool for Indian cities seeking to adopt best practices in mitigation and adaptation.[135] It builds on the work of the National Mission for Sustainable Habitat, which since 2008 has helped cities tackle climate risks and foster clean, inclusive and sustainable development. The new framework uses 28 indicators to assess cities' vulnerabilities and potential for climate action on energy and green buildings, urban planning, green cover and biodiversity, mobility and air quality, water management and waste management. Almost 100 cities used the tool in the first phase.

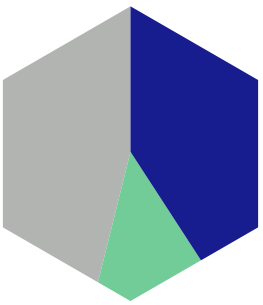
Together, these major initiatives provide immense opportunities to mainstream climate action – from mass deployment of rooftop solar PV, to energy- and water-efficient home-building. India's government is also committed to making ambitious investments in infrastructure. The India Investment Grid aims to mobilise US$1.5–2 trillion in public and private finance through a National Infrastructure Pipeline, with thousands of projects.[136]

The benefits of pursuing compact, connected, clean and resilient cities

New analysis for this report shows substantial emission reduction potential in India's cities.[137] By 2050, the modelling shows, a bundle of proven low-carbon measures could reduce urban emissions from buildings, transport, waste and materials for infrastructure by 89% in 2050, saving 1,784 Mt CO_2-e relative to a baseline scenario. Over half of India's urban abatement potential to 2050 (54%) is in cities with fewer than 1 million residents today, compared with 25% in cities of over 5 million.

Residential buildings hold 52% of the cumulative abatement potential identified; commercial buildings, another 20%, and transport, 15%. Across sectors, nearly half the total abatement potential depends on decarbonising electricity. In 2019, India got 76% of its power supply from fossil fuels, mainly coal.[138] India has pledged to increase the share of non-fossil fuel installed capacity to 40% by 2030, and it is making progress: from 2015 to 2019, the share of solar and wind power in the electricity mix more than doubled, from 3.4% to 7.3%. The government is also investing in Green Energy Corridors,[139] a major effort to integrate renewables into the grid, transmitted from eight renewable-rich states.

A SIGNIFICANT PERCENTAGE OF INDIA'S MITIGATION POTENTIAL IS IN SMALLER CITIES



ABATEMENT POTENTIAL BY CITY SIZE
<300,000
300,000 – 1 MILLION
>1 MILLION

Fully implementing the modelled measures would require US$3.6 trillion in incremental investments to 2050, but they could more than pay for themselves through energy and material cost savings, yielding returns with a net present value of US$1.6 trillion.[140] Public transport offers particularly attractive opportunities: investing US$79.1 billion by 2050 could bring returns with a net present value of US$1.4 trillion. It would also reduce air pollution and traffic congestion – two urgent concerns for India – and, if designed to prioritise the needs of the poor, make cities more inclusive.[141]

Unlocking the potential of India's cities

The COVID-19 pandemic has hit India hard, with about 11 million confirmed cases by late February 2021 – second only to the United States – and over 156,000 deaths.[142] India's GDP shrank by 8% in 2020,[143] though it is now projected to grow by 11.5% in 2021. Fiscal stimulus packages totalling US$325 billion as of February 2021 have helped revitalise the economy, but also bolstered high-carbon industries.[144] There have been green measures as well, however, including a US$26.5 billion investment in biogas and cleaner fuels; a waiver on interstate transmission fees for renewable energy until December 2022; incentives for solar panel and LED technology manufacturing; and a pledge to have 25% of new vehicle registrations in Delhi be EVs by 2024. These are positive steps.

Going forward, four key opportunities for impact at the national level are:

Align national infrastructure and urban development policies, programmes and investments with the vision of ClimateSmart Cities. From the urban missions to the National Infrastructure Pipeline, the Government of India's ambitious agenda has the potential to transform cities for the better, building resilience and accelerating decarbonisation while improving living conditions for all. A systematic approach will be crucial to making the most of these opportunities.

Scale up energy efficiency initiatives and incorporate clean energy and efficient technologies in housing and other urban programmes. Through its Bureau of Energy Efficiency, the Ministry of Power has launched initiatives on lighting, commercial buildings and appliances, as well as demand-side management in industry and municipalities. The National Mission for Enhanced Energy Efficiency has set up two funds to enable project financing for and within cities;[145] the market potential for these programmes is estimated at US$10 billion.[146]

Support local governments – especially small and mid-sized cities – to enable them to drive urban transformation. Limited institutional capacity remains a key barrier to ambitious mitigation and adaptation action in many cities. It is crucial to align institutional and fiscal capacities across levels of government to ensure cities have the funds, technical know-how and institutional support they need. The national government has vital resources, for instance, while state governments control land policy and acquisition,[147] and local governments are best positioned to engage communities.

Step up investments in sustainable transport, prioritising the urban poor. Though car ownership in Indian cities is rising,[148] a large share of trips still involve public or non-motorised transport – 70% in New Delhi, for example.[149] It is important to prioritise those commuters in road design and improve safety for them, as they now account for two-thirds of total road traffic fatalities.[150] It is also crucial to improve service for the large share of the population who ride buses, minibuses and rickshaws.[151]

From the urban missions to the National Infrastructure Pipeline, the Government of India's ambitious agenda has the potential to transform cities for the better, building resilience and accelerating decarbonisation while improving living conditions for all.

Esplanade metro station in Kolkata, India. Source: Matyas Rehak/Shutterstock.

Indonesia

Compact, connected, clean and resilient cities as drivers of sustainable development

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

2030
2.3 MILLION JOBS
50% (253 MT CO_2-e) REDUCTION IN GHG EMISSIONS

2050
876,000 JOBS
96% (790 MT CO_2-e) REDUCTION IN GHG EMISSIONS

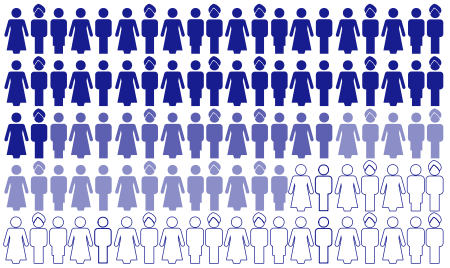
WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$1.0 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$2.7 TRILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Jakarta, Indonesia. Source: Tresia Hoban/Pixabay

Indonesia is a rising economic power, with a GDP of US$3.2 trillion in 2019.[152] Gross national income (GNI) per capita has grown sevenfold since 2000, reaching US$4,050 in 2019, which brought Indonesia into the ranks of upper-middle-income countries.[153] The share of Indonesians living below the national poverty line was almost halved from 2000 to 2018, to 9.8%,[154] and the share in extreme poverty (living on less than US$1.90 per day) dropped to 3.6%, one-tenth the level in 1999.[155] The middle class is growing rapidly.[156]

INDONESIA IS URBANISING FAST – SHARE OF POPULATION IN URBAN AREAS:



2000 42%
2018 55%
2050 (PROJECTED) 73%

Indonesia is also urbanising rapidly, with about 55% of its population in urban areas as of 2018, up from just 42% in 2000; by 2050, almost 73% of Indonesians are expected to live in cities.[157] A large share of economic activity is clustered in cities: urban areas generated nearly 60% of Indonesia's GDP between 2010 and 2016, and metro Jakarta alone, nearly a quarter.[158]

Yet Indonesia has not reaped the full socio-economic rewards of urbanisation. A World Bank analysis found that for every percentage-point increase in urbanisation, Indonesia's GDP per capita rose by only 4%, versus 13% in India, 10% in China, and 8% in Vietnam.[159] Cities have also struggled to keep up with demand for basic services: only 42% of urban households have access to piped water supply, and only 72% have access to improved sanitation facilities. For those in the poorest quintile, the shares are 9% and 36%, respectively.[160] Indonesia also has a major housing deficit,[161] which it is trying to address through intensive home-building.[162]

Urban inefficiencies cost Indonesia dearly. Both Jakarta and Surabaya rank among the world's most congested cities,[163] and an estimated 60% of Jakartans suffer from diseases related to air pollution, mainly from transportation.[164] Yet for decades, the government has focused on building and expanding roads while underinvesting in public transport and non-motorised options in cities.[165]

AN ESTIMATED 60% OF JAKARTANS SUFFER FROM DISEASES RELATED TO AIR POLLUTION, MAINLY FROM TRANSPORTATION

Urban expansion, meanwhile, has consumed large swathes of cropland as well as vital ecosystems such as mangroves. Between 2000 and 2014, analysis for this report shows, Indonesian cities grew by 3.9% or 6,904 km² – more than the land area of Bali.[166] With millions of urban dwellers concentrated in low-lying coastal areas, flooding is a major concern, and it is exacerbated by severe land subsidence due to wetland drainage for agriculture and groundwater abstractions by industry and households.[167] Jakarta is sinking by almost 20 cm per year;[168] Semarang, by 7–11 cm per year.[169] Building resilience to floods and other shocks is an urgent priority for Indonesia's urban areas, with some 110 million people in 60 cities regularly exposed to coastal storms, tsunamis, earthquakes and other disasters.[170]

ALMOST 23%
OF THE WORLD'S MANGROVES FORESTS ARE IN INDONESIA

Indonesia is embracing nature-based solutions to build resilience and boost carbon storage. In the wake of the 2015 peatland fires, which sharply increased air pollution (including in cities) and GHG emissions, the government established a Peatland Restoration Agency in 2016, aiming to restore 2 million hectares within five years.[171] Protecting mangroves is also crucial. Indonesia has the largest area of mangrove forests in the world: 3.1 million hectares, or almost 23% of the global total.[172] Mangroves store large amounts of carbon[173] and also provide important buffers for coastal areas. In December 2018, for instance, mangroves helped save many lives during the Sundra Strait Tsunami.[174]

Building social resilience in vulnerable communities is also crucial, and can go hand in hand with decarbonisation and compact, connected urban development. In Surabaya and Jakarta, for example, where large parts of the population live in kampungs, or informal settlements, flood resilience-building efforts are increasingly empowering local residents to help shape plans for their communities and become environmental stewards.[175]

More broadly, Indonesia has begun to embrace a more sustainable development pathway, starting by reducing fossil fuel subsidies.[176] In 2017, it launched a Low Carbon Development Initiative (LCDI) to foster economic growth that reduces emissions, builds climate resilience and minimises exploitation of natural resources.[177] The LCDI identifies haphazard, sprawling urbanisation as a problem to address, and calls for a faster transition to renewable energy, greater investment in energy efficiency, and more sustainable infrastructure investments. The 2020–2024 National Medium-Term Development Plan, informed by the LCDI, includes climate action and resilience-building as a core programme.[178]

Another key vehicle for change is the Smart Cities movement, which Indonesia launched in 2017, enlisting 100 cities to date. Jakarta, which pioneered the concept, has used technology to better understand residents' needs, improve service delivery and attract new businesses.[179] Each city can tailor the concept to its own priorities.[180] There are challenges, including the cost to cities[181] and ensuring that all residents can benefit, but there is enormous potential.

The benefits of pursuing compact, connected, clean and inclusive cities

New analysis for this report shows that Indonesia could reduce urban GHG emissions by 50% (253 Mt CO_2-e) in 2030 and 96% (790 Mt CO_2-e) in 2050, relative to a baseline scenario, using proven low-carbon measures. The vast majority of the abatement potential – 76% – is in cities with fewer than a million residents today; 7% is in Jakarta, and 17% in cities with 1–5 million residents.

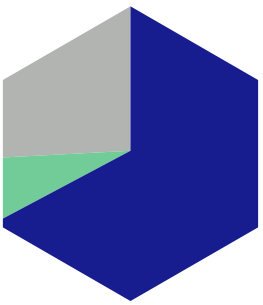
Economic modelling suggests that fully implementing these low-carbon measures would require incremental investments of US$1 trillion by 2050 – but they could provide returns with a net present value of US$2.7 trillion by 2050.[182]

The greatest potential for emission reductions is in buildings, which hold 69% of the cumulative abatement potential to 2050 (about two-thirds in homes). Passenger transport holds 14% and reduced materials use, energy efficiency and improved production processes another 11%. Notably, across sectors, 52% of the total abatement potential depends on decarbonising electricity. In 2019, 84% of Indonesia's power came from fossil fuels – mainly coal, but with a growing share from natural gas.[183]

The most economically attractive measures are in compact urbanisation (which reduces travel demand) and public transport. The modelling indicates that they would require US$24.4 billion and US$90.9 billion, respectively, in incremental investment, but would yield energy and material savings with a net present value of US$731.2 billion and US$1.97 trillion, respectively. This does not take into account the benefits of improved urban accessibility, cleaner air, or avoided congestion.

From a jobs perspective, the modelling shows the greatest potential is in deep retrofits of residential and commercial buildings and new construction to maximise energy efficiency, which could employ almost 2 million people in 2030. These would be large, long-term investments, however: an estimated US$723 billion to 2050 that would take a few decades to fully pay off.

A SIGNIFICANT PERCENTAGE OF INDONESIA'S MITIGATION POTENTIAL IS IN SMALLER CITIES



ABATEMENT POTENTIAL BY CITY SIZE

<300,000

300,000 – 1 MILLION

>1 MILLION

Unlocking the potential of Indonesia's cities

COVID-19 has taken a toll on Indonesia, with about 1.3 million confirmed cases by late February 2021 and over 34,000 deaths.[184] It also brought about Indonesia's first recession in two decades,[185] with about 2.6 million left jobless by August 2020.

The government has responded with US$75 billion in stimulus spending as of February 2021,[186] most recently in a US$28.5 billion infrastructure package. The "labour-intensive" projects include housing construction, sanitation for 1.6 million homes and rooftop solar, but also a natural gas network and 965 km of roads.[187] During the pandemic, Indonesia also deregulated mining and provided substantial funds to high-carbon industries.[188] Future stimulus efforts could give greater priority to urban investments that reduce emissions and build resilience to climate change and other shocks.

US$75 BILLION

IN STIMULUS SPENDING AS OF FEBRUARY 2021

HOUSING CONSTRUCTION

SANITATION FOR **1.6 MILLION** HOMES

ROOFTOP SOLAR

Four other key opportunities for impact at the national level are:

Invest in sustainable urban mobility, including both public transport, and walking and biking infrastructure. Transit-oriented development is essential as well. Not only is this a highly cost-effective way to reduce GHG emissions, it would also tackle the urgent crises of traffic congestion and air pollution, and particularly benefit lower-income people who can't afford cars.

Scale up ecosystems restoration around cities to build resilience. Protecting peatlands is crucial to slow subsidence, and mangroves provide buffers from growing coastal storm threats; both are also major carbon sinks. Moreover, healthy coastal ecosystems support livelihoods, especially for the poor.

Accelerate the transition to clean electricity. Indonesia is already scaling up renewable energy but has prioritised liquid biofuels.[189] Scaling up wind and especially solar power would unlock enormous abatement potential and better position Indonesia to become a regional EV market leader.[190]

Leverage the Smart Cities movement to advance sustainability, resilience-building and inclusion. There is enormous untapped potential still to engage citizens in solving infrastructure, mobility and resilience challenges. An immediate priority is to ensure that small and mid-sized cities have the resources they need to seize these opportunities. It is also crucial to ensure that city residents at all income levels, including in kampungs, can fully participate.

An immediate priority is to ensure that small and mid-size cities have the resources they need to seize these opportunities. It is also crucial to ensure that city residents at all income levels, including in kampungs, can fully participate.

Tanjungpandan, Indonesia. Source: Eddie Cheever/Shutterstock

Brazil

Prioritising urban transport and housing investments for inclusion and resilience

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

2030
4.5 MILLION JOBS
35% (75 MT CO_2-e) REDUCTION IN GHG EMISSIONS

2050
1.3 MILLION JOBS
88% (238 MT CO_2-e) REDUCTION IN GHG EMISSIONS

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$1.7 TRILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$370 BILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Rio de Janeiro, Brazil. Source: Simon Mayer/Shutterstock

Brazil urbanised early and quickly, with more than half its population in cities by 1965 and 87% as of 2018.[191] Even in regions with strong agricultural and mining sectors, cities are central to the economy; the 25 largest urban areas generate 63% of GDP.[192] In the past two decades, however, urban population growth has been greatest not in major hubs like São Paulo or Rio de Janeiro, but in smaller cities,[193] which tend to have more limited capacity to manage urbanisation or to deliver municipal services.[194]

BRAZIL URBANISED EARLY AND QUICKLY – SHARE OF POPULATION IN URBAN AREAS:

1965 50%
2018 87%
2050 (PROJECTED) 92%

After robust growth in the 2000s that sharply increased per capita income and drove down poverty, Brazil's economy has struggled in recent years.[195] It fell into recession in 2015–2016 and had not fully recovered when the pandemic hit.[196] Brazil's labour productivity was relatively low,[197] unemployment was relatively high,[198] and household, corporate and public debt had risen.[199]

COVID-19 not only took a heavy human toll – over 10 million confirmed cases and 246,000 lives lost as of late February 2021[200] – but it also shrank GDP by 4.5% in 2020.[201] In the third quarter of 2020, the unemployment rate hit a record 14.6%, with 11.3 million fewer people employed than a year earlier.[202] The nearly 14 million Brazilians who live in favelas[203] have been particularly hard-hit; a June 2020 survey found 80% of households in informal settlements were living on less than half their previous income and 76% had lacked enough money for food.[204]

63%
OF BRAZIL'S GDP IS GENERATED BY THE 25 LARGEST URBAN AREAS, MAKING CITIES CENTRAL TO BRAZIL'S ECONOMY

The COVID-19 crisis has highlighted the urgency of building resilience among Brazil's urban poor, many of whom are also disproportionately exposed to climate-related disasters because they live on hillsides and floodplains on the edges of cities.[205] As economic and population hubs, Brazil's cities are also critical to a successful recovery for the nation as a whole.

Brazil has been widely recognised for its urban innovation. Curitiba pioneered bus rapid transit (BRT) in 1974; it is now available in 21 Brazilian cities and metro areas, carrying 10.6 million passengers per day on 86 corridors spanning 789 km.[206] Porto Alegre pioneered a participatory budgeting process that has since scaled to over 2,700 cities around Brazil and the world.[207] The 2001 City Statute (Estatuto da Cidade) institutionalised several innovations, including participatory master planning.[208] The Ministry of Cities, established in 2003 (and folded into a new Ministry of Regional Development in 2019), led big, ambitious programmes that provided affordable housing, expanded basic services and strengthened social safety nets in urban areas across the country.[209]

Yet federal housing investments – especially through the Minha Casa, Minha Vida programme in the past decade[210] – have also reshaped the urban landscape, concentrating new housing on the outskirts of cities, where land was less expensive. Informal settlements have further clustered poverty in the urban periphery, and municipalities have struggled to provide adequate services, from sanitation, to public transport. Casa Verde e Amarela, a new programme that replaced MCMV in January 2021, could be an opportunity to do better. The goal is to finance new homes for 1.6 million low-income families, regularise land tenure for 2 million, and support improvements in 400,000 existing homes by 2024.[211]

Overall, new analysis for the Coalition shows Brazil's cities expanded by 1,603 km² between 2000 and 2014 alone – more than the area of São Paulo city.[212] Most of this was driven by the consolidation and growth of mid-sized cities, especially those that are part of large, dispersed metro areas. A large share of this sprawl, 46%, consumed grasslands, forests, wetlands and other ecosystems that provide vital services, including carbon storage, flood protection and biodiversity.

AIR POLLUTION, MUCH OF IT FROM TRANSPORT, WAS LINKED TO MORE THAN 44,000 DEATHS IN 2016

Robust growth in export-driven commercial agriculture has led to the rapid expansion of many smaller cities without adequate infrastructure and services to support the population. In the Midwestern states of Goiás and Mato Grosso, for instance, disconnected and inadequately managed urban expansion is keeping cities from realising their economic potential.[213] The regional development agency, SUDECO, has advocated for a sustainability transformation, in line with the National Regional Development Policy and the 2030 Agenda, to build shared prosperity. Cities in the Amazon region are also growing rapidly. For example, Parauapebas, in Pará, has grown from 154,000 inhabitants in 2010 to over 213,000 in 2020.[214]

Car dependency is another serious concern. Road traffic accidents took 30,371 lives in Brazil in 2019, a modest 7% improvement from 2015.[215] Air pollution, much of it from transport, was linked to more than 44,000 deaths in 2016.[216] Productivity losses are high as well. A list of the top 25 most congested global cities in 2019 ranked Rio de Janeiro No. 2, with an average of 190 hours lost in traffic; São Paulo came in at No. 5, and Belo Horizonte at No. 13.[217]

RIO DE JANEIRO WAS THE SECOND MOST CONGESTED GLOBAL CITY IN 2019

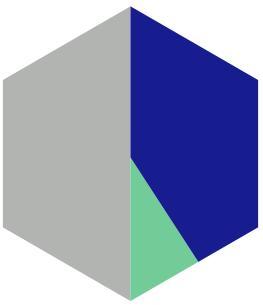
The National Urban Mobility Policy,[218] adopted in 2012, sought to reshape transportation to prioritise accessibility, sustainability and integration between modes, though several factors have limited its impacts.[219] Cities have taken important steps as well, from lowering speed limits, to creating "complete streets" that are safer for pedestrians and cyclists, to integrating informal transit providers with formal networks to improve overall service.[220] Still, much remains to be done to ensure all city residents can travel safely, efficiently and affordably, and access key services and economic opportunities.[221]

BRAZIL

Brazil is already experiencing the effects of climate change, which will only escalate, with particular impacts on poor and marginalised communities. In March 2020, torrential rains, floods and landslides killed about 150 people in three states, including residents of São Paulo, Rio de Janeiro and Belo Horizonte,[222] who have seen an escalation of extreme rainfall in recent years.

There are also slower-onset impacts. Climate change is expected to reduce precipitation in much of Brazil and increase droughts, with northeastern Brazil among the "hotspots" of drying.[223] Hydropower production is projected to be 28% lower by 2040 than if runoff had remained at 1990 levels,[224] which could reduce revenues by billions of dollars per year.[225] Some cities are already struggling with water scarcity – most notably São Paulo, which almost ran out of water in 2014.[226] Climate change and deforestation combined are expected to worsen the risk of landslides around many Brazilian cities.[227] And coastal cities will be exposed to flooding from storm surge and sea-level rise.[228]

A SIGNIFICANT PERCENTAGE OF BRAZIL'S MITIGATION POTENTIAL IS IN SMALLER CITIES



ABATEMENT POTENTIAL BY CITY SIZE

<300,000

300,000 – 1 MILLION

>1 MILLION

The benefits of pursuing compact, connected, clean and resilient cities

Brazil did not enhance its climate commitments in its 2020 update to its NDC, but new analysis for the Coalition shows a bundle of low-carbon measures could enable Brazil to cut its urban GHG emissions by 75 Mt CO_2-e (35%) in 2030 and 238 Mt CO_2-e (88%) in 2050, compared with a baseline scenario.[229] Substantial incremental investments would be needed – US$272.2 billion by 2050 – but they could more than pay for themselves through energy and materials savings alone, yielding cumulative returns with a net present value of US$369.7 billion by 2050.[230] They could also generate employment, supporting over 4.5 million new jobs in 2030.

The transport sector holds 45% of Brazil's urban abatement potential to 2050 and also some of the most economically attractive options. Shifting travel from cars to public transit, for example, would require incremental investments of US$29.6 billion to 2050 but could yield returns with a net present value of US$223.3 billion. Another US$350 million invested in vehicle efficiency, the modelling shows, could yield returns by 2050 with a net present value of US$7.95 billion. Shifting to electric vehicles, meanwhile, could support an estimated 128,000 jobs in 2030. São Paulo, Rio de Janeiro and other cities are already adopting electric buses and even garbage trucks, and Brazil now has multiple EV production plants, making everything from batteries to 22-metre articulated buses.[231]

Residential and commercial buildings hold another 28% of Brazil's urban abatement potential – not counting building materials. Many of the required investments, especially in deep retrofits for energy efficiency, would take decades to pay for themselves, but they have strong job creation potential. In 2030, building retrofits and energy-efficient construction in the residential and commercial sectors combined could support over 577,000 new jobs. At a time when so many low-income Brazilians are unemployed, this offers a prime opportunity for economic stimulus, with lasting benefits.

Unlocking the potential of Brazil's cities

In response to the COVID-19 crisis, Brazil approved US$224 billion in fiscal stimulus by February 2021, but very little for decarbonisation or resilience-building.[232] The government has provided support for industry and aviation, and relaxed restrictions on logging, mining and other development. On the positive side, it has provided some support for renewable energy and approved green bonds for sustainable infrastructure that are expected to attract nearly US$34 billion by 2029.

In addition, Brazil's government can help unleash the power of compact, connected, clean and resilient cities by seizing opportunities such as:

Develop and support metropolitan governance to foster integrated and sustainable urban development. Promote the institutional development of the inter-federative governance structures in metropolitan regions and collaboration among cities, providing financial incentives and technical support, data and expert analysis (e.g. projections of future expansion under different scenarios).

Prioritise low-carbon transport investments to reduce air pollution and GHGs and enhance urban accessibility. Promote electric mobility through fiscal incentives and guaranties to enable new business models, such as leasing. Accelerate the switch to electric buses. Align national transport finance flows to promote social inclusion: from bringing new bus lines to lower-income neighbourhoods, to ensuring that public transit hubs are safely accessible on foot.

Revamp national housing programmes and policies to ensure they provide safe, affordable and sustainable urban housing with access to jobs and basic services. Whenever possible, create new housing by revitalising and sustainably densifying existing urban areas. When new land must be used, carefully plan development to ensure it is compact, connected, clean and resilient. Support housing upgrades and retrofits as well as new construction.

Investments in public transport, pedestrian and cycling infrastructure, and building energy efficiency all have strong stimulus potential.

Support cities in expanding finance for low-carbon and resilience-building projects to improve service delivery and help address infrastructure investment deficits. This may include developing pipelines of bankable projects and prioritising these projects for finance by development banks and national development agencies; providing expert assistance and national guidance to implement land value capture and reducing barriers to private investment in cities to sustainably increase fiscal space.

Rio de Janeiro, Brazil. Source: NakNakNak/Pixabay

Mexico

How urban transformation can reduce poverty and inequality and build resilience

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

2030
526,000 JOBS
34% (98 MT CO_2-e) REDUCTION IN GHG EMISSIONS

2050
132,000 JOBS
87% (284 MT CO_2-e) REDUCTION IN GHG EMISSIONS

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$960 BILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$210 BILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Queretaro, Mexico. Source: Cesar Gomez/Shutterstock

Mexico is highly urbanised, with 80% of its population in cities,[233] and nearly 90% of gross value added produced in urban areas.[234] Yet although GDP per capita nearly doubled in the past five decades, to US$10,404 in 2018,[235] poverty and inequality remain serious problems – and COVID-19 has exacerbated both. Even prior to the pandemic, over 27% of Mexican workers had informal jobs[236] and 55% could not access key benefits such as social security and public housing loans.

Achieving greater equality is a national priority, and more compact, connected, clean and resilient cities are a key part of the solution. Mexico's cities are sprawling: new analysis for this report shows urban areas expanded by 1,821 km² between 2000 and 2014 – more than the land area of Mexico City. For many years, national housing programmes exacerbated sprawl, as new social housing construction – two-thirds of which is federally funded[237] – occurred mostly in peripheral areas, where land is cheaper but jobs, public services and public transit are limited or don't exist.

Sprawl, in turn, drives costly and unsustainable mobility patterns. On average, transport accounts for 19% of household expenses in Mexico, more than in any other G20 country.[238] Those who can afford to, drive, and between 2006 and 2018, the number of vehicles in Mexico doubled, with the majority registered in urban areas.[239] Only a fraction of Mexicans own cars, however. Nationwide, 80% of trips are on public transit[240] and the poor often endure long, complex and even dangerous commutes.[241] Yet funding for urban mobility is often fragmented and tends to favour roads over transit, walking or biking.

COVID-19 has also exposed deep vulnerabilities in Mexico's social fabric. As of February 2021, Mexico had the seventh-highest COVID mortality rate in the world: 133 per 100,000.[242] The economy has also been devastated, with GDP shrinking by 8.5% in 2020.[243] By one estimate, 12.2 million will fall into poverty due to the pandemic, more than half into extreme poverty;[244] another estimate puts it at 7.5–8.7 million, four-fifths in urban areas, with deepening inequality.[245]

At the same time, Mexico faces growing climate-related risks, including costly disasters.[246] An in-depth review of Mexican cities found that existing sustainability issues could compound the impacts of climate change – for instance, high water use in increasingly water-scarce areas, and urban heat island effects amid rising temperatures.[247] Mexico City is sinking due to excessive groundwater abstraction, and climate change is intensifying the problem, while also increasing floods, landslides and other hazards.[248] Small cities with far fewer resources or technical

MEXICO IS HIGHLY URBANISED – SHARE OF POPULATION IN URBAN AREAS:

2018 80%
2050 (PROJECTED) 88%

OVER 27%
OF MEXICAN WORKERS HAD INFORMAL JOBS AND
55%
COULD NOT ACCESS KEY BENEFITS

19%
OF HOUSEHOLD EXPENDITURE IS ON TRANSPORT

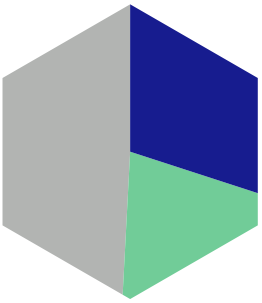
Mexico City is sinking due to excessive groundwater abstraction, and climate change is intensifying the problem, while also increasing floods, landslides and other hazards.

expertise face equally serious challenges.[249] Building resilience – both by addressing physical and systemic risks, and by tackling poverty and inequality – is an urgent priority.

The benefits of pursuing compact, connected, clean and resilient cities

Even with the economic slowdown caused by COVID-19, Mexico is not on track to meet its existing climate commitments, and recent actions are expected to increase emissions.[250] But new analysis for this report shows that cities could help Mexico change that trend. Modelling for the Coalition shows adopting a bundle of low-carbon measures in the buildings, transport and waste sectors could reduce urban GHG emissions by 34% (98 Mt CO_2-e) in 2030 and 87% (284 Mt CO_2-e) in 2050, relative to a baseline scenario.[251] One-fifth (19%) of this abatement potential is in Mexico City; 28% is in cities with 1–5 million residents, such as Guadalajara and Puebla; and more than half is in cities with less than a million residents.

A SIGNIFICANT PERCENTAGE OF MEXICO'S MITIGATION POTENTIAL IS IN SMALLER CITIES



ABATEMENT POTENTIAL BY CITY SIZE

<300,000

300,000 – 1 MILLION

>1 MILLION

These low-carbon measures could provide returns with a net present value of at least US$208.8 billion by 2050.[252] They would require US$963 billion in incremental investments through 2050, which would generate US$652.6 billion per year in energy and material savings in 2050 alone.

Building energy efficiency measures could provide more than half the abatement potential but account for nearly 90% of total investment needs. Deep building retrofits present the largest job creation potential, offering huge opportunities for the construction sector, which employs a large share of low-skilled workers. Decarbonising Mexico's electricity supply, meanwhile, could create high-quality jobs, and it is needed to realise one-third of urban abatement potential. As of 2018, roughly 80% of Mexico's electricity came from fossil fuels, mainly natural gas.[253]

The most economically attractive options are in transportation, which accounts for 28% of urban abatement potential but would require just 8% of total investments. Reducing travel demand, integrating transport planning and land use, and encouraging a shift away from motorised transport could reduce emissions from Mexican cities by over 8 Mt CO_2-e by 2030 and 17.33 Mt CO_2-e by 2050. Vehicle efficiency and electrification could save a further 6.83 Mt CO_2-e by 2030 and 19.67 Mt CO_2-e by 2050. The national government is already working on an electric mobility strategy,[254] but there is significant scope to expand public transit and non-motorised transport investments.

MEXICO

Unlocking the potential of Mexico's cities

Mexico faces significant economic challenges due to the COVID-19 pandemic. But by putting compact, connected, clean, and resilient cities at the heart of its recovery strategy, aligned with a long-term vision, it can emerge stronger from this crisis, with particular benefits for poor and marginalised people. To date, Mexico's COVID-19 fiscal stimulus has been relatively modest, US$28 billion as of February 2021, weighted heavily towards high-carbon investments, but also including an expansion of Mexico City's cycling network.[255] Future stimulus efforts should prioritise low-carbon urban measures – especially those with high job creation potential and/or large benefits for the poor.

REDUCING EMISSIONS BY SHIFTING FROM MOTORISED TRANSPORT:

OVER 8 MT CO_2-e

BY 2030

17.33 MT CO_2-e

BY 2050

To fully realise its cities' potential to support sustainable, inclusive and equitable growth, Mexico also needs institutional and fiscal reforms as well as targeted measures to strengthen municipalities' technical and financial capacities and to support municipal-level coordination.[256] The good news is that much of this can be accomplished without significant new expenditure, as it involves mainly changes in governance and reallocation of existing resources.

There are many ways for the national government to help unleash the power of compact, connected, clean and resilient cities. Four such opportunities are:

Support the creation of metropolitan authorities to enable integrated land use and transport planning. The Guadalajara Metropolitan Authority provides a potential model, which other urban areas (including Mexico City) are seeking to emulate. Given that much of the urban growth in Mexico is occurring in smaller cities, capacity-building of municipal staff is also crucial to enable inclusive, sustainable urban development, including at the metropolitan scale.[257]

VEHICLE EFFICIENCY AND ELECTRIFICATION COULD SAVE A FURTHER:

6.83 MT CO_2-e

BY 2030

19.67 MT CO_2-e

BY 2050

Expand the supply of well-located social urban housing that is adequate, secure and affordable, complemented with inclusive and resilient mass transit options. Recent reforms to national housing and lending programmes should facilitate this. Safe housing and greater access to jobs and key services in cities will also strengthen the resilience of vulnerable populations.

Prioritise a just transition to zero-carbon cities, with special attention to the needs of poor and marginalised people. Mexico's long-term prosperity and global competitiveness depend on whether it can successfully transform its economy for a net-zero future. With strong national support, cities can drive that shift, pioneering new technologies and policies. In that context, a strong commitment to a just transition is essential, so that informal workers and others living in precarious conditions get to share in the benefits and are not unintentionally hurt, even short-term, by decarbonisation measures.

Scale up support for programmes to foster the social production of housing and habitat, leveraging low-carbon strategies to reduce poverty. Mexico's new housing and land use policies have the potential to transform the lives of many poor and marginalised people, not least by enabling them to shape the urban infrastructure they rely on. This is also a powerful tool to build social resilience in communities that are now deeply vulnerable.

Mexico's new housing and land use policies have the potential to transform the lives of many poor and marginalised people, not least by enabling them to shape the urban infrastructure they rely on. This is also a powerful tool to build social resilience in communities that are now deeply vulnerable.

Mexico City, Mexico. Source: Albert John/Shutterstock

South Africa

Tackling urban poverty and inequality through decarbonisation and resilience-building

LOW-CARBON MEASURES IN CITIES COULD SUPPORT THE EQUIVALENT OF:

2030
656,000 JOBS
54% (81 MT CO_2-e) REDUCTION IN GHG EMISSIONS

2050
325,000 JOBS
92% (146 MT CO_2-e) REDUCTION IN GHG EMISSIONS

WOULD REQUIRE **CUMULATIVE INVESTMENTS** OF US$270 BILLION TO 2050 AND **YIELD RETURNS** WITH A NET PRESENT VALUE OF US$220 BILLION **BASED ON COST SAVINGS ALONE***.

**These are indicative estimates based on modelling by SEI and Vivid Economics – please refer to Annex 1 and Annex 2 for further details.*

Source: Angelo Moleele/Unsplash

South Africa's largest cities are powerful economic engines, attracting migrants from across the country and sub-Saharan Africa. Two-thirds of the population live in cities and half in just six urban areas.[258] The Gauteng City-Region alone, which includes Johannesburg, Tshwane (Pretoria) and Ekurhuleni, was home to 12.9 million people as of 2015 and generated 35% of South Africa's economic output.[259] Most high-skill jobs are in the major cities and earnings for skilled workers are also higher than in rural areas.[260] In 2015, the mean urban household income was almost 3.5 times the mean rural income.[261] Though the rate of urban growth has slowed over the past 15 years,[262] it still far outpaces the nation as a whole; by 2035, 74% of the population is projected to be urban.[263]

SOUTH AFRICA'S POPULATION IS MAINLY IN CITIES – SHARE OF POPULATION IN URBAN AREAS:

2018 66%
2050 (PROJECTED) 80%

South Africa's cities have built significant private wealth,[264] but it is very unequally distributed. Since its democratic transition, major efforts have been made to raise living standards in the peri-urban townships, integrate cities, build housing and expand economic opportunities, with visible results.[265] But large disparities persist: the Gini coefficient for South Africa was 0.63 in 2014, making it the most unequal country in the world;[266] in Gauteng City-Region, it was 0.74 as of 2011.[267] Municipalities struggle to keep up with demand for urban housing, sanitation and electrification – not least because a large share of urban population growth has been in peri-urban areas.[268]

Urban mobility in South Africa both reflects inequality and exacerbates it. In the five biggest metro areas, the average morning commute takes an hour.[269] The country has well-developed roads, but poor pedestrian infrastructure and lighting create perilous conditions for those who walk,[270] and buses and trains do not serve many lower-income areas well.[271] Two-thirds of public transport trips in South Africa's metro areas involve 16-seat minibus taxis.[272] These are often the only viable option, but there are serious safety issues and costs are higher due to limited subsidies. For 99% of workers in the lowest income quintile in 2013, average transport costs to work exceeded 20% of their income.

TRANSPORT COSTS OVER A
FIFTH OF INCOME
FOR 99% OF WORKERS IN THE LOWEST INCOME QUINTILE

And South Africa's cities keep sprawling outward. New analysis for this report shows the urban footprint expanded by 1,464 km² between 2000 and 2014.[273] More than half of that was onto habitats that sustain biodiversity and sequester carbon, such as forests, shrublands and grasslands. Another 31% was onto built-up rural areas and 14% directly onto cultivated land. Many informal settlements are also on marginal land exposed to floods, landslides and other hazards.[274]

Climate change is already taking a toll on South Africa's cities. Water scarcity is a growing problem, and in 2018, Cape Town came close to having to shut off water taps.[275] In climate risk reports to CDP,[276] Johannesburg, Durban and Cape Town all reported concerns about droughts, as well as extreme heat and floods. Cape Town also reported saltwater intrusion, storm surge and coastal flood risks. Loss of protective habitats exacerbates risks for both Cape Town and Durban, which each account for about a quarter of South Africa's coastal urban land,[277] and have only 55% and 44% of their natural land cover remaining, respectively.

South Africa's new Long-Term Low Emissions Development Strategy is billed as 'the beginning of our journey' towards net-zero emissions by 2050.

South Africa has been stepping up its climate ambition. In September 2020, it submitted its first Long-Term Low Emissions Development Strategy (SA-LEDS) under the Paris Agreement.[278] Billed as "the beginning of our journey" towards net-zero emissions by 2050, the plan builds on existing policies to tackle poverty and inequality, decarbonise and build resilience across multiple sectors. In December, President Cyril Ramaphosa followed up with a new, multi-stakeholder Presidential Climate Change Coordinating Commission charged with ensuring a just transition.[279]

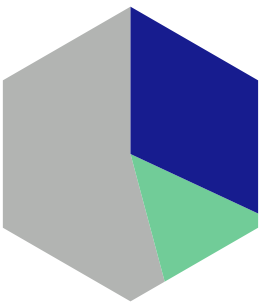
Cities themselves are already demonstrating inclusive, low-carbon solutions. Johannesburg, Cape Town, Durban and Tshwane are all part of C40[280] and have developed climate strategies.[281] The Integrated Urban Development Framework (IUDF),[282] adopted in 2016, provides a powerful tool for decarbonisation and resilience-building, as part of a vision for "liveable, safe, resource-efficient cities and towns that are socially integrated, economically inclusive and globally competitive".

The benefits of pursuing compact, connected, clean and resilient cities

New analysis for this report shows that urban climate action could dramatically reduce South Africa's GHG emissions. Implementing a bundle of technically feasible low-carbon measures could reduce urban emissions by 54% (81 Mt CO_2-e) in 2030 and 92% (146 Mt CO_2-e) in 2050, relative to a baseline scenario.[283]

Fully realising that potential would require incremental investments of US$272.2 billion to 2050[284] but they would more than pay for themselves in energy and materials savings alone, yielding gains with a net present value of US$216.3 billion by 2050. They could also support about 656,000 new jobs in 2030 and thus could contribute to a just transition.

A SIGNIFICANT PERCENTAGE OF SOUTH AFRICA'S MITIGATION POTENTIAL IS IN SMALLER CITIES



ABATEMENT POTENTIAL BY CITY SIZE

<300,000

300,000 – 1 MILLION

>1 MILLION

The most economically attractive urban abatement options are in more compact urban development and public transport – which often go hand in hand. Investing US$33.4 billion by 2050 to advance those two goals could generate savings with a net present value of US$288 billion by 2050. From a job-creation perspective, energy-efficient construction and retrofits in both the residential and commercial sectors are most promising, with potential to support over 577,000 new jobs in 2030.

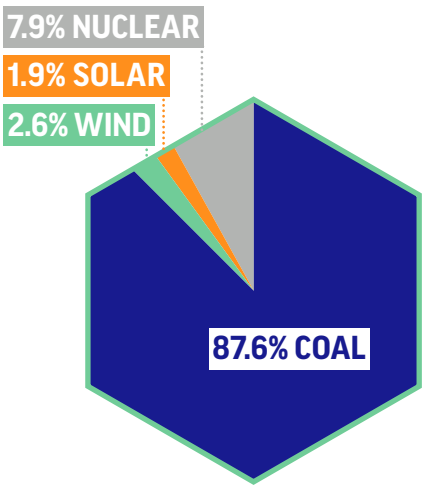
INVESTING IN COMPACT URBAN DEVELOPMENT AND PUBLIC TRANSPORT

INCREMENTAL INVESTMENT **US$33.4 BILLION**
NET PRESENT VALUE OF **US$288 BILLION**

Decarbonising the electricity supply is necessary to achieve 50.5% of the urban abatement potential. In 2019, 87.6% of South Africa's power supply came from coal, down from 93.5% in 2005, but still an overwhelming majority.[285] Only 2.6% and 1.9%, respectively, came from wind and solar power; the rest was nuclear. The Integrated Resource Plan (IRP) proposes decommissioning 10 GW of coal power capacity by 2030, another 25 GW by 2050, and replacing it mainly with wind and solar.[286]

A major Electricity Regulation Act reform adopted in October 2020[287] could dramatically accelerate decarbonisation while improving energy access and service reliability. The reform allows cities to purchase power directly from independent producers or generate their own. Frustrated by high costs and frequent load-shedding, several municipalities have already expressed interest in parting ways with Eskom, the state-owned utility.[288] By 2030, for example, eThekwini (Durban) envisions owning almost 650 MW of renewable generation capacity, mainly from wind and solar PV, but also from landfill gas, wastewater and hydropower, plus 500 MWh of storage capacity. In addition, it aims to secure 745 MW of generating capacity from independent producers by 2030.

SOURCES OF SOUTH AFRICA'S POWER SUPPLY, 2019



Unlocking the potential of South Africa's cities

A key challenge for South Africa is that even before the COVID-19 crisis, the economy was in recession, and the pandemic shrank GDP by 7.5% in 2020.[289] In the third quarter, unemployment hit 30.8%, the highest level since the national jobless survey began in 2008.[290] By the start of February 2021, the virus had also taken more than 45,000 lives.[291]

Targeted investments in decarbonisation and resilience-building can help South Africa build back better. By February 2021, the government had approved US$38 billion in fiscal stimulus,[292] including support for fast-tracking the IRP and adding 11.8 GW of new power generation capacity, more than half from renewable sources, by 2022.[293] Unbundling Eskom into separate generation, transmission and distribution companies – which would facilitate efforts to diversify power generation – is also part of the economic recovery plan.[294] However, South Africa has also bailed out and supported high-carbon industries during the COVID

50.5%
OF THE ABATEMENT POTENTIAL IS ACHIEVED BY DECARBONISING THE ELECTRICITY SUPPLY

crisis.[295] Future stimulus efforts should better reflect South Africa's bold vision for a net-zero future, with healthy, inclusive and sustainable cities.

There are many ways for South Africa's government to accelerate urban transformation, including:

Accelerate policy reforms to enable municipalities to procure their own clean energy and use renewables to improve electricity access. Cape Town officials, for instance, say they want to seize this opportunity but need greater clarity and support from the national government.[296] Cost, technical capacity and logistical challenges could also pose significant barriers, especially for smaller cities.[297] The national government can provide resources and connect municipalities with experts to help develop viable business models[298] and strategies to benefit poor and marginalised people.

Put pro-poor urban measures at the heart of plans to implement the SA-LEDS and achieve a just transition. Several national policies have laid a foundation for this. From rooftop solar PV and solar water heaters to waste-to-energy solutions, there are many interventions that can create jobs with modest training requirements, improve energy access, and reduce GHG emissions.

Prioritise improved mobility for lower-income urban residents. This may include bringing better bus service to townships and peri-urban settlements but also innovative approaches to improving minibus taxi service to make it safer, more affordable and more sustainable. Much-safer pedestrian and cycling infrastructure is also urgently needed. Not only would these measures improve access to jobs in cities – they could also create many jobs, as shown in the modelling.

Protect and restore ecosystems in and around cities and invest in greening the urban landscape. This is crucial for building resilience to floods, landslides and coastal storms, as well as droughts. Urbanised areas where the poor live also tend to have more impervious surfaces and fewer trees than wealthier areas, which makes them more vulnerable to both floods and heat waves.[299] Building resilience through nature-based solutions can also create new jobs.

Cape Town, South Africa.Source: Shutterstock

Part C

A global call to action

The COVID-19 crisis has posed daunting challenges for national policy-makers, exposing the fragility of hard-won development progress. It has also highlighted the urgency of addressing climate change, which already threatens the safety and livelihoods of millions of people around the world.

This report shows how putting cities front and centre in both COVID-19 recovery and longer-term climate and development strategies can create jobs, advance key development priorities and accelerate the shift to net-zero emissions. It also shows, through the lens of six emerging economies, that national governments have a central role in unlocking cities' enormous potential.

The country analyses offer recommendations tailored to each country's specific context. But even as we work with stakeholders in China, India, Indonesia, Brazil, Mexico and South Africa to seize the opportunities we have identified, we urge leaders in other countries, as well as the broader development community, to rise to this historic moment.

Salvador, Brazil. Source: Travelhock/Shutterstock

Building on the recommendations in *Climate Emergency, Urban Opportunity*,[300] we urge **national leaders** to:

Develop an overarching strategy to deliver shared prosperity while reaching net-zero emissions – and place cities at its heart. A shared national vision is crucial to mobilising action and investments across sectors and line ministries, and also sends important signals to the private sector, city leaders and the world. China's 14th Five-Year Plan and South Africa's SA-LEDS, for example, offer prime opportunities to do this.

Develop and implement national policies to support compact, connected, clean and resilient cities – for example, by reforming land use and building regulations to promote liveable density and transform the built environment, decarbonising the power grid, and phasing out fossil fuel-powered vehicles.

Fund and finance sustainable and resilient urban infrastructure. India, for instance, has pledged to mobilise US$1.5–2 trillion in public and private finance through a National Infrastructure Pipeline, which could be truly transformative. Key measures might include eliminating fossil fuel subsidies to unlock funding for investment in green urban infrastructure; shifting national transport budgets from road-building to public, active transport and new zero-carbon mobility solutions; establishing a pipeline of bankable urban projects; and national and subnational fiscal reform to provide new sources of revenue for investment, alongside and with the private sector. It is also important to invest in the adaptation of existing urban infrastructure to anticipated future climate conditions and ensure that new investment is put towards infrastructure designed for forward-looking climate-focused performance standards.

Support local climate action in cities through governance and fiscal reforms that empower local governments to take more ambitious action, foster innovation, enhance cities' own-source revenue options and facilitate metropolitan-scale collaboration.

Proactively plan for a just and resilient urban transition by prioritising measures that build resilience and expand economic opportunities for the urban poor, including those in informal settlements; planning for workers to transition out of high-carbon sectors; and ensuring that the benefits of decarbonisation investments in cities are widely and equitably distributed. Cities in Indonesia and Mexico, for example, are pioneering participatory urban planning and budgeting.

Many countries were already taking positive steps prior to the COVID-19 crisis. Clearly pandemic response must now take priority; but as we have noted, low-carbon investments and resilience-building in cities can be powerful tools to stimulate the economy, create jobs and alleviate poverty.[301] We urge **national governments** to seize these opportunities – and keep pushing forward towards a longer-term vision for compact, connected, clean and resilient cities.

Work in partnership with the private sector to help finance urban transformation and build key capacities. Meeting the financing gap for sustainable urban infrastructure will still demand a step change in investment not only in the public sector, but also in the private sector. National policies can create an enabling environment for stimulating, shaping and de-risking private-sector activity and investment. Greater use of fiscal measures such as land value capture instruments and carefully designed public-private partnerships can help crowd-in investment. And national governments and educational institutions can work with industry to nurture the ecosystem of diverse knowledge and professional skills that cities will need for this transition, from urban planners, architects and engineers, to ICT professionals and finance experts.

Urban leaders continue to innovate and raise their ambition, through local action and joint initiatives such as the Cities Race to Zero[302] and the Global Green New Deal.[303]
We urge **urban leaders** to:

Work hand in hand with national governments to urge and support their efforts to prioritise compact, connected, clean and resilient cities. Engage with national leaders to identify and deliver policies and investments that support sustainable development, decarbonisation and resilience-building in cities. This includes placing cities at the heart of updated NDCs and long-term strategies to 2050. It also requires developing meaningful partnerships with national ministries, including finance ministries.

Keep innovating and raising local ambitions – from pilot projects in major cities that can be emulated by communities nationwide, to joining the Cities Race to Zero. Mayors and municipal officials can draw on this report to help make the political case for local action, as well as to identify attractive low-carbon options that might suit their cities.

Strengthen the role of communities in cities, especially poor and marginalised people, in planning and decision-making processes that affect their lives.[304] Many cities are already demonstrating the power of truly inclusive governance, and community-driven development approaches adopted by many governments offer helpful guidance. Local leaders can further empower these citizens by amplifying their voices and ensuring their insights reach decision-makers at higher levels of government.

Raise awareness about the need to seize the urban opportunity. Local leaders are already powerful advocates for this cause, both within their communities and on the global stage. They can use the evidence base in this report to add new urgency and new examples to their calls to action.

FINANCIAL INSTITUTIONS & THE BROADER DEVELOPMENT COMMUNITY

Financial institutions and the **broader development community** also have key roles to play in realising cities' potential to drive sustainable and inclusive growth, build resilience and ensure a successful recovery from the COVID-19 crisis. We urge them to:

Build a multilateral system that fosters inclusive, resilient, zero-carbon cities, by making urban action a priority in climate and development finance, especially in countries that are urbanising rapidly and face significant challenges in meeting city residents' needs. As outlined in *Climate Emergency, Urban Opportunity*,[305] key actions include ending fossil fuel financing by international financial institutions; ensuring that development assistance is aligned with national urban strategies that are compatible with the Paris Agreement and the Sustainable Development Goals; and helping city governments to access international public finance for low-carbon, climate resilient development with appropriate fiduciary oversight by national governments. A few international finance institutions, such as the European Bank for Reconstruction and Development, have well-developed lines of lending to municipal authorities and utilities that have proven valuable for crowding-in and building private-sector experience with lending to subnational governments.

Work with national governments to redirect development assistance and concessional finance away from investments that exacerbate climate risks, and towards urban transformation. It is time to stop financing not just fossil fuel projects, but any investments that drive further sprawl, lock in car dependency or isolate the poor in urban peripheries. More rigorous attention to resilience is also needed, to avoid any further investments in infrastructure in low-elevation coastal zones and other high-risk areas that do not fully account for climate risks, or even create new hazards.

Support low-carbon and resilience-building investments with longer payback times, such as building retrofits and new construction to maximise energy efficiency, and ecosystems restoration to reduce flooding and coastal storm-surge risks. Some of the most promising urban decarbonisation strategies, including many with large job creation potential, have high upfront costs but may take decades to pay for themselves. Multilateral development banks (MDBs) have a key role to play in helping to provide technical assistance to prepare "investment-ready" urban programmes and providing "patient" capital to enable those investments, including to assist in overcoming market failures related to principal-agent challenges, prevalent in decarbonising buildings in cities.

Endnotes

1 Lakner et al., 2020, 'Updated Estimates of the Impact of COVID-19 on Global Poverty: The Effect of New Data'.

2 Goldin and Muggah, 2020, 'COVID-19 Is Increasing Multiple Kinds of Inequality. Here's What We Can Do about It', World Economic Forum.

3 Dobbs et al., 2011, 'Urban World: Mapping the Economic Power of Cities'; UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

4 Mizutori and Sharif, 2020, 'COVID-19 Shows Urgent Need for Cities to Prepare for Pandemics', *Thomson Reuters Foundation* (blog).

5 Hadden Loh, Love, and Vey, 2020, 'The Qualities That Imperil Urban Places during COVID-19 Are Also the Keys to Recovery', *Brookings Institution, The Avenue* (blog); OECD, 2020, 'Cities Policy Responses'.

6 UN, 2020, 'COVID-19 in an Urban World'.

7 IMF, 2020, *World Economic Outlook, October 2020: A Long and Difficult Ascent*. Among the world's 10 largest economies, China is the only one projected to have positive economic growth in 2020.

8 OECD, 2020, 'Cities Policy Responses'.

9 UN, 2020, 'COVID-19 in an Urban World'.

10 Carozzi, Provenzano, and Roth, 2020, 'Urban Density and COVID-19'; Keegan, 2020, 'Why Cities Are Not as Bad for You as You Think', *BBC Future* (blog); Adlakha and Sallis, 2020, 'Activity-Friendly Neighbourhoods Can Benefit Non-Communicable and Infectious Diseases', *Cities & Health*; Hamidi, Sabouri, and Ewing, 2020, 'Does Density Aggravate the COVID-19 Pandemic?', *Journal of the American Planning Association*.

11 See, e.g., Tabary, 2020, 'Cities Reboot: Will Adapting to COVID-19 Change Urban Life for Good?', *Reuters*; Joshi-Ghani, 2020, 'How COVID-19 Will Impact Our Cities in the Long Term', World Economic Forum Pioneers of Change Summit Blog; Pillai, 2020, 'Public Transport Takes a Covid Hit as Commuters Switch to Private Vehicles: Study', *Hindustan Times*; Sharifi and Khavarian-Garmsir, 2020, 'The COVID-19 Pandemic: Impacts on Cities and Major Lessons for Urban Planning, Design, and Management', *Science of The Total Environment*.

12 OECD, 2020, 'Cities Policy Responses'.

13 UN, 2020, 'COVID-19 in an Urban World'.

14 CUT, 2019, 'Climate Emergency, Urban Opportunity'.

15 Their collective share in 2019 was 31.7%, including 17.3% from China. Authors' calculations based on World Bank GDP data (PPP, in current international $). See *https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD*.

16 Authors' calculations based on 2018 data from the International Energy Agency (total CO_2 emissions): *https://www.iea.org/data-and-statistics*.

17 Authors' calculations based on 2018 data from UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'. China alone is home to 20% of the world's urban residents, and India, to another 11%.

18 For a sampling of different perspectives from industrialised vs. emerging economies, watch "Build Back Better through Collaborative Climate Action: A High-Level Discussion with National and Subnational Governments", held on 19 October 2020, available at *https://daringcities.org/program/build-back-better-through-collaborative-climate-action-a-high-level-discussion-with-national-and-subnational-governments/*.

19 CUT, 2019, 'Climate Emergency, Urban Opportunity'.

20 See *https://sdgs.un.org/goals/goal11*.

21 CUT, 2019, 'Climate Emergency, Urban Opportunity'.

22 See, e.g., Satterthwaite, 2016, 'Successful, Safe and Sustainable Cities: Towards a New Urban Agenda', *Commonwealth Journal of Local Governance*; UCLG, 2014, 'Basic Services for All in an Urbanizing World'.

23 See the Coalition's September 2020 report: Gulati et al., 2020, 'The Economic Case for Greening the Global Recovery through Cities: 7 Priorities for National Governments'.

24 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

25 Ardila-Gomez, 2020, 'Can COVID-19 Pave the Way toward Walkable, Bikeable Cities?', *World Bank Transport for Development* (blog).

26 C40 Cities, 2020, 'How to Build Back Better with a 15-Minute City'.

27 See *http://www.citiesracetozero.org* and the listing of cities in the Climate Ambition Alliance, at *https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94*.

28 Prydz and Wadhwa, 2019, 'Classifying Countries by Income', World Development Indicators Stories.

29 Analysis by the Stockholm Environment Institute for the Coalition. See *Annex 1* for a detailed methodology, including global and national data sources used. All estimates are compared with a baseline scenario that reflects countries' first round of Nationally Determined Contributions (NDCs). The baseline does not reflect recent updates to NDCs or related commitments. The modelling shows Brazil can achieve an 88% reduction by 2050, compared with the baseline scenario. In China and India, the modelling shows an 89% reduction can be achieved by 2050; in Indonesia, 96%; in Mexico, 87%, and in South Africa, 92%.

30 As noted above, hundreds of cities, including several in these six countries, have joined the Race to Zero. See *http://www.citiesracetozero.org* and the listing of cities in the Climate Ambition Alliance, at *https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94*.

31 Total GHG emissions include land use, forestry and land-use change (LULUCF). For a detailed methodology, including sources used in the analysis, see *Annex 1*. Table 3 in *Annex 1* presents country-by-country data for total GHG emissions, energy-related CO_2 emissions, GHG emissions from the modelled sectors, and the share of energy-related and total GHG emissions that they represent.

32 See IEA country-by-country data on electricity generation by fuel at *https://www.iea.org/data-and-statistics*.

33 The estimated shares are 50.5% for South Africa, 52.0% for Indonesia and 49.9% for India.

34 See IEA electricity generation data at *https://www.iea.org/countries/china*.

35 Almeida Prado et al., 2016, 'How Much Is Enough? An Integrated Examination of Energy Security, Economic Growth and Climate Change Related to Hydropower Expansion in Brazil', *Renewable and Sustainable Energy Reviews*; de Queiroz et al., 2016, 'Climate Change Impacts in the Energy Supply of the Brazilian Hydro-Dominant Power System', *Renewable Energy*.

36 These estimates of annual returns and net present value are sensitive to discount rates, energy prices, learning rates and other factors. This analysis considered the economic case under several scenarios: real discount rates of 1.4%, 3.5% and 5.5% per year, and real energy price increases of 1%, 2.5% and 4%. Learning rates are sector- and technology-specific. The data presented in this report reflect a 3.5% discount rate and a 1% real energy price increase. For a detailed methodology, see *Annex 2*.

37 Gulati et al., 2020, 'The Economic Case for Greening the Global Recovery through Cities: 7 Priorities for National Governments'.

38 CUT, 2019, 'Climate Emergency, Urban Opportunity'.

39 Saghir et al., 2020, 'Building Forward Better from COVID-19: Accelerating Action on Climate Adaptation'.

40 Masters, 2021, 'World Hammered by Record 50 billion-Dollar Weather Disasters in 2020', *Yale Climate Connections* (blog); Global Times, 2020, 'China Experiences 21 Large-Scale Floods in 2020, Setting Historical Record'.

41 Myers, 2020, 'After Covid, China's Leaders Face New Challenges From Flooding', *The New York Times*.

42 Saghir et al., 2020, 'Building Forward Better from COVID-19: Accelerating Action on Climate Adaptation'.

43 Bhattacharya, 2020, 'Is Extreme Heat Making India Unlivable?', *Mint* (blog).

44 NRDC, 2020, 'Expanding Heat Resilience across India: Heat Action Plan Highlights'.

45 Hess et al., 2018, 'Building Resilience to Climate Change: Pilot Evaluation of the Impact of India's First Heat Action Plan on All-Cause Mortality', *Journal of Environmental and Public Health*.

46 Baker and Gadgil, 2017, 'East Asia and Pacific Cities: Expanding Opportunities for the Urban Poor'.

47 World Resources Institute calculation based on data in the *China Statistics Book 2020*.

48 De Dominicis et al., 2020, 'Future Interactions Between Sea Level Rise, Tides, and Storm Surges in the World's Largest Urban Area', *Geophysical Research Letters*.

49 For a discussion of coastal risks in Brazil, see Muehe, 2010, 'Brazilian Coastal Vulnerability to Climate Change', *Pan-American Journal of Aquatic Sciences*.

50 Climate Central, 2019, 'Flooded Future: Global Vulnerability to Sea Level Rise Worse than Previously Understood'.

51 Kulp and Strauss, 2019, 'New Elevation Data Triple Estimates of Global Vulnerability to Sea-Level Rise and Coastal Flooding', *Nature Communications*; Bhattacharya, 2019, 'Mumbai and Kolkata Face the Wrath of Sea-Level Rise', *Mint* (blog).

52 Erkens et al., 2015, 'Sinking Coastal Cities', *Proceedings of the International Association of Hydrological Sciences*; Lin and Hidayat, 2018, 'Jakarta, the Fastest-Sinking City in the World', *BBC News*.

53 Husnayaen et al., 2018, 'Physical Assessment of Coastal Vulnerability under Enhanced Land Subsidence in Semarang, Indonesia, Using Multi-Sensor Satellite Data', *Advances in Space Research*.

54 SACN, 2016, 'State of South African Cities 2016'.

55 UNDP, 2019, 'US$43 million Project to Boost Climate Resilience for India's Coastal Communities Gets Underway', *United Nations Development Programme Press Release* (blog).

56 Hallegatte, Rentschler, and Rozenberg, 2019, *Lifelines: The Resilient Infrastructure Opportunity*; Val et al., 2019, 'Climate Change-Related Risks and Adaptation of Interdependent Infrastructure Systems', in *Climate Adaptation Engineering*; Rodrigue, 2020, The Geography of Transport Systems.

57 Wirayani, 2017, 'Port Operator to Implement Reclamation at Tanjung Emas Port', *The Jakarta Post*.

58 Suherdjoko, 2018, 'Ahmad Yani Airport Opens New Terminal', *The Jakarta Post*.

59 Xinhua, 2020, 'Across China: "Sponge City" Program Bears Fruit'.

60 Hou, 2020, '39,000 Aging Residential Communities in Nation Set for Renovation', *China Daily*.

61 Donato et al., 2011, 'Mangroves among the Most Carbon-Rich Forests in the Tropics', *Nature Geoscience*; Sidik et al., 2018, 'Mangrove Conservation for Climate Change Mitigation in Indonesia', *WIREs Climate Change*.

62 Warren et al., 2017, 'An Appraisal of Indonesia's Immense Peat Carbon Stock Using National Peatland Maps: Uncertainties and Potential Losses from Conversion', *Carbon Balance and Management*; Leifeld and Menichetti, 2018, 'The Underappreciated Potential of Peatlands in Global Climate Change Mitigation Strategies', *Nature Communications*.

63 Harrison et al., 2020, 'Tropical Forest and Peatland Conservation in Indonesia: Challenges and Directions', *People and Nature*.

64 See *https://brg.go.id/rencana-strategis-badan-restorasi-gambut-2016-2020/*.

65 Sustainia and C40, 2017, 'Cities100 2017: 100 Solutions for Climate Action in Cities'.

66 Schwedhelm et al., 2020, 'Biking Provides a Critical Lifeline during the Coronavirus Crisis', *World Resources Institute* (blog); Ardila-Gomez, 2020, 'Can COVID-19 Pave the Way toward Walkable, Bikeable Cities?', *World Bank Transport for Development* (blog).

67 SEDATU, 2019, 'Programa Nacional de Vivienda 2019–2024'.

68 The concept of social production of housing – and more broadly, of "habitat" – is seen as a key strategy to achieve more inclusive and socially just urbanisation. See, e.g., García, 2019, 'Producción Social de La Vivienda: Proceso Transformador de Las Ciudades Mexicanas', *WRI México* (blog); Arébalo et al., 2012, 'El Camino Posible: Producción Social Del Hábitat En América Latina'.

69 Simarmata and Surtiari, 2020, 'Adaptation to Climate Change: Decision Making and Opportunities for Transformation in Jakarta, Indonesia'; UNESCAP and UN Habitat, 2019, 'The Future of Asian and Pacific Cities 2019: Transformative Pathways Towards Sustainable Urban Development'. See also the Kampung Iklim (Climate Village) programme: *https://proklim.org*.

70 Bennett et al., 2019, 'Just Transformations to Sustainability', *Sustainability*; Matin, Forrester, and Ensor, 2018, 'What Is Equitable Resilience?', *World Development*.

71 Calculated by WRI China staff based on NBS, 2020, 'China Statistical Yearbook 2019'; China Statistics Press, 2020, 'China City Statistical Yearbook'.

72 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

73 See World Bank GDP data (PPP, in constant 2017 dollars): *https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.KD?locations=CN*.

74 See World Bank data for poverty headcount ratio at US$1.90 per day (PPP, constant 2011 dollars): *https://data.worldbank.org/indicator/SI.POV.DDAY?locations=CN*.

75 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

76 IEA, 2019, 'Global Energy & CO_2 Status Report 2019'. See also the IEA China country data page: *https://www.iea.org/countries/china*.

77 See IEA total energy supply data at *https://www.iea.org/countries/china*.

78 See the World Health Organization Global Ambient Air Quality Database (update 2018): *https://www.who.int/airpollution/data/cities/en/*.

79 Yin et al., 2020, 'The Effect of Air Pollution on Deaths, Disease Burden, and Life Expectancy across China and Its Provinces, 1990–2017: An Analysis for the Global Burden of Disease Study 2017', *The Lancet Planetary Health*.

80 AMAP, 2019, 'Traffic Analysis Report of Major Cities in China in 2018'.

81 See *Annex 3* for a full methodology.

82 World Bank, Development Research Center of the State Council, and China's Ministry of Finance, 2014, 'Urban China: Toward Efficient, Inclusive, and Sustainable Urbanization'.

83 See World Bank Gini index estimates: *https://data.worldbank.org/indicator/SI.POV.GINI?locations=CN*.

84 In per capita terms. See Table 6-7 in NBS, 2020, 'China Statistical Yearbook 2019'.

85 In per capita terms. See Table 6-23 in NBS, 2020, 'China Statistical Yearbook 2019'.

86 Ahmad and Colenbrander, 2020, 'Financing a Sustainable and Inclusive Urban Transition in China'.

87 Curran, Siderius, and Singh, 2019, 'Cities, Climate Change and Chronic Heat Exposure'.

88 Global Times, 2020, 'China Experiences 21 Large-Scale Floods in 2020, Setting Historical Record'.

89 Masters, 2021, 'World Hammered by Record 50 billion-Dollar Weather Disasters in 2020', *Yale Climate Connections* (blog); Global Times, 2020, 'China Experiences 21 Large-Scale Floods in 2020, Setting Historical Record'.

90 Calculated by WRI China; Data sources: China Statistics Book 2020.

91 Hallegatte et al., 2013, 'Future Flood Losses in Major Coastal Cities', *Nature Climate Change*.

92 Parton, 2018, 'China's Looming Water Crisis'.

93 Chen et al., 2020, 'Land Subsidence and Its Relation with Groundwater Aquifers in Beijing Plain of China', *Science of The Total Environment*.

94 Mehrotra and Bonansea, 2020, 'Greater Than Parts: A Metropolitan Opportunity (Vol. 3): Metropolitan Atlas: Spatial Analytics for Developing Cities'.

95 Hansen, Li, and Svarverud, 2018, 'Ecological Civilization: Interpreting the Chinese Past, Projecting the Global Future', *Global Environmental Change*.

96 Gilbert and Zhao, 2017, *The Knowns and Unknowns of China's Green Finance, Contributing Paper for The Sustainable Infrastructure Imperative: Financing for Better Growth and Development*.

97 Oates et al., 2020, 'Building Climate Resilience and Water Security in Cities: Lessons from the Sponge City of Wuhan, China'.

98 Su, 2015, 'Enhanced Action on Climate Change: China's Intended Nationally Determined Contributions'.

99 United Nations, 2020, '"Enhance Solidarity" to Fight COVID-19, Chinese President Urges, Also Pledges Carbon Neutrality by 2060', UN News.

100 van Bourgoundien, 2021, "Is China's Five Year Plan a Decarbonization Blueprint?," DW; Normile, 2021, "China Announces Major Boost for R&D, but Plan Lacks Ambitious Climate Targets," *Science*.

101 See IEA electricity generation by source data at *https://www.iea.org/countries/china*.

102 See Johns Hopkins University Coronavirus Resource Center: *https://coronavirus.jhu.edu/data/mortality*; as of 1 February 2020, China had logged just over 100,000 deaths from COVID-19.

103 IMF, 2021, *World Economic Outlook – Update January 2021: Policy Support and Vaccines Expected to Lift Activity*.

104 NBS, 2021, 'Households' Income and Consumption Expenditure in 2020', National Bureau of Statistics of China – Press Releases.

105 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

106 Electricity consumption per capita rose from 2.5 MWh in 2008 to 4.9 MWh in 2018. See IEA data at *https://www.iea.org/countries/china*.

107 Ye et al., 2020, 'China's New Urbanisation Opportunity: A Vision for the 14th Five-Year Plan. Coalition for Urban Transitions'.

108 Xinhua, 2020, 'Across China: "Sponge City" Program Bears Fruit'.

109 Saghir et al., 2020, 'Building Forward Better from COVID-19: Accelerating Action on Climate Adaptation'.

110 Hou, 2020, '39,000 Aging Residential Communities in Nation Set for Renovation', *China Daily*.

111 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

112 Government of India, 2015, 'Smart Cities Mission Guidelines'.

113 Oxford Economics, 2018, 'Global Cities: The Future of the World's Leading Urban Economies to 2035'.

114 Sankhe et al., 2020, 'India's Turning Point: An Economic Agenda to Spur Growth and Jobs'.

115 ILO, 2017, 'India Labour Market Update'.

116 World Bank, 2020, 'Beaten or Broken? Informality and COVID-19'.

117 Mukhra, Krishan, and Kanchan, 2020, 'COVID-19 Sets off Mass Migration in India', *Archives of Medical Research*.

118 See, e.g., WEF, 2021, 'Indian Cities in the Post Pandemic World'; Kidwai, 2020, 'COVID Exposes Underinvestment in Cities. India Must Rethink Its Approach for an Inclusive Future', *The Indian Express*; Ravindra, 2020, 'A Post-COVID-19 Plan for Future of Our Cities', *Deccan Herald*.

119 Sankhe et al., 2020, 'India's Turning Point: An Economic Agenda to Spur Growth and Jobs'.

120 Mahadevia, Mahendra, and Pai, 2018, "Ahmedabad: Town Planning Schemes for Equitable Development—Glass Half Full or Half Empty?"

121 Sanyal and Deuskar, 2012, 'Town Planning Schemes as a Hybrid Land Readjustment Process in Ahmedabad, India: A Better Way to Grow?', in *Value Capture and Land Policies: Proceedings of the 2011 Land Policy Conference*; Mahadevia, Mahendra, and Pai, 2018, 'Ahmedabad: Town Planning Schemes for Equitable Development—Glass Half Full or Half Empty?'

122 Analysis by the Marron Institute of Urban Management, New York University. See *Annex 3* for a detailed methodology.

123 Bhattacharya, 2020, 'Is Extreme Heat Making India Unlivable?', *Mint* (blog).

124 Curran, Siderius, and Singh, 2019, 'Cities, Climate Change and Chronic Heat Exposure'.

125 NRDC, 2020, 'Expanding Heat Resilience across India: Heat Action Plan Highlights'.

126 Iceland, 2017, 'Water Stress Is Helping Drive Conflict and Migration. How Should the Global Community Respond?', World Resources Institute Commentaries.

127 Singh and Kumar, 2019, 'Climate versus Demographic Controls on Water Availability across India at 1.5 °C, 2.0 °C and 3.0 °C Global Warming Levels', *Global and Planetary Change*.

128 UNISDR, 2018, 'Economic Losses, Poverty & Disasters: 1988-2017'.

129 Climate Central, 2019, 'Flooded Future: Global Vulnerability to Sea Level Rise Worse than Previously Understood'.

130 Kulp and Strauss, 2019, 'New Elevation Data Triple Estimates of Global Vulnerability to Sea-Level Rise and Coastal Flooding', *Nature Communications*; Bhattacharya, 2019, 'Mumbai and Kolkata Face the Wrath of Sea-Level Rise', *Mint* (blog).

131 See *https://pmaymis.gov.in*.

132 See *http://amrut.gov.in*.

133 See the 2013–2022 guidelines at *https://smartnet.niua.org/content/69cdbbff-68d9-46f9-8a48-a8afc9af6325*.

134 See *http://smartcities.gov.in*.

135 For an overview by the National Institute of Urban Affairs, see *https://www.niua.org/csc/assessment-overview.html*. For recent media coverage, see Srivastava, 2020, 'Caught by Deluges and Droughts, India's Cities Look to Become Climate Smarter', *Reuters*.

136 See *https://indiainvestmentgrid.gov.in*.

137 Modelling for the Coalition by the Stockholm Environment Institute. See *Annex 1* for a detailed methodology.

138 See IEA electricity generation by source data at *https://www.iea.org/countries/india*.

139 See *https://mnre.gov.in/green-energy-corridor*.

140 Modelling for the Coalition by Vivid Economics. See *Annex 2* for a detailed methodology.

141 Many Indian cities are already prioritising pro-poor public transport solutions, including by incorporating informal service providers. See Venter, Mahendra, and Hidalgo, 2019, 'From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South'.

142 See Johns Hopkins University Coronavirus Resource Center: *https://coronavirus.jhu.edu/data/mortality*.

143 IMF, 2021, *World Economic Outlook – Update January 2021: Policy Support and Vaccines Expected to Lift Activity*.

144 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

145 See *https://www.beeindia.gov.in/content/feeed*.

146 Bureau of Energy Efficiency, 2016, 'Market Assessment for Partial Risk Guarantee Fund for Energy Efficiency & Venture Capital Fund for Energy Efficiency'. This is 0.3% of the more than US$3 trillion in estimated investment required in the buildings sector to achieve ambitious urban climate action—financing programs through the National Mission for Enhanced Energy Efficiency (NMEE) are limited to tradable industrial credits and consumption-based efficiency measures, mainly appliance replacements.

147 Rubnitz, 2018, 'State-Led Alternative Mechanisms to Acquire, Plan, and Service Land For Urbanisation in India', WRI Ross Center for Sustainable Cities; Sami, 2011, 'The Political Economy of Urban Land in India: Key Issues'.

148 Government Of India, 2018, 'Statistical Year Book India 2018'.

149 Deloitte, 2018, 'Deloitte City Mobility Index: Delhi'.

150 Dandona et al., 2020India State-Level Disease Burden Initiative Road Injury Collaborators, 2019, 'Mortality Due to Road Injuries in the States of India: The Global Burden of Disease Study 1990-2017', *Lancet Public Health*.

151 Errampalli, Patil, and Prasad, 2020, 'Evaluation of Integration between Public Transportation Modes by Developing Sustainability Index for Indian Cities', *Case Studies on Transport Policy*; Kumar et al., 2016, 'Informal Public Transport Modes in India: A Case Study of Five City Regions', *IATSS Research*; Shah and Adhvaryu, 2016, 'Public Transport Accessibility Levels for Ahmedabad, India', *Journal of Public Transportation*.

152 See World Bank global data: *https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.KD?most_recent_value_desc=true*.

153 The World Bank's classifications use GNI rather than GDP. Serajuddin and Hamadeh, 2020, 'New World Bank Country Classifications by Income Level: 2020-2021', *World Bank Data Blog* (blog). See also World Bank data: *https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=ID*.

154 See World Bank data: *https://data.worldbank.org/indicator/SI.POV.NAHC?locations=ID*. The poverty level in 2000 was 19.1%.

155 See World Bank data: *https://data.worldbank.org/indicator/SI.POV.DDAY?locations=ID*. However, 30% of the population is still either poor or considered vulnerable to falling back into poverty; see World Bank, 2020, 'Indonesia: Poverty & Equity Brief'.

156 World Bank, 2019, 'Aspiring Indonesia—Expanding the Middle Class'.

157 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

158 See Figure 2.3 in *Time to ACT*; Jakarta's core produced 16.4% of GDP, and its periphery, another 7.2%.

159 World Bank, 2016, 'Indonesia's Urban Story'.

160 Baker and Gadgil, 2017, 'East Asia and Pacific Cities: Expanding Opportunities for the Urban Poor'.

161 World Bank, 2017, 'Indonesia – National Affordable Housing Program Project'.

162 The One million Houses programme, launched by President Joko Widodo, has aimed to build a million units per year, though the target was only first met in 2018. In 2020, 965,217 units were built, 80% of them for low-income people. See PUPR, 2021, 'Di Tengah Pandemi COVID-19, Realisasi Program Sejuta Rumah TA 2020 Capai 965.217 Unit', Kementerian Pekerjaan Umum Dan Perumahan Rakyat – Info PUPR; Rahman, 2021, 'Govt Housing Program Falls Short of 1 million Target Last Year', *The Jakarta Post*, 2019, 'Housing Program Exceeds 1 million Target in 2018', *The Jakarta Post*.

163 See, e.g., the Castrol Magnatec Stop-Start Index: *http://interone2.azurewebsites.net/campaigns/stop-start-index.html*.

164 Greenstone and Fan, 2019, 'Indonesia's Worsening Air Quality and Its Impact on Life Expectancy'.

165 Roberts, Sander, and Tiwari, 2019, *Time to ACT: Realizing Indonesia's Urban Potential*.

166 Analysis by the Marron Institute of Urban Management, New York University. See *Annex 3* for a detailed methodology.

167 Bappenas, 2019, 'Low Carbon Development: A Paradigm Shift Towards a Green Economy in Indonesia'.

168 Erkens et al., 2015, 'Sinking Coastal Cities', *Proceedings of the International Association of Hydrological Sciences*; see also Lin and Hidayat, 2018, 'Jakarta, the Fastest-Sinking City in the World', *BBC News*.

169 Husnayaen et al., 2018, 'Physical Assessment of Coastal Vulnerability under Enhanced Land Subsidence in Semarang, Indonesia, Using Multi-Sensor Satellite Data', *Advances in Space Research*.

170 Gunawan et al., 2015, 'City Risk Diagnostic for Urban Resilience in Indonesia'.

171 See *https://brg.go.id/rencana-strategis-badan-restorasi-gambut-2016-2020/*.

172 Giri et al., 2011, 'Status and Distribution of Mangrove Forests of the World Using Earth Observation Satellite Data', *Global Ecology and Biogeography*.

173 Sidik et al., 2018, 'Mangrove Conservation for Climate Change Mitigation in Indonesia', *WIREs Climate Change*.

174 Bappenas, 2019, 'Low Carbon Development: A Paradigm Shift Towards a Green Economy in Indonesia'.

175 Simarmata and Surtiari, 2020, 'Adaptation to Climate Change: Decision Making and Opportunities for Transformation in Jakarta, Indonesia'; UNESCAP and UN Habitat, 2019, 'The Future of Asian and Pacific Cities 2019: Transformative Pathways Towards Sustainable Urban Development'.

176 Government of Indonesia, 2019, 'Indonesia's Effort to Phase out and Rationalise Its Fossil-Fuel Subsidies'.

177 Bappenas, 2019, 'Low Carbon Development: A Paradigm Shift Towards a Green Economy in Indonesia'.

178 Bappenas, 2019, '2020-2024 National Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional 2020-2024)'.

179 UNESCAP and UN Habitat, 2019, 'The Future of Asian and Pacific Cities 2019: Transformative Pathways Towards Sustainable Urban Development'.

180 Pratama, 2018, 'Smart City Narrative in Indonesia: Comparing Policy Documents in Four Cities', *Public Administration Issues*.

181 Davy, 2019, 'What Lies Ahead of Indonesia's 100 Smart Cities Movement?', *The Jakarta Post*.

182 These estimates are indicative only, and do not yet account for potential changes due to COVID-19. For a detailed methodology, see *Annex 2*.

183 IEA electricity generation by source data at *https://www.iea.org/countries/indonesia*.

184 See Johns Hopkins University Coronavirus Resource Center: *https://coronavirus.jhu.edu/data/mortality*.

185 Suroyo and Diela, 2020, 'Indonesia Suffers First Recession in over 20 Years, Finmin Says "Worst Is Over"', *Reuters*.

186 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

187 Ministry of Finance, 2020, 'Pemerintah Siapkan Anggaran Infrastruktur Rp417,8 Triliun untuk Tahun 2021', Kementerian Keuangan – Berita.

188 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

189 IRENA, 2017, 'Renewable Energy Prospects: Indonesia'.

190 Indonesia aims to start manufacturing electric vehicles (EVs) by 2022 and have EVs make up 20% of the country's auto production by 2025. See *Reuters*, 2019, 'Indonesia President Signs New EV Decree to Bolster Industry'.

191 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

192 IPEA, 2016, 'Relatório Brasileiro Para o Habitat III'.

193 From 2000 to 2020, Brazil's urban population grew by about 31%, but the population of cities with fewer than 1 million residents grew by 36%, and that of cities with 300,000–500,000 residents grew by 73%. See data in UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

194 See, e.g., Muñoz Miranda and Martínez-Vázquez, 2018, 'Metropolitan Financing in Brazil: Current Trends and Lessons from the International Experience'.

195 GDP per capita grew by 73% from 2000 to 2014, to US$15,719 (PPP, current international $); see World Bank data: *https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?locations=BR*. Meanwhile, from 2001 to 2014, the extreme poverty ratio (US$1.90, PPP, 2011) dropped from 11.5% to 2.7%. See World Bank data: *https://data.worldbank.org/indicator/SI.POV.DDAY?locations=BR*.

196 GDP per capita was US$15,300 in 2019 (PPP, current international $), or about 2.7% lower than in 2014. See World Bank data: *https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?locations=BR*.

197 Veloso et al., 2016, 'Produtividade Do Setor de Serviços No Brasil: Um Estudo Comparativo'.

198 See World Bank data: *https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=BR*. The unemployment rate nearly doubled from 2014 to 2017, from 6.7% to 12.8%; it had been declining slowly before the pandemic.

199 See World Bank data: *https://data.worldbank.org/indicator/DT.DOD.DECT.CD?locations=BR*.

200 See Johns Hopkins University Coronavirus Resource Center: *https://coronavirus.jhu.edu/data/mortality*.

201 IMF, 2021, *World Economic Outlook – Update January 2021: Policy Support and Vaccines Expected to Lift Activity*.

202 McGeever, 2020, 'Brazil Unemployment Rate Hits Record High 14.6%, as People Return to Look for Work', *Reuters*.

203 Data Favela, 2020, 'Pandemia Na Favela'.

204 The Data Favela study covered more than 3,300 households. See also this study focused on São Paulo: Manfrinato et al., 2020, 'High Prevalence of Food Insecurity, the Adverse Impact of COVID-19 in Brazilian Favela', *MedRxiv*.

205 Coates, 2018, 'Exploring Disaster Eventfulness in Urbanizing Brazil', Peace Review; Rasch, 2016, 'Assessing Urban Vulnerability to Flood Hazard in Brazilian Municipalities', *Environment and Urbanization*.

206 See Global BRT Data: *http://brtdata.org/location/latin_america/brazil*.

207 Abers et al., 2018, 'Porto Alegre: Participatory Budgeting and the Challenge of Sustaining Transformative Change'.

208 Caldeira and Holston, 2015, 'Participatory Urban Planning in Brazil', *Urban Studies*.

209 Moscarelli et al., 2017, 'The Challenges of Integrated Urban Planning and Management in Brazil: Analysis of the Ministry of Cities Experience', *Urbe. Revista Brasileira de Gestão Urbana*; Fernandes, 2007, 'Implementing the Urban Reform Agenda in Brazil', *Environment and Urbanization*; see also Scruggs, 2019, 'Ministry of Cities RIP: The Sad Story of Brazil's Great Urban Experiment', *The Guardian*.

210 Somers and Baud, 2015, *My House, My Life: Decision-Making Processes and Local Citizen Participation in Housing Project Minha Casa, Minha Vida in Salvador Da Bahia*; e Silva, 2020, 'Addressing the Housing Shortage without Building Cities: The Minha Casa Minha Vida Program, Brazil', in *Communities, Land and Social Innovation*.

211 Government of Brazil, 2021, 'Programa Casa Verde e Amarela agora é lei', Noticias.

212 Analysis by the Marron Institute of Urban Management, New York University. See *Annex 3* for a detailed methodology.

213 SUDECO, 2019, 'Plano Regional de Desenvolvimento Do Centro-Oeste – 2020–2023'.

214 See IBGE data: *https://www.ibge.gov.br/en/cities-and-states/pa/parauapebas.html*; see also Romero, 2012, 'Swallowing Rain Forest, Cities Surge in Amazon (Published 2012)', *The New York Times*.

215 Government of Brazil, 2020, 'Brasil registra queda em número de mortes no trânsito', Noticias.

216 Ministério da Saúde, 2019, 'Saúde Brasil 2018: Uma Análise Da Situação de Saúde e Das Doenças e Agravos Crônicos: Desafios e Perspectivas'; see also Bravo et al., 2016, 'Air Pollution and Mortality in São Paulo, Brazil: Effects of Multiple Pollutants and Analysis of Susceptible Populations', *Journal of Exposure Science & Environmental Epidemiology*; Miraglia and Gouveia, 2014, 'Costs of Air Pollution in Brazilian Metropolitan Regions', *Ciencia & Saude Coletiva*.

217 INRIX, 2020, 'INRIX 2019 Global Traffic Scorecard', Inrix.

218 See *https://www2.camara.leg.br/legin/fed/lei/2012/lei-12587-3-janeiro-2012-612248-norma-pl.html*.

219 Lessa, Lobo, and Cardoso, 2019, 'Accessibility and Urban Mobility by Bus in Belo Horizonte/Minas Gerais – Brazil', *Journal of Transport Geography*; Fontoura, Chaves, and Ribeiro, 2019, 'The Brazilian Urban Mobility Policy: The Impact in São Paulo Transport System Using System Dynamics', *Transport Policy*; Vasconcellos, 2018, 'Urban Transport Policies in Brazil: The Creation of a Discriminatory Mobility System', *Journal of Transport Geography*.

220 Venter, Mahendra, and Hidalgo, 2019, 'From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South'.

221 For insights on inclusive transport strategies from Brazil and other emerging and developing economies, see Venter, Mahendra, and Hidalgo, 2019, 'From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South'.

222 Phillips, 2020, 'Climate Crisis Blamed for Rains and Floods That Have Killed 150 in Brazil', *The Guardian*.

223 Hoegh-Guldberg et al., 2018, 'Impacts of 1.5°C of Global Warming on Natural and Human Systems', in *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*.

224 de Queiroz et al., 2016, 'Climate Change Impacts in the Energy Supply of the Brazilian Hydro-Dominant Power System', *Renewable Energy*.

225 de Queiroz et al., 2019, 'Hydropower Revenues under the Threat of Climate Change in Brazil', *Renewable Energy*.

226 Brito, 2018, 'Water in Brazil: From Abundance to Scarcity', *Agência Brasil*; Ozment and Feltran-Barbieri, 2018, 'Help for São Paulo's Complex Water Woes: Protect and Restore Forests', *World Resources Institute* (blog).

227 See, e.g., Nehren et al., 2019, 'Natural Hazards and Climate Change Impacts in the State of Rio de Janeiro: A Landscape Historical Analysis', in *Strategies and Tools for a Sustainable Rural Rio de Janeiro*.

228 Muehe, 2010, 'Brazilian Coastal Vulnerability to Climate Change', *Pan-American Journal of Aquatic Sciences*.

229 Modelling for the Coalition by the Stockholm Environment Institute. See *Annex 1* for a detailed methodology.

230 Modelling for the Coalition by Vivid Economics. See *Annex 2* for a detailed methodology.

231 C40 Cities and The International Council on Clean Transportation, 2020, 'Latin America's Electric Bus Transition Is Irreversible', *Dialogo Chino* (blog); Hampel, 2020, 'BYD Opens Electric Bus Battery Factory in Brazil', *Electrive.Com* (blog); BNamericas, 2019, 'Brazil's Electric Bus Market to Grow Faster than Expected'.

232 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

233 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

234 Kim and Zangerling, 2016, *Mexico Urbanization Review: Managing Spatial Growth for Productive and Livable Cities in Mexico*. Gross value added (GVA) data are based on 2010 estimates, and indicate that cities produce 87% of Mexico's GVA.

235 See World Bank data: *https://data.worldbank.org/indicator/NY.GDP.PCAP.KD?locations=MX*; GDP is measured in constant 2010 US$.

236 ILO, 2018, 'Women and Men in the Informal Economy: A Statistical Picture'.

237 See Sistema Nacional de Información e Indicadores de Vivienda (SNIIV) data: *http://sniiv.conavi.gob.mx/cubo/financiamientos.aspx*

238 Gómez-Álvarez et al., 2017, *Steering the Metropolis: Metropolitan Governance for Sustainable Urban Development*.

239 See INEGI, "Sistema Estatal y Municipal de Bases de Datos," 2020, *https://www.inegi.org.mx/*.

240 DGCS, 2017, 'En México 80% de Los Traslados Se Hacen En Transporte Público'.

241 Heeckt and Huerta Melchor, forthcoming, 'Compact, Connected, Clean and Inclusive: A New Vision for Transport and Housing in Mexico's Cities'.

242 See Johns Hopkins University Coronavirus Resource Center: *https://coronavirus.jhu.edu/data/mortality*.

243 IMF, 2021, *World Economic Outlook – Update January 2021: Policy Support and Vaccines Expected to Lift Activity*.

244 Székely, Acevedo, and Flores, 2020, 'Magnitud Del Impacto Social Del COVID-19 En México y Alternativas Para Amortiguarlo: Resultados Por Entidad Federativa'.

245 Lustig and Pabon, 2020, 'The Impact of COVID-19 Economic Shock on Inequality and Poverty in Mexico', *Working Papers*.

246 Ruiz-Rivera and Lucatello, 2017, 'The Interplay Between Climate Change and Disaster Risk Reduction Policy: Evidence from Mexico', *Environmental Hazards*.

247 Estrada et al., 2020, 'An Analysis of Current Sustainability of Mexican Cities and Their Exposure to Climate Change', *Frontiers in Environmental Science*.

248 Kimmelman, 2017, 'Mexico City, Parched and Sinking, Faces a Water Crisis', *The New York Times*.

249 UNEP, 2019, 'Banking on Nature: A Mexican City Adapts to Climate Change', *United Nations Environment Programme* (blog).

250 See Climate Action Tracker: *https://climateactiontracker.org/countries/mexico/*.

251 Modelling for the Coalition by the Stockholm Environment Institute. See *Annex 1* for a detailed methodology.

252 Modelling for the Coalition by Vivid Economics. See *Annex 2* for a detailed methodology.

253 See IEA electricity generation by source data at *https://www.iea.org/countries/mexico*.

254 SEMARNAT, 2018, 'Estrategia Nacional de Movilidad Eléctrica'.

255 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

256 See Zubicaray Díaz et al., 2020, 'Acciones federales para la planeación urbana: Hacia mejores ciudades para todos' (includes English summary).

257 Heeckt and Huerta Melchor, forthcoming, 'Compact, Connected, Clean and Inclusive: A New Vision for Transport and Housing in Mexico's Cities'.

258 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

259 Parilla and Leal Trujillo, 2015, 'South Africa's Global Gateway: Profiling the Gauteng City-Region's International Competitiveness and Connections'.

260 Arndt, Davies, and Thurlow, 2019, 'Urbanization, Structural Transformation and Rural-Urban Linkages in South Africa'.

261 Stats SA, 2019, 'Inequality Trends in South Africa: A Multidimensional Diagnostic of Inequality'.

262 Abrahams et al., 2018, 'South Africa: National Urban Policies and City Profiles for Johannesburg and Cape Town'.

263 South Africa's total population is projected to grow by about 14% from 2020 to 2035, to 66.9 million, while the urban population grows by more than 25%, to 46.5 million. All data from UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

264 Three of the five cities with the greatest private wealth in Africa – Johannesburg (No. 1), Cape Town (No. 2), and Durban (No. 5) – are in South Africa. AfrAsia Bank and New World Wealth, 2019, 'Africa Wealth Report 2019'. The ranking is based on total individual private wealth (equities, real estate, businesses) less liabilities. Johannesburg is estimated to hold US$248 billion, concentrated in the Sandton suburb, home to the largest stock market in Africa. Cape Town holds an estimated US$133 billion, and Durban, US$54 billion.

265 SACN, 2016, 'State of South African Cities 2016'; Turok and Borel-Saladin, 2014, 'Is Urbanisation in South Africa on a Sustainable Trajectory?', *Development Southern Africa*.

266 See World Bank data: *https://data.worldbank.org/indicator/SI.POV.GINI*.

267 Wray et al., 2014, 'Changing Spatial Inequality across the GCR'; see also SACN, 2016, 'State of South African Cities 2016'. Selected city-by-city data (which do not reflect differences among adjacent municipalities, however) are available at *https://scoda.co.za/dataset/state-of-cities-report-data-2016*.

268 SACN, 2016, 'State of South African Cities 2016'.

269 The range is 55-61 minutes and is based on the latest National Household Travel Survey data available, from 2013. See van Ryneveld, 2018, 'Urban Transport Analysis for the Urbanisation Review'.

270 Janmohammed, 2019, 'Road Safety in the South African Context', *SaferSpaces* (blog).

271 Gedye, 2020, 'Public Transport Inequality', *New Frame*.

272 van Ryneveld, 2018, 'Urban Transport Analysis for the Urbanisation Review'.

273 Analysis by the Marron Institute of Urban Management, New York University. See *Annex 3* for a detailed methodology.

274 Ziervogel et al., 2016, 'Flooding in Cape Town's Informal Settlements: Barriers to Collaborative Urban Risk Governance', *South African Geographical Journal*.

275 Joubert and Ziervogel, 2019, 'Day Zero: One City's Response to a Record-Breaking Drought'.

276 CDP, 2019, 'Cities at Risk: Dealing with the Pressures of Climate Change'.

277 SACN, 2016, 'State of South African Cities 2016'.

278 Government of South Africa, 2020, 'South Africa's Low-Emission Development Strategy 2050'.

279 Presidency of Republic of South Africa, 2020, 'Presidential Climate Change Coordinating Commission Appointed', Media Room.

280 See *https://www.c40.org/other/southafrica*.

281 SACN, 2016, 'State of South African Cities 2016'.

282 CoGTA, 2021, 'The Integrated Urban Development Framework (IUDF)', *Cooperative Governance Traditional Affairs – Featured News* (blog).

283 Modelling for the Coalition by the Stockholm Environment Institute. See *Annex 1* for a detailed methodology.

284 Modelling for the Coalition by Vivid Economics. See *Annex 2* for a detailed methodology.

285 See IEA "Electricity generation by source" data: *https://www.iea.org/countries/south-africa*.

286 Department of Mineral Resources and Energy, 2019, 'Integrated Resource Plan 2019'. There is a loophole for private IPP to develop two new coal plants. If these developments go ahead will depend if these plants can reach financial closure under increasingly challenging market conditions.

287 Department of Mineral Resources and Energy, 2020, 'Electricity Regulation Act Regulations: New Generation Capacity: Amendment'.

288 Erasmus, 2021, 'The Big Switch-off: This Is EThekwini's Vision to Dump Eskom', *Daily Maverick*; BusinessTech, 2021, 'Cape Town Says It's Ready to Leave Eskom and Load Shedding behind – but Needs National Government to Catch Up'; 2021, 'Stellenbosch Wants to Be the First Municipality in South Africa to Leave Eskom and Load Shedding Behind'.

289 IMF, 2021, *World Economic Outlook – Update January 2021: Policy Support and Vaccines Expected to Lift Activity*.

290 Winning, 2020, 'South Africa's Unemployment Rate Reaches Record High above 30%', *Reuters*.

291 See Johns Hopkins University Coronavirus Resource Center: *https://coronavirus.jhu.edu/data/mortality*.

292 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

293 Ramaphosa, 2020, 'Address on South Africa's Economic Reconstruction and Recovery Plan'.

294 Dludla, 2021, 'SA Is Looking to a Future without an Eskom Monopoly over Country's Energy Supply', *IOL* (blog).

295 Vivid Economics, 2021, 'Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)'.

296 BusinessTech, 2021, 'Cape Town Says It's Ready to Leave Eskom and Load Shedding behind – but Needs National Government to Catch Up'.

297 Crompton, 2020, 'South Africa's Electricity Supply: What's Tripping the Switch', *The Conversation* (blog).

298 Montmasson-Clair et al., 2017, 'New Roles for South African Municipalities in Renewable Energy – A Review of Business Models'.

299 Maree and Khanyile, 2017, 'Green Vegetation and Impervious Surfaces in the Gauteng Province'.

300 This call to action is a synthesis and update of the agenda laid out in CUT, 2019, 'Climate Emergency, Urban Opportunity'; see the full report for details.

301 Gulati et al., 2020, 'The Economic Case for Greening the Global Recovery through Cities: 7 Priorities for National Governments'.

302 See *http://www.citiesracetozero.org* and the listing of cities in the Climate Ambition Alliance, at *https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94*.

303 See *https://www.c40.org/global-green-new-deal*.

304 For a more detailed discussion in the context of adaptation and resilience-building, see GCA, 2019, 'Adapt Now: A Global Call for Leadership on Climate Resilience'.

305 CUT, 2019, 'Climate Emergency, Urban Opportunity'.

306 Gokkon, 2019, 'Indonesia Picks Coal and Oil Heartland as Site of New Capital City', Mongabay Environmental News; Diela, 2019, 'Sleepy to Sleepless? Indonesia's Future Capital in the Forest', *Reuters*.

307 SEDATU, 2020, 'Estrategia Nacional de Ordenamiento Territorial 2020-2040'; Senado de la República, 2020, 'Presenta Sedatu al Senado Estrategia Nacional de Ordenamiento Territorial', Coordinación de Comunicación Social.

308 SEDATU, 2019, 'Programa Nacional de Vivienda 2019–2024'.

309 The concept of social production of housing – and more broadly, of "habitat" – is seen as a key strategy to achieve more inclusive and socially just urbanisation. See, e.g., García, 2019, 'Producción Social de La Vivienda: Proceso Transformador de Las Ciudades Mexicanas', *WRI México* (blog); Arébalo et al., 2012, 'El Camino Posible: Producción Social Del Hábitat En América Latina'.

310 UN DESA, 2018, 'World Urbanization Prospects: The 2018 Revision'.

311 See IEA "Electricity generation by source" data: *https://www.iea.org/countries/south-africa*.

References

Abers, R., R. King, D. Votto, and I. Brandão. 2018. "Porto Alegre: Participatory Budgeting and the Challenge of Sustaining Transformative Change," June. *https://www.wri.org/wri-citiesforall/publication/porto-alegre-participatory-budgeting-and-challenge-sustaining.*

Abrahams, C., D. Everatt, A. van den Heever, D. Mushongera, C. Nwosu, P. Pilay, A. Scheba, and I. Turok. 2018. "South Africa: National Urban Policies and City Profiles for Johannesburg and Cape Town." SHLC Research Report. Sustainable, Healthy and Learning Cities and Neighbourhoods. *http://www.centreforsustainablecities.ac.uk/research/south-africa-national-urban-policies-city-profiles-johannesburg-capetown/.*

Adlakha, D., and J.F. Sallis. 2020. "Activity-Friendly Neighbourhoods Can Benefit Non-Communicable and Infectious Diseases." *Cities & Health* Special Issue: COVID-19 (July). doi:10.1080/23748834.2020.1783479.

AfAsia Bank and New World Wealth. 2019. "Africa Wealth Report 2019." *https://www.afrasiabank.com/en/about/newsroom/africa-wealth-report-2019*.

Ahmad, E., and S. Colenbrander. 2020. "Financing a Sustainable and Inclusive Urban Transition in China." London and Washington, DC: Coalition for Urban Transitions. *https://urbantransitions.global/en/publication/financing-a-sustainable-and-inclusive-urban-transition-in-china/.*

Almeida Prado, F., S. Athayde, J. Mossa, S. Bohlman, F. Leite, and A. Oliver-Smith. 2016. "How Much Is Enough? An Integrated Examination of Energy Security, Economic Growth and Climate Change Related to Hydropower Expansion in Brazil." *Renewable and Sustainable Energy Reviews* 53 (January): 1132–36. doi:10.1016/j.rser.2015.09.050.

AMAP. 2019. "Traffic Analysis Report of Major Cities in China in 2018." Beijing. *https://report.amap.com/download.do*.

Ardila-Gomez, A. 2020. "Can COVID-19 Pave the Way toward Walkable, Bikeable Cities?" *World Bank Transport for Development* (blog). August 3, 2020. *https://blogs.worldbank.org/transport/can-covid-19-pave-way-toward-walkable-bikeable-cities*.

Arébalo, M., G. Bazoberry, C. Blanco, S. Díaz, R. Fernández Wagner, A. Florian, R. García Quispe, et al. 2012. "El Camino Posible: Producción Social Del Hábitat En América Latina." San José, Costa Rica: Programa Regional de Vivienda y Hábitat, Centro Cooperativo Sueco. *https://hic-al.org/wp-content/uploads/2019/01/el_camino_posible.pdf*.

Arndt, C., R. Davies, and J. Thurlow. 2019. "Urbanization, Structural Transformation and Rural-Urban Linkages in South Africa." SA-TIED Working Paper #41. Washington, DC: International Food Policy Research Institute. *https://sa-tied.wider.unu.edu/article/urbanization-structural-transformation-and-rural-urban-linkages-in-south-africa*.

Baker, J.L., and G.U. Gadgil. 2017. "East Asia and Pacific Cities: Expanding Opportunities for the Urban Poor." Washington, DC: World Bank. *http://hdl.handle.net/10986/27614*.

Bappenas. 2019. "2020-2024 National Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional 2020-2024)." Jakarta: Ministry of National Development Planning, Government of Indonesia. *https://www.bappenas.go.id/files/rpjmn/Narasi%20Rancangan%20RPJMN%202020-2024.pdf*.

Bappenas. 2019. "Low Carbon Development: A Paradigm Shift towards a Green Economy in Indonesia." Low Carbon Development Initiative (LCDI) report. Jakarta: Ministry of National Development Planning, Government of Indonesia. *https://www.bappenas.go.id/id/berita-dan-siaran-pers/pembangunan-rendah-karbon-pergeseranparadigma-menuju-ekonomi-hijau-di-indonesia/*.

Bennett, N.J., J. Blythe, A.M. Cisneros-Montemayor, G.G. Singh, and U.R. Sumaila. 2019. "Just Transformations to Sustainability." *Sustainability* 11 (14): 3881. doi:10.3390/su11143881.

Bhattacharya, B. 2019. "Mumbai and Kolkata Face the Wrath of Sea-Level Rise." *Mint* (blog). November 1, 2019. *https://www.livemint.com/mint-lounge/features/mumbai-and-kolkata-face-the-wrath-of-sea-level-rise-11572591349097.html*.

Bhattacharya, B. 2020. "Is Extreme Heat Making India Unlivable?" *Mint* (blog). September 26, 2020. *https://www.livemint.com/mint-lounge/features/is-extreme-heat-making-india-unlivable-11601034638011.html*.

BNamericas. 2019. "Brazil's Electric Bus Market to Grow Faster than Expected." July 5, 2019. *https://www.bnamericas.com/en/features/brazils-electric-bus-market-to-grow-faster-than-expected*.

Bourgoundien, K. van. 2021. "Is China's Five Year Plan a Decarbonization Blueprint?" *DW*, March 5, 2021. *https://www.dw.com/en/china-coal-emissions-climate-change/a-56644449*.

Bravo, M.A., J. Son, C.U. de Freitas, N. Gouveia, and M.L. Bell. 2016. "Air Pollution and Mortality in São Paulo, Brazil: Effects of Multiple Pollutants and Analysis of Susceptible Populations." *Journal of Exposure Science & Environmental Epidemiology* 26 (2): 150–61. doi:10.1038/jes.2014.90.

Brito, D. 2018. "Water in Brazil: From Abundance to Scarcity." *Agência Brasil*, October 27, 2018. *https://agenciabrasil.ebc.com.br/en/geral/noticia/2018-10/water-brazil-abundance-scarcity*.

Bureau of Energy Efficiency. 2016. "Market Assessment for Partial Risk Guarantee Fund for Energy Efficiency & Venture Capital Fund for Energy Efficiency." Ministry of Power, Government of India, with support from the US Agency for International Development. *https://www.climatelinks.org/resources/market-assessment-partial-risk-guarantee-fund-energy-efficiency-venture-capital-fund*.

BusinessTech. 2021. "Cape Town Says It's Ready to Leave Eskom and Load Shedding behind – but Needs National Government to Catch Up." January 20, 2021. *https://businesstech.co.za/news/energy/463316/cape-town-says-its-ready-to-leave-eskom-and-load-shedding-behind-but-needs-national-government-to-catch-up/*.

BusinessTech. 2021. "Stellenbosch Wants to Be the First Municipality in South Africa to Leave Eskom and Load Shedding Behind." January 28, 2021. *https://businesstech.co.za/news/energy/463952/stellenbosch-wants-to-be-the-first-municipality-in-south-africa-to-leave-eskom-and-load-shedding-behind/*.

C40 Cities. 2020. "How to Build Back Better with a 15-Minute City." Implementation guide. C40 Cities Climate Leadership Group and C40 Knowledge Hub. *https://www.c40knowledgehub.org/s/article/How-to-build-back-better-with-a-15-minute-city?language=en_US*.

C40 Cities, and the International Council on Clean Transportation. 2020. "Latin America's Electric Bus Transition Is Irreversible." *Diálogo Chino* (blog). December 10, 2020. *https://dialogochino.net/en/climate-energy/38837-latin-americas-electric-bus-transition-is-irreversible/*.

Caldeira, T., and J. Holston. 2015. "Participatory Urban Planning in Brazil." *Urban Studies* 52 (11): 2001–17. doi:10.1177/0042098014524461.

Carozzi, F., S. Provenzano, and S. Roth. 2020. "Urban Density and COVID-19." CEP Discussion Paper 1711. London: Centre for Economic Performance, London School of Economics and Political Science. *https://cep.lse.ac.uk/_new/publications/abstract.asp?index=7234*.

CDP. 2019. "Cities at Risk: Dealing with the Pressures of Climate Change." London. *https://www.cdp.net/en/research/global-reports/cities-at-risk*.

Chen, B., H. Gong, Y. Chen, X. Li, C. Zhou, K. Lei, L. Zhu, L. Duan, and X. Zhao. 2020. "Land Subsidence and Its Relation with Groundwater Aquifers in Beijing Plain of China." *Science of the Total Environment* 735 (September): 139111. doi:10.1016/j.scitotenv.2020.139111.

China Statistics Press. 2020. "China City Statistical Yearbook." Beijing. *https://navi.cnki.net/KNavi/YearbookDetail?pcode=CYFD&pykm=YZGCA&bh=*.

Climate Central. 2019. "Flooded Future: Global Vulnerability to Sea Level Rise Worse than Previously Understood." *https://www.climatecentral.org/news/report-flooded-future-global-vulnerability-to-sea-level-rise-worse-than-previously-understood*.

Coates, R. 2018. "Exploring Disaster Eventfulness in Urbanizing Brazil." *Peace Review* 30 (2): 144–51. doi:10.1080/10402659.2018.1458941.

CoGTA. 2021. "The Integrated Urban Development Framework (IUDF)." *Cooperative Governance Traditional Affairs – Featured News* (blog). January 14, 2021. *https://www.cogta.gov.za/index.php/2021/01/14/the-integrated-urban-development-framework-iudf/*.

Crompton, R. 2020. "South Africa's Electricity Supply: What's Tripping the Switch." *The Conversation* (blog). December 13, 2020. *http://theconversation.com/south-africas-electricity-supply-whats-tripping-the-switch-151331*.

Curran, P., C. Siderius, and T. Singh. 2019. "Cities, Climate Change and Chronic Heat Exposure." Policy brief. London: Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science. *https://www.lse.ac.uk/granthaminstitute/publication/cities-climate-change-and-chronic-heat-exposure/*.

CUT. 2019. "Climate Emergency, Urban Opportunity." Global Report. London and Washington, DC: Coalition for Urban Transitions, in partnership with C40 Cities Climate Leadership Group and Ross Center for Sustainable Cities, World Resources Institute. *https://urbantransitions.global/en/publication/climate-emergency-urban-opportunity/*.

Data Favela. 2020. "Pandemia Na Favela." Presented at the Data Favela Forum, co-hosted by Central Única das Favelas (CUFA), Instituto Locomotiva, and UNESCO in Brazil, June 24. *https://en.unesco.org/news/data-favela-forum-webinars-discuss-racism-and-inequality-pandemic-times-brazil*.

Davy, J. 2019. "What Lies Ahead of Indonesia's 100 Smart Cities Movement?" *The Jakarta Post*, December 5, 2019. *https://www.thejakartapost.com/life/2019/12/05/what-lies-ahead-of-indonesias-100-smart-cities-movement.html*.

De Dominicis, M., J. Wolf, S. Jevrejeva, P. Zheng, and Z. Hu. 2020. "Future Interactions between Sea Level Rise, Tides, and Storm Surges in the World's Largest Urban Area." *Geophysical Research Letters* 47 (4): e2020GL087002. doi:*https://doi.org/10.1029/2020GL087002*.

Deloitte. 2018. "Deloitte City Mobility Index: Delhi." Deloitte Insights. *https://www2.deloitte.com/content/dam/insights/us/articles/4331_Deloitte-City-Mobility-Index/Delhi_GlobalCityMobility_WEB.pdf*.

Department of Mineral Resources and Energy. 2019. "Integrated Resource Plan 2019." South Africa: Republic of South Africa. *http://www.energy.gov.za/IRP/irp-2019.html*.

Department of Mineral Resources and Energy. 2020. "Electricity Regulation Act Regulations: New Generation Capacity: Amendment." Pretoria: Government of South Africa. *https://www.gov.za/documents/electricity-regulation-act-regulations-new-generation-capacity-amendment-16-oct-2020-0000*.

DGCS. 2017. "En México 80% de Los Traslados Se Hacen En Transporte Público." Boletín UNAM-DGCS-384. Mexico City: Dirección General de Comunicación Social, Universidad Nacional de México. *https://www.dgcs.unam.mx/boletin/bdboletin/2017_384.html*.

Diela, T. 2019. "Sleepy to Sleepless? Indonesia's Future Capital in the Forest." *Reuters*, September 5, 2019. *https://www.reuters.com/article/us-indonesia-capital-idUSKCN1VP01Y*.

Dludla, S. 2021. "SA Is Looking to a Future without an Eskom Monopoly over Country's Energy Supply." *IOL* (blog). January 27, 2021. *https://www.iol.co.za/business-report/companies/sa-is-looking-to-a-future-without-an-eskom-monopoly-over-countrys-energy-supply-01ca9dbb-7494-4ba7-ac56-43875006d318*.

Dobbs, R., S. Smit, J. Remes, J. Manyika, C. Roxburgh, and A. Restrepo. 2011. "Urban World: Mapping the Economic Power of Cities." McKinsey Global Institute. *https://www.mckinsey.com/featured-insights/urbanization/urban-world-mapping-the-economic-power-of-cities*.

Donato, D.C., J.B. Kauffman, D. Murdiyarso, S. Kurnianto, M. Stidham, and M. Kanninen. 2011. "Mangroves among the Most Carbon-Rich Forests in the Tropics." *Nature Geoscience* 4 (5): 293–97. doi:10.1038/ngeo1123.

Erasmus, D. 2021. "The Big Switch-off: This Is EThekwini's Vision to Dump Eskom." *Daily Maverick*, January 25, 2021. *https://www.dailymaverick.co.za/article/2021-01-25-the-big-switch-off-this-is-ethekwinis-vision-to-dump-eskom/*.

Erkens, G., T. Bucx, R. Dam, G. de Lange, and J. Lambert. 2015. "Sinking Coastal Cities." *Proceedings of the International Association of Hydrological Sciences* 372 (November): 189–98. doi:*https://doi.org/10.5194/piahs-372-189-2015*.

Errampalli, M., K.S. Patil, and C.S.R.K. Prasad. 2020. "Evaluation of Integration between Public Transportation Modes by Developing Sustainability Index for Indian Cities." *Case Studies on Transport Policy* 8 (1): 180–87. doi:10.1016/j.cstp.2018.09.005.

Estrada, F., J.A. Velasco, A. Martinez-Arroyo, and O. Calderón-Bustamante. 2020. "An Analysis of Current Sustainability of Mexican Cities and Their Exposure to Climate Change." *Frontiers in Environmental Science* 8. doi:10.3389/fenvs.2020.00025.

Fernandes, E. 2007. "Implementing the Urban Reform Agenda in Brazil." *Environment and Urbanization* 19 (1): 177–89.

Fontoura, W.B., G. de L.D. Chaves, and G.M. Ribeiro. 2019. "The Brazilian Urban Mobility Policy: The Impact in São Paulo Transport System Using System Dynamics." *Transport Policy* 73 (January): 51–61. doi:10.1016/j.tranpol.2018.09.014.

García, N. 2019. "Producción Social de La Vivienda: Proceso Transformador de Las Ciudades Mexicanas." *WRI México* (blog). May 13, 2019. *https://wrimexico.org/bloga/producci%C3%B3n-social-de-la-vivienda-proceso-transformador-de-las-ciudades-mexicanas*.

GCA. 2019. "Adapt Now: A Global Call for Leadership on Climate Resilience." Rotterdam and Washington, DC: Global Commission on Adaptation. *https://gca.org/reports/adapt-now-a-global-call-for-leadership-on-climate-resilience/*.

Gedye, L. 2020. "Public Transport Inequality." *New Frame*, February 25, 2020. *https://www.newframe.com/public-transport-inequality/*.

Gilbert, S., and L. Zhao. 2017. *The Knowns and Unknowns of China's Green Finance, Contributing Paper for The Sustainable Infrastructure Imperative: Financing for Better Growth and Development*. New Climate Economy, London and Washington, DC. *http://newclimateeconomy.report/misc/working-papers*.

Giri, C., E. Ochieng, L.L. Tieszen, Z. Zhu, A. Singh, T. Loveland, J. Masek, and N. Duke. 2011. "Status and Distribution of Mangrove Forests of the World Using Earth Observation Satellite Data." *Global Ecology and Biogeography* 20 (1): 154–59. doi:*https://doi.org/10.1111/j.1466-8238.2010.00584.x*.

Global Times. 2020. "China Experiences 21 Large-Scale Floods in 2020, Setting Historical Record," September 23, 2020. *https://www.globaltimes.cn/content/1201803.shtml*.

Goh, C., J. Han, Y. He, B. Hofman, Y. Hou, P. Liu, S. Liu, K. Rohland, M.K. Warwick, and X. Zhuo. 2014. *Urban China: Toward Efficient, Inclusive, and Sustainable Urbanization*. Washington, DC, and Beijing: The World Bank and Development Research Center of the State Council, People's Republic of China. *http://documents.worldbank.org/curated/en/274891468018263655/Urban-China-toward-efficient-inclusive-and-sustainable-urbanization*.

Gokkon, B. 2019. "Indonesia Picks Coal and Oil Heartland as Site of New Capital City." *Mongabay Environmental News*, August 26, 2019, sec. Environmental news. *https://news.mongabay.com/2019/08/indonesia-picks-coal-and-oil-heartland-as-site-of-new-capital-city/*.

Goldin, I., and R. Muggah. 2020. "COVID-19 Is Increasing Multiple Kinds of Inequality. Here's What We Can Do about It." World Economic Forum. October 9, 2020. *https://www.weforum.org/agenda/2020/10/covid-19-is-increasing-multiple-kinds-of-inequality-here-s-what-we-can-do-about-it/*.

Gómez-Álvarez, D., R.M. Rajack, E. López-Moreno, and G. Lanfranchi. 2017. *Steering the Metropolis: Metropolitan Governance for Sustainable Urban Development*. Inter-American Development Bank.

Government of Brazil. 2020. "Brasil registra queda em número de mortes no trânsito." Noticias. September 18, 2020. *https://www.gov.br/pt-br/noticias/transito-e-transportes/2020/09/brasil-registra-queda-em-numero-de-mortes-no-transito*.

Government of Brazil. 2021. "Programa Casa Verde e Amarela agora é lei." Noticias. January 14, 2021. *https://www.gov.br/pt-br/noticias/assistencia-social/2021/01/programa-casa-verde-e-amarela-agora-e-lei*.

Government of India. 2015. "Smart Cities Mission Guidelines." Ministry of Housing and Urban Affairs. *https://smartcities.gov.in/guidelines*.

Government of India. 2018. "Statistical Year Book India 2018." Ministry of Statistics and Program Implementation. *http://mospi.nic.in/statistical-year-book-india/2018/*.

Government of Indonesia. 2019. "Indonesia's Effort to Phase out and Rationalise Its Fossil-Fuel Subsidies." Self report on the G20 peer review of inefficient fossil fuel subsidies that encourage wasteful consumption in Indonesia. Jakarta: Ministry of Energy and Mineral Resources and Ministry of Finance.

Government of South Africa. 2020. "South Africa's Low-Emission Development Strategy 2050." Submitted to the Secretariat of the United Nations Framework Convention on Climate Change. Pretoria. *https://unfccc.int/documents/253724*.

Greenstone, M., and Q. Fan. 2019. "Indonesia's Worsening Air Quality and Its Impact on Life Expectancy." Air Quality Life Index Update March 2019. Chicago, IL, US: Energy Policy Institute at the University of Chicago. *https://aqli.epic.uchicago.edu/wp-content/uploads/2019/03/Indonesia-Report.pdf*.

Gulati, M., R. Becqué, N. Godfrey, A. Akhmouch, A. Cartwright, J. Eis, S. Huq, M. Jacobs, R. King, and P. Rode. 2020. "The Economic Case for Greening the Global Recovery through Cities: 7 Priorities for National Governments." London and Washington, DC: Coalition for Urban Transitions. *https://urbantransitions.global/en/publication/the-economic-case-for-greening-the-global-recovery-through-cities/*.

Gunawan, I., S. Sagala, S. Amin, H. Zawani, and R. Mangunsong. 2015. "City Risk Diagnostic for Urban Resilience in Indonesia." Jakarta: World Bank. *https://openknowledge.worldbank.org/handle/10986/23771*.

Hadden Loh, T., H. Love, and J.S. Vey. 2020. "The Qualities That Imperil Urban Places during COVID-19 Are Also the Keys to Recovery." *Brookings Institution, The Avenue* (blog). March 25, 2020. *https://www.brookings.edu/blog/the-avenue/2020/03/25/the-qualities-that-imperil-urban-places-during-covid-19-are-also-the-keys-to-recovery/*.

Hallegatte, S., C. Green, R.J. Nicholls, and J. Corfee-Morlot. 2013. "Future Flood Losses in Major Coastal Cities." *Nature Climate Change* 3 (9): 802–6. doi:10.1038/nclimate1979.

Hallegatte, S., J. Rentschler, and J. Rozenberg. 2019. *Lifelines: The Resilient Infrastructure Opportunity*. Sustainable Infrastructure Series. Washington, DC: The World Bank. doi:10.1596/978-1-4648-1430-3.

Hamidi, S., S. Sabouri, and R. Ewing. 2020. "Does Density Aggravate the COVID-19 Pandemic?" *Journal of the American Planning Association* 86 (4): 495–509. doi:10.1080/01944363.2020.1777891.

Hampel, C. 2020. "BYD Opens Electric Bus Battery Factory in Brazil." *Electrive.Com* (blog). September 1, 2020. *https://www.electrive.com/2020/09/01/byd-opens-factory-in-brazil-to-make-batteries-primarily-for-electric-buses/*.

Hansen, M.H., H. Li, and R. Svarverud. 2018. "Ecological Civilization: Interpreting the Chinese Past, Projecting the Global Future." *Global Environmental Change* 53: 195–203. doi:10.1016/j.gloenvcha.2018.09.014.

Harrison, M.E., J.B. Ottay, L.J. D'Arcy, S.M. Cheyne, Anggodo, C. Belcher, L. Cole, et al. 2020. "Tropical Forest and Peatland Conservation in Indonesia: Challenges and Directions." *People and Nature* 2 (1): 4–28. doi:*https://doi.org/10.1002/pan3.10060*.

Heeckt, C., and O. Huerta Melchor. 2021. "Compact, Connected, Clean and Inclusive: A New Vision for Transport and Housing in Mexico's Cities." London and Washington, DC: Coalition for Urban Transitions. *https://urbantransitions.global/en/publication/compact-connected-clean-and-inclusive-cities-in-mexico-an-agenda-for-national-housing-and-transport-policy-reform/*.

Hess, J.J., S. Lm, K. Knowlton, S. Saha, P. Dutta, P. Ganguly, A. Tiwari, et al. 2018. "Building Resilience to Climate Change: Pilot Evaluation of the Impact of India's First Heat Action Plan on All-Cause Mortality." *Journal of Environmental and Public Health* 2018 (Article ID 7973519): e7973519. doi:10.1155/2018/7973519.

Hoegh-Guldberg, O., D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, et al. 2018. "Impacts of 1.5°C of Global Warming on Natural and Human Systems." In *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*, edited by V. Masson-Delmotte, P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, et al. Geneva: Intergovernmental Panel on Climate Change. *https://www.ipcc.ch/sr15/*.

Hou, L. 2020. "39,000 Aging Residential Communities in Nation Set for Renovation." *China Daily*, April 16, 2020. *https://www.chinadaily.com.cn/a/202004/16/WS5e98480ca3105d50a3d16c3d.html*.

Husnayaen, A.B. Rimba, T. Osawa, I.N.S. Parwata, Abd.R. As-syakur, F. Kasim, and I.A. Astarini. 2018. "Physical Assessment of Coastal Vulnerability under Enhanced Land Subsidence in Semarang, Indonesia, Using Multi-Sensor Satellite Data." *Advances in Space Research* 61 (8): 2159–79. doi:10.1016/j.asr.2018.01.026.

Iceland, C. 2017. "Water Stress Is Helping Drive Conflict and Migration. How Should the Global Community Respond?" World Resources Institute Commentaries. September 25, 2017. *https://www.wri.org/news/water-stress-helping-drive-conflict-and-migration*.

IEA. 2019. "Global Energy & CO_2 Status Report 2019." Paris: International Energy Agency. *https://www.iea.org/reports/global-energy-co2-status-report-2019/emissions*.

ILO. 2017. "India Labour Market Update." International Labour Organization, Country Office for India. *https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-new_delhi/documents/publication/wcms_568701.pdf*.

ILO. 2018. "Women and Men in the Informal Economy: A Statistical Picture." International Labour Organization. *https://www.ilo.org/global/publications/books/WCMS_626831/*.

IMF. 2020. *World Economic Outlook, October 2020*: A Long and Difficult Ascent. Washington, DC: International Monetary Fund. *https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/world-economic-outlook-october-2020#Full%20Report%20and%20Executive%20Summary*.

IMF. 2021. *World Economic Outlook – Update January 2021*: Policy Support and Vaccines Expected to Lift Activity. Washington, DC: International Monetary Fund. *https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update*.

India State-Level Disease Burden Initiative Road Injury Collaborators. 2019. "Mortality Due to Road Injuries in the States of India: The Global Burden of Disease Study 1990-2017." *Lancet Public Health* 5 (2). doi:*https://doi.org/10.1016/S2468-2667(19)30246-4*.

INRIX. 2020. "INRIX 2019 Global Traffic Scorecard." March 8, 2020. *https://inrix.com/scorecard/*.

IPEA. 2016. "Relatório Brasileiro Para o Habitat III." Brasilia: Instituto de Pesquisa Econômica Aplicada. *https://www.ipea.gov.br/portal/index.php?option=com_content&view=article&id=27266*.

IRENA. 2017. "Renewable Energy Prospects: Indonesia." Abu Dhabi: International Renewable Energy Agency. /publications/2017/Mar/Renewable-Energy-Prospects-Indonesia.

Janmohammed, A. 2019. "Road Safety in the South African Context." *SaferSpaces* (blog). 2019. *https://www.saferspaces.org.za/understand/entry/road-safety-in-the-south-african-context*.

Joshi-Ghani, A. 2020. "How COVID-19 Will Impact Our Cities in the Long Term." World Economic Forum Pioneers of Change Summit Blog. November 20, 2020. *https://www.weforum.org/agenda/2020/11/what-will-our-cities-look-like-after-covid-19/*.

Joubert, L., and G. Ziervogel. 2019. "Day Zero: One City's Response to a Record-Breaking Drought." *http://dayzero.org.za/Day-Zero.pdf*.

Keegan, M. 2020. "Why Cities Are Not as Bad for You as You Think." *BBC Future* (blog). December 1, 2020. *https://www.bbc.com/future/article/20201201-the-surprising-upsides-to-living-in-cities*.

Kidwai, N.L. 2020. "COVID Exposes Underinvestment in Cities. India Must Rethink Its Approach for an Inclusive Future." *The Indian Express*, August 19, 2020. *https://indianexpress.com/article/opinion/columns/rethinking-the-city-6560311/*.

Kim, Y., and B. Zangerling eds. 2016. Mexico Urbanization Review: Managing Spatial Growth for Productive and Livable Cities in Mexico. Washington, DC: World Bank. *http://hdl.handle.net/10986/24930*.

Kimmelman, M. 2017. "Mexico City, Parched and Sinking, Faces a Water Crisis." *The New York Times*, February 17, 2017. *https://www.nytimes.com/interactive/2017/02/17/world/americas/mexico-city-sinking.html*.

Kulp, S.A., and B.H. Strauss. 2019. "New Elevation Data Triple Estimates of Global Vulnerability to Sea-Level Rise and Coastal Flooding." *Nature Communications* 10 (1): 4844. doi:10.1038/s41467-019-12808-z.

Kumar, M., S. Singh, A.T. Ghate, S. Pal, and S.A. Wilson. 2016. "Informal Public Transport Modes in India: A Case Study of Five City Regions." *IATSS Research* 39 (2): 102–9. doi:10.1016/j.iatssr.2016.01.001.

Lakner, C., N. Yoznan, D.G. Mahler, R.A. Castaneda Aguilar, H. Wu, and M. Fleury. 2020. "Updated Estimates of the Impact of COVID-19 on Global Poverty: The Effect of New Data." October 7, 2020. *https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty-effect-new-data*.

Leifeld, J., and L. Menichetti. 2018. "The Underappreciated Potential of Peatlands in Global Climate Change Mitigation Strategies." *Nature Communications* 9 (1): 1071. doi:10.1038/s41467-018-03406-6.

Lessa, D.A., C. Lobo, and L. Cardoso. 2019. "Accessibility and Urban Mobility by Bus in Belo Horizonte/Minas Gerais – Brazil." *Journal of Transport Geography* 77 (May): 1–10. doi:10.1016/j.jtrangeo.2019.04.004.

Lin, M.M., and R. Hidayat. 2018. "Jakarta, the Fastest-Sinking City in the World." *BBC News*, August 12, 2018, sec. Asia. *https://www.bbc.com/news/world-asia-44636934*.

Lustig, N., and V. Martínez Pabon. 2020. "The Impact of COVID-19 Economic Shock on Inequality and Poverty in Mexico." Working Paper 2014. New Orleans: Tulane University, Department of Economics. *https://ideas.repec.org/p/tul/wpaper/2014.html*.

Mahadevia, D., A. Mahendra, and M. Pai. 2018. "Ahmedabad: Town Planning Schemes for Equitable Development—Glass Half Full or Half Empty?" WRI Report Case Study. Washington, DC: World Resources Institute. *https://www.wri.org/wri-citiesforall/publication/ahmedabad-town-planning-schemes-equitable-development-glass-half-full*.

Manfrinato, C.V., A. Marino, V.F. Conde, M. do C.P. Franco, E. Stedefeldt, and L.Y. Tomita. 2020. "High Prevalence of Food Insecurity, the Adverse Impact of COVID-19 in Brazilian Favela." *MedRxiv*, August, 2020.07.31.20166157. doi:10.1101/2020.07.31.20166157.

Maree, G., and S. Khanyile. 2017. "Green Vegetation and Impervious Surfaces in the Gauteng Province." Map of the Month, May 2017. Gauteng City-Region Observatory. *https://www.gcro.ac.za/outputs/map-of-the-month/detail/green-vegetation-and-impervious-surfaces-in-the-gauteng-province/*.

Masters, J. 2021. "World Hammered by Record 50 Billion-Dollar Weather Disasters in 2020." *Yale Climate Connections* (blog). January 25, 2021. *https://yaleclimateconnections.org/2021/01/world-hammered-by-record-50-billion-dollar-weather-disasters-in-2020/*.

Matin, N., J. Forrester, and J. Ensor. 2018. "What Is Equitable Resilience?" *World Development* 109: 197–205.

McGeever, J. 2020. "Brazil Unemployment Rate Hits Record High 14.6%, as People Return to Look for Work." *Reuters*, November 27, 2020. *https://www.reuters.com/article/us-brazil-economy-employment-idUSKBN2871CI*.

Mehrotra, S., and B. Bonansea. 2020. "Greater Than Parts: A Metropolitan Opportunity (Vol. 3): Metropolitan Atlas: Spatial Analytics for Developing Cities." Text/HTML. Washington, DC: World Bank. *http://documents.worldbank.org/curated/en/246201605296114652/Metropolitan-Atlas-Spatial-Analytics-for-Developing-Cities*.

Ministério da Saúde. 2019. "Saúde Brasil 2018: Uma Análise Da Situação de Saúde e Das Doenças e Agravos Crônicos: Desafios e Perspectivas." Brasilia: Health Surveillance Secretariat, Ministry of Health. *http://bvsms.saude.gov.br/bvs/publicacoes/saude_brasil_2018_analise_situacao_saude_doencas_agravos_cronicos_desafios_perspectivas.pdf*.

Ministry of Finance. 2020. "Pemerintah Siapkan Anggaran Infrastruktur Rp417,8 Triliun untuk Tahun 2021." Kementerian Keuangan – Berita. November 17, 2020. *https://www.kemenkeu.go.id/publikasi/berita/pemerintah-siapkan-anggaran-infrastruktur-rp417-8-triliun-untuk-tahun-2021/*.

Miraglia, S.G.E.K., and N. Gouveia. 2014. "Costs of Air Pollution in Brazilian Metropolitan Regions." *Ciencia & Saude Coletiva* 19 (10): 4141.

Mizutori, M., and M.M. Sharif. 2020. "COVID-19 Shows Urgent Need for Cities to Prepare for Pandemics." *Thomson Reuters Foundation* (blog). June 15, 2020. *https://news.trust.org/item/20200615120207-y321f/*.

Montmasson-Clair, G., K. Kritzinger, L. Scholtz, and M. Gulati. 2017. "New Roles for South African Municipalities in Renewable Energy – A Review of Business Models." Pretoria: Trade & Industrial Policy Strategies. *https://www.tips.org.za/research-archive/sustainable-growth/green-economy-3/item/3325-new-roles-for-south-african-municipalities-in-renewable-energy-a-review-of-business-models*.

Moscarelli, F., M. Kleiman, F. Moscarelli, and M. Kleiman. 2017. "The Challenges of Integrated Urban Planning and Management in Brazil: Analysis of the Ministry of Cities Experience." *Urbe. Revista Brasileira de Gestão Urbana* 9 (2): 157–71. doi:10.1590/2175-3369.009.002.ao01.

Muehe, D. 2010. "Brazilian Coastal Vulnerability to Climate Change." *Pan-American Journal of Aquatic Sciences* 5 (October): 1–11.

Mukhra, R., K. Krishan, and T. Kanchan. 2020. "COVID-19 Sets off Mass Migration in India." *Archives of Medical Research* 51 (7): 736–38. doi:10.1016/j.arcmed.2020.06.003.

Muñoz Miranda, A., and J. Martínez-Vázquez. 2018. "Metropolitan Financing in Brazil: Current Trends and Lessons from the International Experience." Inter-American Development Bank. doi:10.18235/0001461.

Myers, S.L. 2020. "After COVID, China's Leaders Face New Challenges from Flooding." *The New York Times*, August 21, 2020, sec. World. *https://www.nytimes.com/2020/08/21/world/asia/china-flooding-sichuan-chongqing.html*.

NBS. 2020. "China Statistical Yearbook 2019." Beijing: National Bureau of Statistics of China. *http://www.stats.gov.cn/tjsj/ndsj/2019/indexeh.htm*.

NBS. 2021. "Households' Income and Consumption Expenditure in 2020." National Bureau of Statistics of China – Press Releases. January 19, 2021. *http://www.stats.gov.cn/english/PressRelease/202101/t20210119_1812523.html*.

Nehren, U., A. Kirchner, W. Lange, M. Follador, and D. Anhuf. 2019. "Natural Hazards and Climate Change Impacts in the State of Rio de Janeiro: A Landscape Historical Analysis." In *Strategies and Tools for a Sustainable Rural Rio de Janeiro*, edited by U. Nehren, S. Schlüter, C. Raedig, D. Sattler, and H. Hissa, 313–30. Springer Series on Environmental Management. Cham: Springer International Publishing. doi:10.1007/978-3-319-89644-1_20.

Normile, D. 2021. "China Announces Major Boost for R&D, but Plan Lacks Ambitious Climate Targets." *Science*, March 5, 2021. *https://www.sciencemag.org/news/2021/03/china-announces-major-boost-rd-plan-lacks-ambitious-climate-targets*.

NRDC. 2020. "Expanding Heat Resilience across India: Heat Action Plan Highlights." National Resources Defense Council. *https://www.nrdc.org/sites/default/files/india-heat-resilient-cities-ib.pdf*.

Oates, L., L. Dai, A. Sudmant, and A. Gouldson. 2020. "Building Climate Resilience and Water Security in Cities: Lessons from the Sponge City of Wuhan, China." China Frontrunners policy brief. London and Washington, DC: Coalition for Urban Transitions. *https://urbantransitions.global/en/publication/china-frontrunners/*.

OECD. 2020. "Cities Policy Responses." Tackling Coronavirus (COVID-19): Contributing to a Global Effort. Paris: Organisation for Economic Co-operation and Development. *http://www.oecd.org/coronavirus/policy-responses/cities-policy-responses-fd1053ff*.

Oxford Economics. 2018. "Global Cities: The Future of the World's Leading Urban Economies to 2035." *http://resources.oxfordeconomics.com/global-cities-2035*.

Ozment, S., and R. Feltran-Barbieri. 2018. "Help for São Paulo's Complex Water Woes: Protect and Restore Forests." *World Resources Institute* (blog). September 25, 2018. *https://www.wri.org/blog/2018/09/help-s-o-paulo-s-complex-water-woes-protect-and-restore-forests*.

Parilla, J., and J. Leal Trujillo. 2015. "South Africa's Global Gateway: Profiling the Gauteng City-Region's International Competitiveness and Connections." Global Cities Initiative. Washington, DC: Brookings Institution. *https://www.brookings.edu/research/south-africas-global-gateway-profiling-the-gauteng-city-regions-international-competitiveness-and-connections/*.

Parton, C. 2018. "China's Looming Water Crisis." London: China Dialogue. *https://cdn.chinadialogue.net/content/uploads/2020/05/20093454/China_s_looming_water_crisis_v.2__1_.pdf*.

Phillips, D. 2020. "Climate Crisis Blamed for Rains and Floods That Have Killed 150 in Brazil." *The Guardian*, March 13, 2020, sec. Environment. *http://www.theguardian.com/environment/2020/mar/13/climate-crisis-blamed-for-rains-and-floods-that-have-killed-150-in-brazil*.

Pillai, S. 2020. "Public Transport Takes a Covid Hit as Commuters Switch to Private Vehicles: Study." *Hindustan Times*, December 29, 2020. *https://www.hindustantimes.com/india-news/public-transport-takes-a-covid-hit-as-commuters-switch-to-private-vehicles-study/story-7ReLooJA63GkC9rbd81DhM.html*.

Pratama, A.B. 2018. "Smart City Narrative in Indonesia: Comparing Policy Documents in Four Cities." *Public Administration Issues*, no. 6: 65–83.

Presidency of Republic of South Africa. 2020. "Presidential Climate Change Coordinating Commission Appointed." Media Room. December 17, 2020. *http://www.thepresidency.gov.za/press-statements/presidential-climate-change-coordinating-commission-appointed*.

Prydz, E.B., and D. Wadhwa. 2019. "Classifying Countries by Income." World Development Indicators Stories. September 9, 2019. *https://datatopics.worldbank.org/world-development-indicators/stories/the-classification-of-countries-by-income.html*.

PUPR. 2021. "Di Tengah Pandemi COVID-19, Realisasi Program Sejuta Rumah TA 2020 Capai 965.217 Unit." Kementerian Pekerjaan Umum Dan Perumahan Rakyat – Info PUPR. January 8, 2021. *https://pu.go.id/berita/di-tengah-pandemi-covid-19-realisasi-program-sejuta-rumah-ta-2020-capai-965217-unit*.

Queiroz, A.R. de, V.A.D. Faria, L.M.M. Lima, and J.W.M. Lima. 2019. "Hydropower Revenues under the Threat of Climate Change in Brazil." *Renewable Energy* 133 (April): 873–82. doi:10.1016/j.renene.2018.10.050.

Queiroz, A.R. de, L.M. Marangon Lima, J.W. Marangon Lima, B.C. da Silva, and L.A. Scianni. 2016. "Climate Change Impacts in the Energy Supply of the Brazilian Hydro-Dominant Power System." *Renewable Energy* 99 (December): 379–89. doi:10.1016/j.renene.2016.07.022.

Rahman, D.F. 2021. "Govt Housing Program Falls Short of 1 Million Target Last Year." *The Jakarta Post*, January 11, 2021. *https://www.thejakartapost.com/news/2021/01/10/govt-housing-program-falls-short-of-1-million-target-last-year.html*.

Ramaphosa, C. 2020. "Address on South Africa's Economic Reconstruction and Recovery Plan." Address to Joint Sitting of Parliament of South Africa. Republic of South Africa. *https://www.gov.za/speeches/president-cyril-ramaphosa-south-africa's-economic-reconstruction-and-recovery-plan-15-oct*.

Rasch, R.J. 2016. "Assessing Urban Vulnerability to Flood Hazard in Brazilian Municipalities." *Environment and Urbanization* 28 (1): 145–68. doi:10.1177/0956247815620961.

Ravindra, A. 2020. "A Post-COVID-19 Plan for Future of Our Cities." *Deccan Herald*, June 7, 2020. *https://www.deccanherald.com/opinion/comment/a-post-covid-19-plan-for-future-of-our-cities-846855.html*.

Reuters. 2019. "Indonesia President Signs New EV Decree to Bolster Industry," August 9, 2019. *https://www.reuters.com/article/indonesia-electric-idINL4N255133*.

Roberts, M., F.G. Sander, and S. Tiwari. 2019. Time to ACT: *Realizing Indonesia's Urban Potential*. Washington, DC: World Bank. *http://hdl.handle.net/10986/31304*.

Rodrigue, J.-P. 2020. *The Geography of Transport Systems*. 5th ed. Routledge. Chapter 3.1 Transportation and Economic Development: *https://transportgeography.org/?page_id=5423*.

Romero, S. 2012. "Swallowing Rain Forest, Cities Surge in Amazon (Published 2012)." *The New York Times*, November 24, 2012. *https://www.nytimes.com/2012/11/25/world/americas/swallowing-rain-forest-brazilian-cities-surge-in-amazon.html*.

Rubnitz, T. 2018. "State-Led Alternative Mechanisms to Acquire, Plan, and Service Land For Urbanisation in India." Text. WRI Ross Center for Sustainable Cities. July 31, 2018. *https://wrirosscities.org/research/publication/state-led-alternative-mechanisms-acquire-plan-and-service-land-urbanisation*.

Ruiz-Rivera, N., and S. Lucatello. 2017. "The Interplay Between Climate Change and Disaster Risk Reduction Policy: Evidence from Mexico." *Environmental Hazards* 16 (3): 193–209. doi:10.1080/17477891.2016.1211506.

Ryneveld, P. van. 2018. "Urban Transport Analysis for the Urbanisation Review." Pretoria: Cities Support Programme, National Treasury. *https://csp.treasury.gov.za/Resource%20_Centre/Conferences/Documents/Urbanization%20Review%20Papers/Paper%209%20-%20Urban%20Transport%20Analysis.pdf*.

SACN. 2016. "State of South African Cities 2016." Johannesburg: South African Cities Network. *https://www.sacities.net/state-of-cities-reports/*.

Saghir, J., M. Schaeffer, A. Chen, E.J. Iijasz-Vasquez, J. So, and M. Mena Carrasco. 2020. "Building Forward Better from COVID-19: Accelerating Action on Climate Adaptation." State and Trends in Adaptation Report 2020, Vol. 1. Rotterdam: Global Center on Adaptation. *https://gca.org/reports/state-and-trends-in-adaptation-report-2020/*.

Sami, N. 2011. "The Political Economy of Urban Land in India: Key Issues." Indian Institute for Human Settlements. *https://doi.org/10.24943/9789351568391*.

Sankhe, S., A. Madgavkar, G. Kumra, J. Woetzel, S. Smit, and K. Chockalingam. 2020. "India's Turning Point: An Economic Agenda to Spur Growth and Jobs." McKinsey Global Institute. *https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/India/Indias%20turning%20point%20An%20economic%20agenda%20to%20spur%20growth%20and%20jobs/MGI-Indias-turning-point-Executive-summary-August-2020-vFinal.pdf*.

Sanyal, B., and C. Deuskar. 2012. "Town Planning Schemes as a Hybrid Land Readjustment Process in Ahmedabad, India: A Better Way to Grow?" *In Value Capture and Land Policies: Proceedings of the 2011 Land Policy Conference*, edited by G.K. Ingram and Y.-H. Hong, 149–82. Cambridge, MA, US: Lincoln Institute of Land Policy. *https://www.lincolninst.edu/publications/conference-papers/town-planning-schemes-hybrid-land-readjustment-process-ahmedabad*.

Satterthwaite, D. 2016. "Successful, Safe and Sustainable Cities: Towards a New Urban Agenda." *Commonwealth Journal of Local Governance*, 3–18. doi:10.5130/cjlg.voi19.5446.

Schwedhelm, A., W. Li, L. Harms, and C. Adriazola-Steil. 2020. "Biking Provides a Critical Lifeline during the Coronavirus Crisis." *World Resources Institute* (blog). April 17, 2020. *https://www.wri.org/blog/2020/04/coronavirus-biking-critical-in-cities*.

Scruggs, G. 2019. "Ministry of Cities RIP: The Sad Story of Brazil's Great Urban Experiment." *The Guardian*, July 18, 2019, sec. Cities. *https://www.theguardian.com/cities/2019/jul/18/ministry-of-cities-rip-the-sad-story-of-brazils-great-urban-experiment*.

SEDATU. 2019. "Programa Nacional de Vivienda 2019–2024." Mexico City: Secretaría de Desarrollo Agrario, Territorial y Urbano. *https://www.gob.mx/cms/uploads/attachment/file/532237/Programa_Nacional_de_Vivienda_2019-2024.pdf*.

SEDATU. 2020. "Estrategia Nacional de Ordenamiento Territorial 2020-2040." Mexico City: Secretaría de Desarrollo Agrario, Territorial y Urbano, Gobierno de México. *http://gaceta.diputados.gob.mx/Gaceta/64/2020/sep/Enot_ver.Ejec-20200922.pdf*.

SEMARNAT. 2018. "Estrategia Nacional de Movilidad Eléctrica." Mexico City, September. *https://www.gob.mx/cms/uploads/attachment/file/395715/6_SEMARNAT_EstElectroMovilidad.pdf*.

Senado de la República. 2020. "Presenta Sedatu al Senado Estrategia Nacional de Ordenamiento Territorial." Coordinación de Comunicación Social. October 27, 2020. *http://comunicacion.senado.gob.mx/index.php/informacion/boletines/49506-presenta-sedatu-al-senado-estrategia-nacional-de-ordenamiento-territorial.html*.

Serajuddin, U., and N. Hamadeh. 2020. "New World Bank Country Classifications by Income Level: 2020-2021." *World Bank Data Blog* (blog). July 1, 2020. *https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2020-2021*.

Shah, J., and B. Adhvaryu. 2016. "Public Transport Accessibility Levels for Ahmedabad, India." *Journal of Public Transportation* 19 (3). doi:*http://doi.org/10.5038/2375-0901.19.3.2*.

Sharifi, A., and A.R. Khavarian-Garmsir. 2020. "The COVID-19 Pandemic: Impacts on Cities and Major Lessons for Urban Planning, Design, and Management." *Science of the Total Environmen*t 749 (December): 142391. doi:10.1016/j.scitotenv.2020.142391.

Sidik, F., B. Supriyanto, H. Krisnawati, and M.Z. Muttaqin. 2018. "Mangrove Conservation for Climate Change Mitigation in Indonesia." *WIREs Climate Change* 9 (5): e529. doi:*https://doi.org/10.1002/wcc.529*.

Silva, C.T. e. 2020. "Addressing the Housing Shortage without Building Cities: The Minha Casa Minha Vida Program, Brazil." In *Communities, Land and Social Innovation*. Edward Elgar Publishing.

Simarmata, H.A., and G.A.K. Surtiari. 2020. "Adaptation to Climate Change: Decision Making and Opportunities for Transformation in Jakarta, Indonesia." Research Paper 2020-3, prepared for the UNRISD project Transformative Adaptation to Climate Change in Southeast Asian Coastal Cities. Geneva: United Nations Research Institute for Social Development. *https://www.unrisd.org/unrisd/website/document.nsf/(httpPublications)/FA1FD6C0607E095380258639005271FA?OpenDocument*.

Singh, R., and R. Kumar. 2019. "Climate versus Demographic Controls on Water Availability across India at 1.5 °C, 2.0 °C and 3.0 °C Global Warming Levels." *Global and Planetary Change* 177 (June): 1–9. doi:10.1016/j.gloplacha.2019.03.006.

Somers, K., and I. Baud. 2015. *My House, My Life: Decision-Making Processes and Local Citizen Participation in Housing Project Minha Casa, Minha Vida in Salvador Da Bahia*.

Srivastava, R. 2020. "Caught by Deluges and Droughts, India's Cities Look to Become Climate Smarter." *Reuters*, October 26, 2020. *https://www.reuters.com/article/india-climate-change-floods-idINL8N2HB14R*.

Stats SA. 2019. "Inequality Trends in South Africa: A Multidimensional Diagnostic of Inequality." Report No. 03-10-19. Pretoria: Statistics South Africa. *http://www.statssa.gov.za/publications/Report-03-10-19/Report-03-10-192017.pdf*.

Su, W. 2015. "Enhanced Action on Climate Change: China's Intended Nationally Determined Contributions." Department of Climate Change, National Development and Reform Commission. *https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China%27s%20First%20NDC%20Submission.pdf*

SUDECO. 2019. "Plano Regional de Desenvolvimento Do Centro-Oeste – 2020–2023." Brasilia: Superintendência do Desenvolvimento do Centro-Oeste. *https://www.gov.br/sudeco/pt-br/centrais-de-conteudo/publicacoes-1/publicacoes-da-diretoria-de-planejamento-e-avaliacao/prdco-2020-2023.pdf/view*.

Suherdjoko. 2018. "Ahmad Yani Airport Opens New Terminal." *The Jakarta Post*, June 6, 2018. *https://www.thejakartapost.com/news/2018/06/06/achmad-yani-airport-opens-new-terminal.html*.

Suroyo, G., and T. Diela. 2020. "Indonesia Suffers First Recession in over 20 Years, Finmin Says '*Worst Is Over.*'" *Reuters*, November 5, 2020. *https://www.reuters.com/article/us-indonesia-economy-gdp-idUSKBN27LoGL*.

Sustainia, and C40. 2017. "Cities100 2017: 100 Solutions for Climate Action in Cities." Copenhagen and London: Sustainia and C40 Cities Climate Leadership Group. *https://www.c40knowledgehub.org/s/article/Cities100-2017?language=en_US*.

Székely, M., I. Acevedo, and I. Flores. 2020. "Magnitud Del Impacto Social Del COVID-19 En México y Alternativas Para Amortiguarlo: Resultados Por Entidad Federativa." Mexico City: Centro de Estudios Educativos y Sociales. *https://www.cees-ease.com/pdf/Impacto%20Social%20COVID%20Estatal%20Completo%20-%20CEES%201%20Junio%202020.pdf*.

Tabary, Z. 2020. "Cities Reboot: Will Adapting to COVID-19 Change Urban Life for Good?" *Reuters*, October 29, 2020. *https://www.reuters.com/article/us-health-coronavirus-cities-insight-trf-idUSKBN27E0O2*.

The Jakarta Post. 2019. "Housing Program Exceeds 1 Million Target in 2018." *The Jakarta Post*, January 9, 2019. *https://www.thejakartapost.com/news/2019/01/09/housing-program-exceeds-1-million-target-in-2018.html*.

Turok, I., and J. Borel-Saladin. 2014. "Is Urbanisation in South Africa on a Sustainable Trajectory?" *Development Southern Africa* 31 (5): 675–91. doi:10.1080/0376835X.2014.937524.

UCLG. 2014. "Basic Services for All in an Urbanizing World." Third Global Report on Local Democracy and Decentralization (GOLD III). Barcelona: United Cities and Local Governments. *https://www.uclg.org/en/media/news/gold-iii-report-basic-services-all-urbanizing-world*.

UN. 2020. "COVID-19 in an Urban World." Policy brief. New York: United Nations. *https://www.un.org/en/coronavirus/covid-19-urban-world*.

UN DESA. 2018. "World Urbanization Prospects: The 2018 Revision." New York: United Nations Department of Economic and Social Affairs, Population Division. *https://population.un.org/wup/Country-Profiles/*.

UNDP. 2019. "US$43 Million Project to Boost Climate Resilience for India's Coastal Communities Gets Underway." *United Nations Development Programme Press Release* (blog). November 13, 2019. *https://www.asia-pacific.undp.org/content/rbap/en/home/presscenter/pressreleases/2019/us-43-million-project-to-boost-climate-resilience-for-indias-coa.html*.

UNEP. 2019. "Banking on Nature: A Mexican City Adapts to Climate Change." *United Nations Environment Programme* (blog). November 19, 2019. *http://www.unenvironment.org/news-and-stories/story/banking-nature-mexican-city-adapts-climate-change*.

UNESCAP, and UN Habitat. 2019. "The Future of Asian and Pacific Cities 2019: Transformative Pathways Towards Sustainable Urban Development." Bangkok: United Nations Economic and Social Commission for Asia and the Pacific and United Nations Human Settlements Programme. *https://www.unescap.org/publications/future-asian-and-pacific-cities-2019-transformative-pathways-towards-sustainable-urban*.

UNISDR. 2018. "Economic Losses, Poverty & Disasters: 1988-2017." Centre for Research on the Epidemiology of Disasters, United Nations Office for Disaster Risk Reduction. *https://www.undrr.org/publication/economic-losses-poverty-disasters-1998-2017*.

United Nations. 2020. "'*Enhance Solidarity*' to Fight COVID-19, Chinese President Urges, Also Pledges Carbon Neutrality by 2060." UN News. September 22, 2020. *https://news.un.org/en/story/2020/09/1073052*.

Val, D.V., D. Yurchenko, M. Nogal, and A. O'Connor. 2019. "Climate Change-Related Risks and Adaptation of Interdependent Infrastructure Systems." In *Climate Adaptation Engineering*, edited by E. Bastidas-Arteaga and M.G. Stewar, 207–42. Butterworth-Heinemann. doi:10.1016/B978-0-12-816782-3.00007-3.

Vasconcellos, E.A. 2018. "Urban Transport Policies in Brazil: The Creation of a Discriminatory Mobility System." *Journal of Transport Geography* 67 (February). *https://trid.trb.org/view/1508692*.

Veloso, F., P.C. Ferreira, S.M. Matos, and B.P. Coelho. 2016. "Produtividade Do Setor de Serviços No Brasil: Um Estudo Comparativo."

Venter, C., A. Mahendra, and D. Hidalgo. 2019. "From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South." Working Paper. Washington, DC: World Resources Institute. *https://www.wri.org/wri-citiesforall/publication/mobility-access-all-expanding-urban-transportation-choices-global-south*.

Vivid Economics. 2021. "Greenness of Stimulus Index: An Assessment of COVID-19 Stimulus by G20 Countries and Other Major Economies in Relation to Climate Action and Biodiversity Goals (February 2021 Release)." Finance for Biodiversity Initiative. *https://www.vivideconomics.com/casestudy/greenness-for-stimulus-index/*.

Warren, M., K. Hergoualc'h, J.B. Kauffman, D. Murdiyarso, and R. Kolka. 2017. "An Appraisal of Indonesia's Immense Peat Carbon Stock Using National Peatland Maps: Uncertainties and Potential Losses from Conversion." *Carbon Balance and Management* 12 (May). doi:10.1186/s13021-017-0080-2.

WEF. 2021. "Indian Cities in the Post Pandemic World." White paper. Geneva and Mumbai: World Economic Forum and IDFC Institute. *https://www.weforum.org/whitepapers/indian-cities-in-the-post-pandemic-world/*.

Winning, A. 2020. "South Africa's Unemployment Rate Reaches Record High above 30%." *Reuters*, November 12, 2020. *https://www.reuters.com/article/safrica-economy-unemployment-idUSKBN27S25D*.

Wirayani, P. 2017. "Port Operator to Implement Reclamation at Tanjung Emas Port." *The Jakarta Post*, February 22, 2017. *https://www.thejakartapost.com/news/2017/02/22/port-operator-to-implement-reclamation-at-tanjung-emas-port.html*.

World Bank. 2013. "Urbanization beyond Municipal Boundaries: Nurturing Metropolitan Economies and Connecting Peri-Urban Areas in India." Washington, DC. *http://documents1.worldbank.org/curated/en/373731468268485378/pdf/757340PUB0EPI0001300pubdate02021013.pdf*.

World Bank. 2016. "Indonesia's Urban Story." Jakarta. *https://www.worldbank.org/en/news/feature/2016/06/14/indonesia-urban-story*.

World Bank. 2017. "Indonesia – National Affordable Housing Program Project." Project Appraisal Document PAD1788. Washington, DC. *https://documents.worldbank.org/en/publication/documents-reports/documentdetail/121201489975262694/Indonesia-National-Affordable-Housing-Program-Project*.

World Bank. 2019. "Aspiring Indonesia—Expanding the Middle Class." Washington, DC. *https://openknowledge.worldbank.org/handle/10986/33237*

World Bank. 2020. "Indonesia: Poverty & Equity Brief." Text/HTML. Washington, DC. *https://www.worldbank.org/en/topic/poverty/publication/poverty-and-equity-briefs*.

World Bank. 2020. "Beaten or Broken? Informality and COVID-19." South Asia Economic Focus, Fall 2020. Washington, DC. *https://openknowledge.worldbank.org/handle/10986/34517*

Wray, C., D. Everatt, G. Götz, and D. Mushongera. 2014. "Changing Spatial Inequality across the GCR." Map of the Month July 2014. Gauteng City-Region Observatory. *https://www.gcro.ac.za/outputs/map-of-the-month/detail/changing-spatial-inequality-across-the-gcr/*.

Xinhua. 2020. "Across China: '*Sponge City*' Program Bears Fruit," October 12, 2020. *http://www.xinhuanet.com/english/2020-10/12/c_139435158.htm*.

Ye, Q., S. Qijiao, Z. Xiaofan, S. Qiu, and L. Tom. 2020. "China's New Urbanisation Opportunity: A Vision for the 14th Five-Year Plan. Coalition for Urban Transitions." London, UK, and Washington, DC: Coalition for Urban Transitions. *https://urbantransitions.global/publications/*.

Yin, P., M. Brauer, A.J. Cohen, H. Wang, J. Li, R.T. Burnett, J.D. Stanaway, et al. 2020. "The Effect of Air Pollution on Deaths, Disease Burden, and Life Expectancy across China and Its Provinces, 1990–2017: An Analysis for the Global Burden of Disease Study 2017." *The Lancet Planetary Health* 4 (9): e386–98. doi:10.1016/S2542-5196(20)30161-3.

Ziervogel, G., J. Waddell, W. Smit, and A. Taylor. 2016. "Flooding in Cape Town's Informal Settlements: Barriers to Collaborative Urban Risk Governance." *South African Geographical Journal* 98 (1): 1–20. doi:10.1080/03736245.2014.924867.

Zubicaray Díaz, G., N. García Montoya, J.A. Macías Mora, H.M. Donado Bula, N. García Córdoba, and L. Gluckstein. 2020. "Acciones federales para la planeación urbana: Hacia mejores ciudades para todos." London and Washington, DC: Coalition for Urban Transitions and World Resources Institute. *https://urbantransitions.global/en/publication/federal-actions-for-urban-planning/*.

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