COALITION FOR URBAN TRANSITIONS

SEIZING SOUTH AFRICA'S URBAN OPPORTUNITY

TACKLING URBAN POVERTY AND INEQUALITY THROUGH DECARBONISATION AND RESILIENCE-BUILDING

About the Seizing the Urban Opportunity series

This series, a collaborative effort by more than 36 organisations across five continents brought together by the Coalition for Urban Transitions, is being launched 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. This report focuses on how to seize the urban opportunity in South Africa.

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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EXECUTIVE SUMMARY

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, mostly in a half-dozen major urban hubs, and by 2035, 74% of the population is projected to be urban.

South Africa's cities accumulate significant private wealth, but it is very unequally distributed. Despite major efforts to raise living standards and integrate cities, large disparities persist. And municipalities struggle to keep up with demand for basic services, particularly in peri-urban areas.

Urban mobility in South Africa both reflects inequality, and exacerbates it. The country has well-developed roads, but poor pedestrian infrastructure and lighting create perilous conditions for those who walk, and buses and trains do not serve many lower-income areas well. Two-thirds of public transport trips in South Africa's metro areas involve minibus taxis.

South Africa's cities also keep sprawling out. New analysis for this report shows the urban footprint expanded by 1,464 km^2 between 2000 and 2014 – more than half of this onto habitats that sustain biodiversity and sequester carbon. Many informal settlements are also on marginal land exposed to floods, landslides and other hazards.

Climate change is already taking a toll on South Africa's cities. Drought and water scarcity are a growing problem. In 2018, Cape Town came close to having to shut off water taps. Other key concerns include extreme heat, floods, and in coastal areas, saltwater intrusion, sea-level rise and storm surges. Loss of protective habitats exacerbates those risks.

South Africa has been stepping up its climate ambition, including with a Long-Term Low Emissions Development Strategy (SA-LEDS) billed as "the beginning of our journey" towards net-zero emissions by 2050. A new Presidential Climate Change Coordinating Commission has been charged with ensuring a just transition.

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

Modelling for the Coalition shows a bundle of existing technologies and practices could cut urban greenhouse gas (GHG) emissions in the buildings, transport and waste sectors by 54% (81 Mt CO_2e) in 2030 and 92% (146 Mt CO_2e) in 2050, relative to a baseline scenario.

Implementing those measures would require incremental investments of US$272.2 billion to 2050, but analysis for the Coalition suggests they would more than pay for themselves in cost savings alone, and yield returns with a net present value of US$216.3 billion by 2050. They could also support about 656,000 new jobs in 2030.

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, and the rest mainly from nuclear power and renewables. The Integrated Resource Plan (IRP) proposes decommissioning 10 GW of coal power capacity by 2030 and another 25 GW by 2050, and replacing it mainly with wind and solar. In addition, a major Electricity Regulation Act reform adopted in October 2020 allows cities to purchase power directly from independent producers or generate their own, which could accelerate decarbonisation while improving energy access.

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. Unemployment has soared, and almost 66,000 lives had been lost to the pandemic as of mid July 2021.

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, including some support for renewables, but also large amounts for high-carbon industries. Future stimulus efforts should better reflect South Africa's bold vision for a net-zero future, with healthy, inclusive and sustainable cities.

Six key ways for South Africa's government to ensure a robust and socially just urban transformation include:

- **Accelerate policy reforms to enable municipalities** to procure their own clean energy and use renewables to improve electricity access.
- **Put pro-poor urban measures** at the heart of plans to implement the SA-LEDS and achieve a just transition.
- **Prioritise improved mobility** for lower-income urban residents.
- **Revamp housing strategies** to prioritise smaller-scale projects that can be built in city sub-centres and on providing well-connected, serviced sites for construction.
- **Provide targeted support for cities of different sizes** and economic structures, helping them to overcome capacity and resource gaps and fostering mutual learning.
- **Protect and restore ecosystems** in and around cities and invest in greening the urban landscape.

INTRODUCTION

In South Africa and around the world, national leaders face a triple challenge right now: ensuring a successful recovery from the devastation of COVID-19, pushing forward on their longer-term vision for equitable development, and addressing the enormous threats posed by climate change. The pandemic has wrought havoc on the global economy, with particularly severe impacts on the poor. It has also highlighted the urgency of building resilience to a wide range of shocks, especially the growing impacts of climate change.

Cities are at the centre of that triple challenge. As population hubs and economic engines, they will play a crucial role in the recovery and in countries' long-term economic vitality. Many have also been particularly hard-hit by the pandemic, however. So now, more than ever, national leadership is crucial to ensure cities can "bounce back" and fully realise their potential as engines of sustainable, inclusive growth. As outlined in the Coalition's 2019 flagship report, Climate Emergency, Urban Opportunity,[1] 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, 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[2] and 41% of CO_2 emissions from fossil fuel use.[3] They are also home to 42% of the world's urban population.[4] 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.

This report presents the results of policy analysis and modelling on South Africa, delving deeper into findings summarised in the Coalition's new Seizing the Urban Opportunity report.[5] It aims to inform a new partnership between the Coalition, South Africa's National Department for Cooperative Governance, the WRI Ross Center and the South African Cities Network to support the implementation of South Africa's Integrated Urban Development Framework and to deliver on its four strategic goals of access, growth, governance and spatial transformation.

For context, we begin by outlining our key findings across the six countries, and how they fit with the Coalition's previous work.

Climate Emergency, Urban Opportunity 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.[6] Compact, connected, clean and resilient cities have significant wider economic, social and environmental benefits as well. With deliberate attention to equity and inclusion, low-carbon measures can also help lift people out of poverty by improving their access to jobs, education and vital services. And by avoiding urban sprawl, countries can protect agricultural land and natural ecosystems around cities, with benefits for food security and resilience.

The COVID-19 pandemic has mobilised historic levels of public spending in many countries, but only a fraction promotes sustainability or climate resilience, and very little focuses on cities.[7] Local leaders, meanwhile, have continued 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,[8] to joining the Cities Race to Zero, pledging to reach net-zero carbon emissions by mid-century or sooner.[9]

Aiming to inform and inspire national leaders in the lead-up to COP26, the Coalition set out 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. 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 in cities.

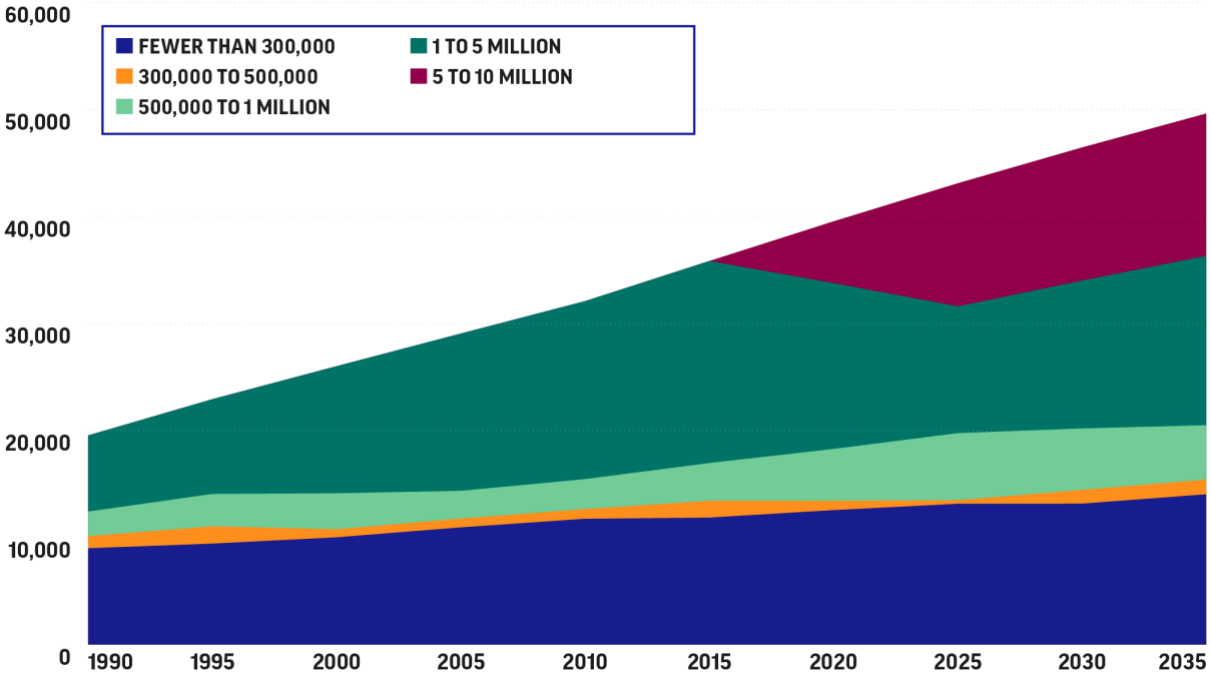
3. **There are many ways to foster low-carbon, resilient and inclusive cities.** National governments have a wide range of options to choose from, including low-cost and immediate opportunities, and there are many synergies between decarbonisation, resilience-building, COVID recovery efforts, and development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

The global report lays out an agenda for action for national and local leaders as well as for the broader development community, including financial institutions. Transforming cities to become catalysts of sustainable, inclusive and resilient growth is a major undertaking, and it is likeliest to succeed if we all come together behind a shared vision. In the sections that follow, we delve into the challenges and opportunities for South Africa in particular.

THE PROMISE – AND CHALLENGES – OF SOUTH AFRICA'S CITIES

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 of them, just in the six largest urban areas.[10] 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.[11] A recent analysis found the country's eight metropolitan municipalities alone contributed 58.4% of GDP in 2018.[12] Between the first quarters of 2015 and 2017, metropolitan areas accounted for 59.5% of all formal and informal jobs created. Most high-skill jobs are in the major cities, and earnings for skilled workers are also higher than in rural areas.[13] Though cities' population growth has slowed in recent years,[14] the draw of economic opportunity makes it likely to continue to outpace the country as a whole. By 2035, 74% of the population is projected to be urban, mainly in cities with over 1 million people.[15]

Figure 1. South Africa's urban population by city size class, 1990–2035 (historical and projected)



Source: Authors' analysis based on data from UN DESA, 2018. Data to 2015 are historical, 2020–2035 are projections.[16]

Intermediate city municipalities (ICMs), home to a quarter of South Africa's population, pose unique challenges and opportunities. These 39 communities, with populations ranging from 140,000 to 797,000 as of 2016, are less prosperous and slower-growing than the metros, but still account for 23.5% of GDP in 2018 and 24% of employment (see Table 1).[17] They run the gamut from larger, economically diverse cities to mining and manufacturing hubs, regional service centres, and very poor, but densely populated areas. Their prospects in a decarbonising economy vary just as widely. Many are more connected to rural areas than to other cities and have large rural populations within their boundaries, with an average of 44% of their residents living on traditional land.[18]

South Africa's cities accumulate significant private wealth, but it is very unequally distributed. 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.[19] Economic growth in Gauteng and Cape Town, the top two metropolitan cities, averaged 3.5% from 1993 to 2016, while the nation only averaged 2.7%.[20] This reflects a post-apartheid reconstruction strategy that prioritised attracting international investments and boosting global competitiveness, with a focus on major cities.[21] In 2015, the mean urban household income was almost 3.5 times the mean rural income,[22] and migration from rural to urban areas lifted as many as 385,000 people from poverty over 2008–2014 alone.[23] Yet as of 2018, the poverty rates in South Africa's most prosperous metropolitan cities – Johannesburg, Cape Town and eThekwini (Durban) – were 39.3%, 44.1% and 40.8%, respectively.[24] The Gini coefficient for South Africa was 0.63 in 2014, making it the most unequal country in the world;[25] in Gauteng City-Region, it was an astonishing 0.74 as of 2011.[26]

The spatial divides created by apartheid persist and continue to entrench urban inequality. Apartheid rule had deliberately isolated Africans, concentrating them in settlements that were physically separated from the major cities while creating homeland cities for different ethnic groups as well as mining, manufacturing and service hubs.[27] In 1996, only 61.6% of residents of South Africa's metro cities were African and 19.1% were white, while in intermediate cities, the proportions were 85.5% and 9.1%, respectively (the rest were coloured or Indian).[28] By 2016, the shares were 71.7% and 12.3% in metro cities and 87.9% and 6.5% in intermediate cities. As a recent analysis put it, "in the post-apartheid era, racial segregation has been perpetuated, if not been replaced, by economic segregation, which in many ways, reinforces uneven development and the racial and socio-spatial disparities and fragmentations of the apartheid era".[29] The National Planning Commission acknowledged as much in 2012, noting that despite major efforts to break down "apartheid geography" through land reform, more compact urban development, better public transit and economic development, "the apartheid spatial divide continues to dominate the landscape".[30] Similarly, a 2018 urbanisation review found that not only had South Africa failed to generate the "urban dividend", but current patterns of urban development "appear to be reinforcing the spatial divisions created under apartheid."[31]

Table 1. A snapshot of South Africa's metro and intermediate cities

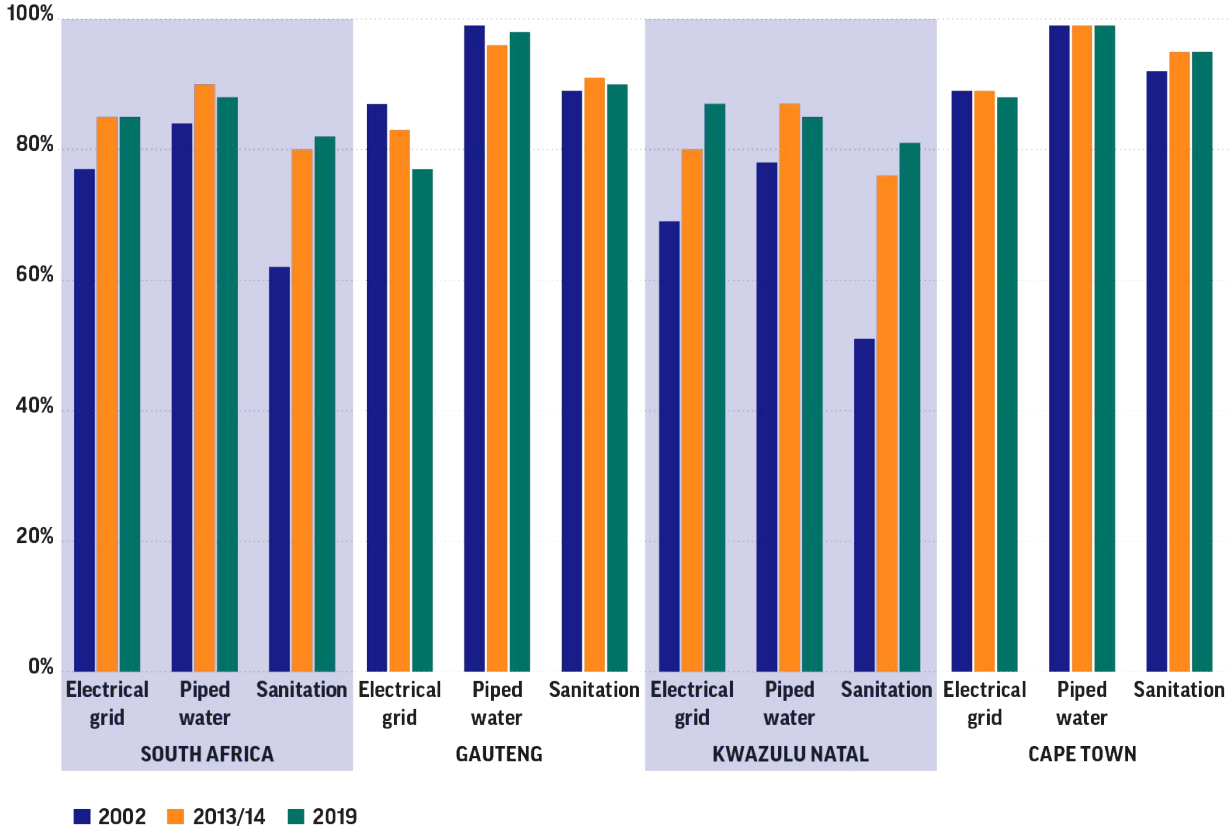
City type	**Share of population** (2021)	**GDP share** (2018)	**Average annual growth** (1996–2018)	**Share of employment** (2018)	**Unemployment rate** (2018)	**Share below poverty line** (2018)
Metropolitan	40.5%	58.4%	3.4%	53.5%	30%	33.4%
Intermediate	26.7%	23.5%	1.8%	24.0%	33%	43.0%

Source: SACN, 2021. Poverty data are for the lower poverty line, which includes the cost of household necessities beyond food.[32]

Cities have made major efforts to expand access to basic municipal services, but have struggled to keep up with demand. Since the beginning of democracy, large investments have been made to raise living standards in the peri-urban townships, integrate cities, build housing and expand economic opportunities, with visible results.[33] Across South Africa, household

access to the electrical grid, piped water and improved sanitation increased between 2002 and 2019, as shown in Figure 2. This reflects deliberate government efforts to close critical gaps. The province of KwaZulu Natal, which includes Durban, made particularly big strides. Still, there are backlogs in urban housing, sanitation, and electrification programs, sparking frequent protests.[34] The Western Cape, which includes Cape Town and already far outperformed the nation on access to urban services, has made little, if any, progress in closing the gaps, and Gauteng Province actually lost ground on access to electricity. A key reason for this is that both provinces have experienced rapid in-migration, with an associated increase in households.[35] A further challenge is that much of the urban population growth has occurred in townships and in peri-urban informal settlements, the first stop for rural and foreign migrants.[36]

Figure 2. Household access to basic services in South Africa and selected provinces



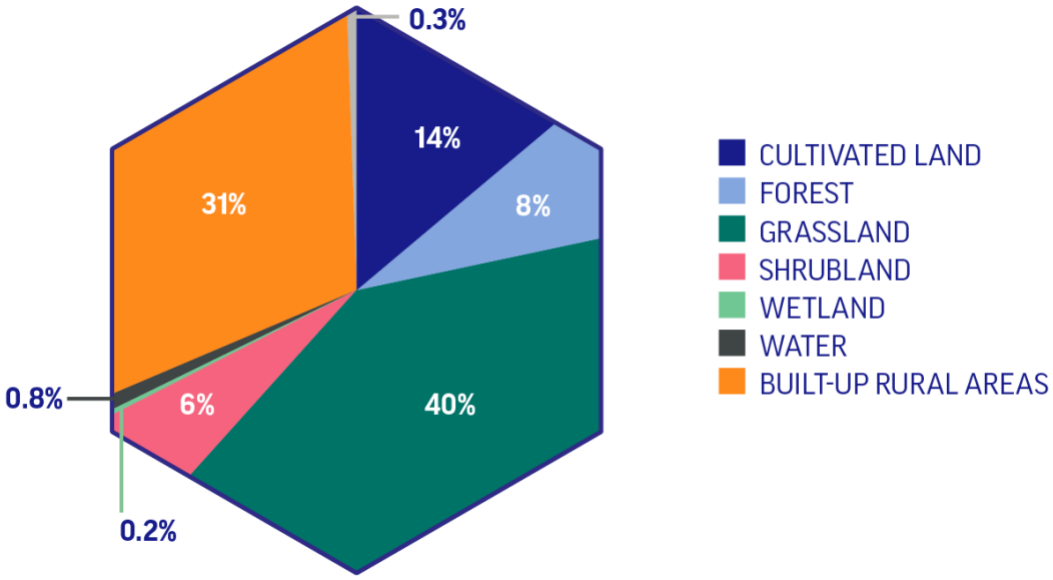
Source: Stats SA, General Household Survey 2019. Data represent the share of households connected to the main electrical grid, with access to piped or tap water, and with improved sanitation. The orange bars represent 2013 data for electricity and piped water, and 2014 data for sanitation.[37]

Urban mobility in South Africa both reflects inequality, and exacerbates it. In the five biggest metro areas, the average morning commute takes an hour.[38] The country has some well-developed roads, but poor pedestrian infrastructure and lighting create perilous conditions for those who walk,[39] and buses and trains do not serve many lower-income areas well.[40] A key problem is that public transport still follows a "hub and spoke" model – with single city centres that people travel into – even though South African metro areas are polycentric, and many commuters need to travel from one sub-centre to another, or from the urban periphery into a sub-centre.[41] This can make for very long, inefficient trips. As a result, bus and rail ridership is very low, and two-thirds of public transport trips in South Africa's metro areas involve 16-seat minibus taxis.[42] They are often the only viable option, but there are serious safety issues, and costs are higher due to very limited subsidies. A 2018 analysis found only 1.2% of public

expenditure on transit went to minibus taxis.[43] For workers in the lower three-fifths of the population, including almost all in the bottom two quintiles, average transport costs to work in 2013 exceeded 20% of their income.

South Africa's cities keep expanding, further deepening spatial disparities. New analysis for this report shows the urban footprint expanded by 1,464 km^2 between 2000 and 2014.[44] 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, which has raised some concerns.[45] Many informal settlements are also on marginal land exposed to floods, landslides and other hazards.[46] And as discussed in Box 1, many low-income urban South Africans live in areas with little tree cover (or any vegetation) and large impervious areas. For municipalities, meanwhile, having to bring services to settlements ever-farther from the city centres is logistically challenging and significantly increases infrastructure costs.[47] However, sprawl patterns are complex, especially in intermediate cities. An analysis of 11 ICMS found that 10 had expanded their footprints from 1990 to 2014, but nine had also become denser, and lower land prices had enabled a form of "spatial infilling" that reduced housing segregation.[48]

Figure 3. Land converted to urban areas in South Africa by type of land cover, 2000–2014

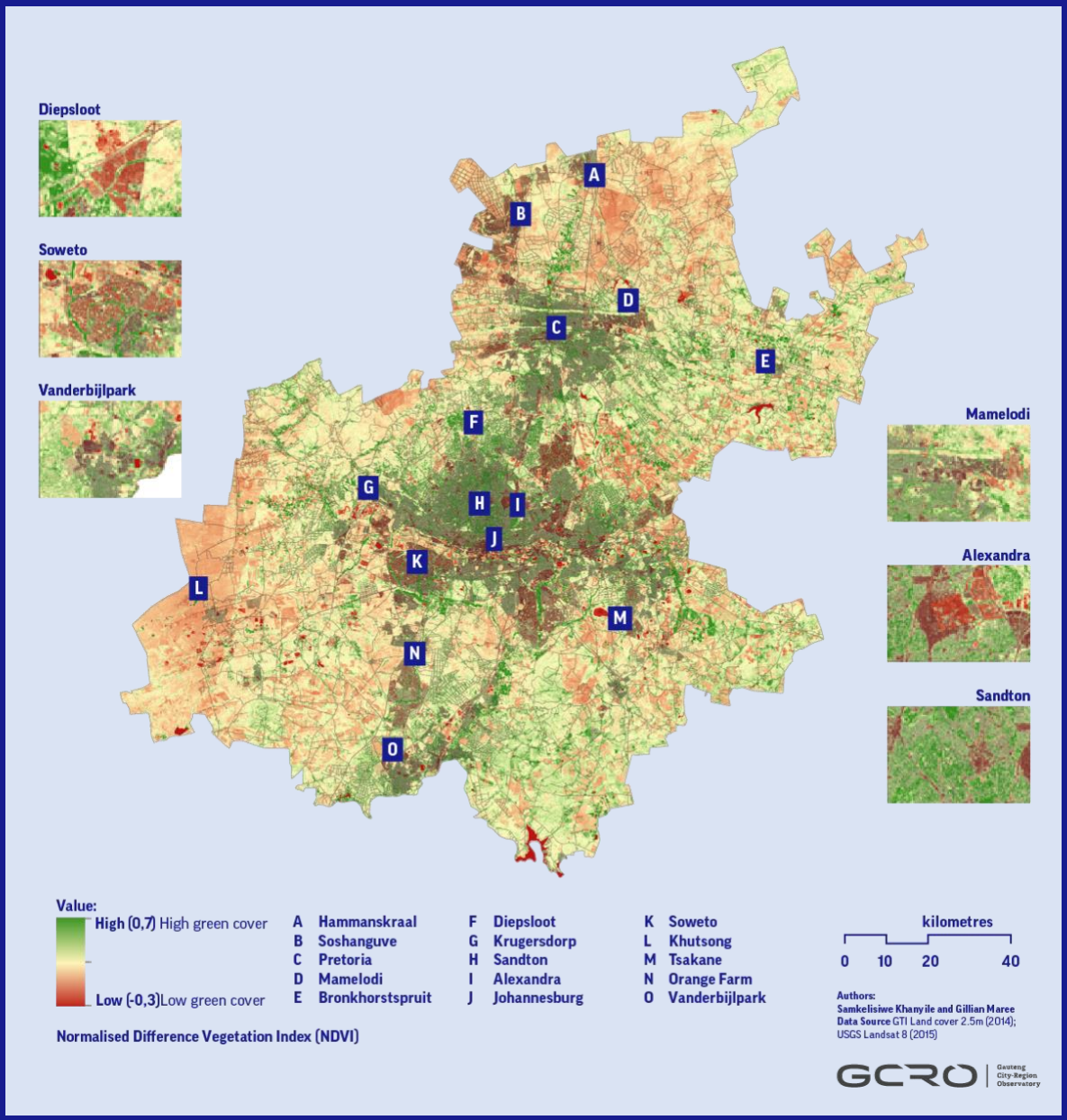


Source: Marron Institute of Urban Management, New York University, for the Coalition.[49]

BOX 1: INEQUITIES AND GREEN COVER IN THE GAUTENG CITY REGION

Green spaces within and around cities provide many crucial benefits, from cleaner air and water, to shade and relief from heat, to flood protection, to carbon storage. In the Gauteng, large differences in green space reflect social inequality, especially around the Gauteng City-Region.

Alexandra, Soweto, and Diepsloot, for example, have very low levels of green vegetation, indicating the predominance of bare soil, hard surfaces, higher urban densities, and virtually no trees – though the predominant biome in the region is grassland, not forest. Areas with a fair amount of impervious surfaces are at increased risk of floods and have less ability to deal with heat waves. In contrast, well established, often wealthier, suburbs (e.g. Sandton) have significant tree coverage in gardens and well-maintained parks (map).



Government housing programmes have reinforced unsustainable and inequitable land use patterns. The South African government has responded to fast-growing demand for affordable urban housing mainly by promoting very large-scale projects – thousands of units requiring vast tracts of land that could only be found on cities' outskirts.[50] Existing incentives and subsidies to improve or densify neighbourhoods within the city, by contrast, or to invest in transit-oriented development, have not been widely used. Not only does this reinforce spatial marginalisation, but servicing sites in outlying areas is expensive, and the number of new homes and serviced sites provided each year has declined, from 235,000 in 2006–2007, to fewer than 175,000 in 2016–2017. Rural-urban migration alone adds 210,000 new urban households per year. Informality has kept rising – from "backyard" houses, to entire settlements – and as of 2019, 16.8% of households in metropolitan areas lived in informal dwellings – including 19.6% in Cape Town and 19.1% in Johannesburg.[51] Some experts have recommended a demand-driven approach focused mainly on providing serviced sites, not full homes, supporting fewer mega-projects and more small projects in city sub-centres.[52]

Intermediate cities face distinct challenges that require targeted responses. A quarter of ICMs are mining cities, for instance, most of which have grown faster than the metros since 1996.[53] But their dependence on a single sector also makes them highly vulnerable to global market volatility and to mine downscaling and closures. For instance, 51.4% of eMalahleni's gross value added (GVA) in 2018 came from coal mining.[54] Overall, 29.1% of employment in mining cities in 2018 was in the mining sector, while in manufacturing cities, only 15.3% of employment was in manufacturing. Changes in mine housing policies have driven a rise in informal settlements, and mining-related environmental hazards pose long-term concerns.[55] Diversifying these cities' economies and ensuring a socially just and inclusive transition is crucial to ensuring that they do not suffer devastating losses at some point – especially those dependent on coal, which is already in decline.[56]

Confronting climate change

Climate change is already taking a toll on South Africa's cities, raising particular concerns over water security. Variable rainfall patterns have put Southern Africa under severe water constraints over the past five years. Some smaller South African municipalities have run out of potable water. Cape Town nearly depleted its water reserves in 2018 and came close to having to shut off water taps.[57] Managing water supply in a changing climate is a balancing act for cities in managing trade-offs between cost and benefits of large dam projects, groundwater solutions, desalination technologies or nature-based solutions, such as removal of water-intensive invasive plants and restoring natural watersheds.[58] Water supplies need to meet the needs of a growing urban population at a time of uncertainty about future rainfall. Urban communities need to actively engage in planning processes to identify sustainable solutions, including nature-based solutions.[59]

Storms, floods, landslides, heat waves and wildfires also pose threats. In climate risk reports to CDP,[60] Johannesburg, Durban and Cape Town all reported concerns about extreme heat and floods, as well as droughts. 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,[61] and have only 55% and 44% of their natural land cover remaining, respectively. This leaves them with limited ecosystem services, including protection from erosion and floods. Coastal cities are required by law to have an Integrated Coastal Management Plan, and careful management will

be crucial for adaptation to climate change. Along with sea-level rise and related risks, two other serious concerns for coastal areas are water pollution from domestic sewage, industrial wastewater and stormwater, and littering and dumping.[62]

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.[63] 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. Three of the priority sectors for the strategy – energy, industry and waste – are deeply relevant to cities, and several of the measures it supports would not only reduce urban emissions, but improve living conditions: from increasing the use of solar water heaters, to promoting cleaner mobility, to improving solid waste and sewage management and adopting "circular economy" approaches. The SA-LEDS also recognises the key roles of subnational governments in advancing climate action, especially the metropolitan cities, and aims to foster greater coordination and mutual learning. In December 2020, President Cyril Ramaphosa appointed a multi-stakeholder Presidential Climate Change Coordinating Commission to coordinate a just transition as part of the implementation of the SA-LEDS.[64]

South Africa also has a bold vision for compact, connected, inclusive, and resilient cities, aligned with a broader low-carbon development agenda. The Integrated Urban Development Framework (IUDF), adopted by the Cabinet in 2016, envisions "liveable, safe, resource-efficient cities and towns that are socially integrated, economically inclusive and globally competitive, where residents actively participate in urban life." It aims to drive change through nine "levers": spatial planning, transport and mobility, human settlements, urban infrastructure, land governance, economic development, empowered communities, urban governance and sustainable finances. Key programmes in the first phase included the introduction of Built Environmental Performance Plans to institutionalise long-term planning; the new Urban Settlements Development Grant, to supplement cities' capital programmes; and additional supports for mid-size cities. The IUDF, developed through a collaboration between the government and national urban experts such as those at the African Centre for Cities,[65] explicitly builds on the National Development Plan[66] and explicitly addresses climate change – both mitigation and adaptation, including disaster risk reduction.

Cities themselves are already demonstrating inclusive, low-carbon solutions. Johannesburg, Cape Town, Durban and Tshwane have all developed climate strategies,[67] and they have also joined the Cities Race to Zero.[68] C40, in which they are all active,[69] has highlighted several of their initiatives as exemplary,[70] including Johannesburg's Climate Change Strategic Framework, which is projected to reduce greenhouse gas (GHG) emissions by 65% by 2050, backed by major investments, including US$143 million in green bonds issued in 2014[71] and land value capture; Durban's African PV mapping tool, which enables residents and businesses to calculate their roof's solar PV potential, estimate cost savings, and find a local installer; [72] the Western Cape Industrial Symbiosis Programme, which connects companies so they can exchange underutilized or wasted resources; and Johannesburg's community-run waste buy-back centres, which boost recycling while improving the livelihoods of informal waste collectors.[73] Going forward, inclusive climate mitigation and adaptation planning could help South African cities tackle longstanding disparities and reduce poverty. Long-term relationship-building and engagement that go beyond purely technocratic approaches can be effective and impactful.[74] Cities also need reliable data and analysis to guide decision-making, which

highlights the importance of trusted institutions at the science-policy interface such as the Gauteng City-Region Observatory,[75] maker of the maps shown in Box 1.

The circular economy approach offers opportunities for income generation, while addressing South Africa's massive waste problem. The SA-LEDS notes that many landfills are full or close to capacity, and it identifies increased recycling, as well as diversion of organic waste – which now makes up about a third of general waste streams – as priorities.[76] Littering and illegal dumping are also major concerns. The national government is trying to tackle the waste problem through a package of 20 initiatives known as Waste Phakisa. The SA-LEDS highlights some as valuable for GHG emission reduction strategies, including increasing materials recovery, turning waste into fuel, and several measures to reduce food waste – which has been found to generate annual costs equivalent to 0.8% GDP, including for disposal.[77] The national government can help municipalities improve waste management through incentives and subsidies and by building local capacity to implement "circular economy" strategies. It is also important to recognise that the waste sector provides livelihoods for many South Africans, with 60,000–215,000 people estimated to work as waste pickers, mostly informally.[78] In 2014, they collectively recovered an estimated 1.24 million tonnes of packaging waste alone. Urban farming can also generate income opportunities and helps to reduce the amount of organic waste in open landfill, without taking up significant amounts of space; solutions include high-tech vertical farms and hydroponics, and small-scale community gardens.[79] Anaerobic digestion, meanwhile, can turn waste into energy.[80]

The electricity challenge

Achieving South Africa's climate goals will require tectonic shifts in the energy system. In 2019, 87.7% of the country's electricity came from coal power, down from 93.6% in 2005, but still an overwhelming majority.[81] Another 5.4% of the 2019 supply came from nuclear power, and only 2.6 and 1.9%, respectively, from wind and solar. Key policies for decarbonisation of the economy are the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), the Carbon Tax,[82] the Integrated Resource Plan (IRP), and the Integrated Urban Development Framework. The IRP proposes decommissioning 10 GW of coal power capacity by 2030, another 25 GW by 2050.[83] The new generation capacity would mainly come from renewable energy sources, largely wind and solar.[84] As part of his COVID-19 recovery package, President Ramaphosa proposed to fast-track the IRP and add 11.8 GW of new power generation capacity, more than half from renewable sources, by 2022.[85]

Regulation for embedded generation continues to limit the uptake of rooftop solar PV. Urban areas come with large roof space, which can supply residential and commercial users with electricity in South Africa's sunny climate. Empowerment of all households and businesses to generate their own electricity from rooftop solar panels can generate excess electricity, which municipalities can then sell to energy intensive industries. Embedded generation, especially at the scale of cities, combined with large scale renewable energy plants by independent power producers can secure future electricity demand.[86] Currently, however, only a few cities allow households to feed in own electricity and charge a connection fee, which supersedes expected savings. Introducing smart meters can increase a more efficient electricity use and increase security in supply.

A major Electricity Regulation Act reform adopted in October 2020 could dramatically accelerate decarbonisation while improving energy access and service reliability.[87] 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.[88] 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. However, as enthusiastic as some urban leaders are about seizing this new opportunity, additional regulatory hurdles still need to be overcome. Cape Town, for instance, has called for clearer guidance on how the reform will be implemented, including what is and is not covered, and how it fits with the IRP.[89]

Cities could use this reform to accelerate urban decarbonisation while improving electricity access – but there are logistical challenges, too. There is an opportunity to procure power at lower cost and generate surpluses, which can be invested into service delivery. It is crucial to be strategic, however. The metropolitan municipalities act as electrical utilities, selling power to consumers that they now procure from Eskom. If the cities spend too much capital on electricity infrastructure, but their high-income customers start generating their own power and stop relying on the grid, they could lose crucial revenue. That, in turn, would limit their capacity to provide adequate services, driving away more customers leave until only those with no choice – the poorest – remain. This trend has already been unfolding among high-income households and businesses over the past decade as a result of intermittent electricity supply, while low- and middle-income households had fewer alternatives.[90] A few cities have adopted feed-in tariffs (FiTs) that allow people to feed surplus electricity that they generate into the grid, which increases the clean energy supply while reducing the cost of adopting renewable technologies.[91] However, there is a connection fee, and uptake has been modest. The REIPPPP, meanwhile, provides for price guarantees for large-scale renewable energy systems, but not for small ones. A national FiT scheme for small producers, including households, with higher payments than are now provided by municipalities, could drive faster growth in embedded generation.

Aerial view of Cape Town. Source: Handmade Pictures

BOX 2: 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.

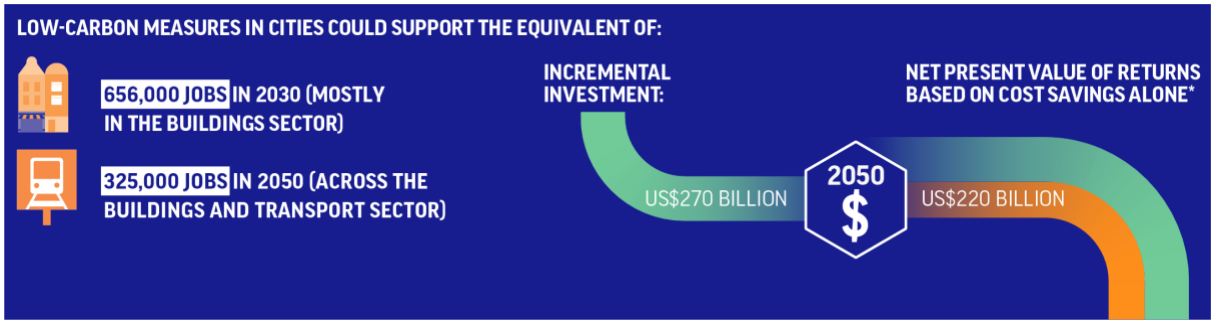
Finally, recognising that coastal populations are particularly exposed to climate change impacts, including sea-level rise, storm surges and other hazards, we drew on the work of the Institute for Demographic Research at City University of New York, the Center for International Earth Science Information 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 report as well as the Coalition's global synthesis report, 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.

HOW URBAN ACTION CAN DRIVE DECARBONISATION AND ECONOMIC GROWTH

South Africa's government and major cities already recognise the value of urban climate action, and new modelling for the Coalition quantifies the potential abatement benefits. The analysis shows that implementing a bundle of existing low-carbon technologies and practices could reduce urban emissions from buildings, transport and waste in South Africa by 54% (81 Mt CO_2e) in 2030 and 92% (146 Mt CO_2e) in 2050, relative to a baseline scenario.[92] Realising that potential would require incremental investments of US$272.2 billion to 2050,[93] but economic modelling for the Coalition shows that 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.

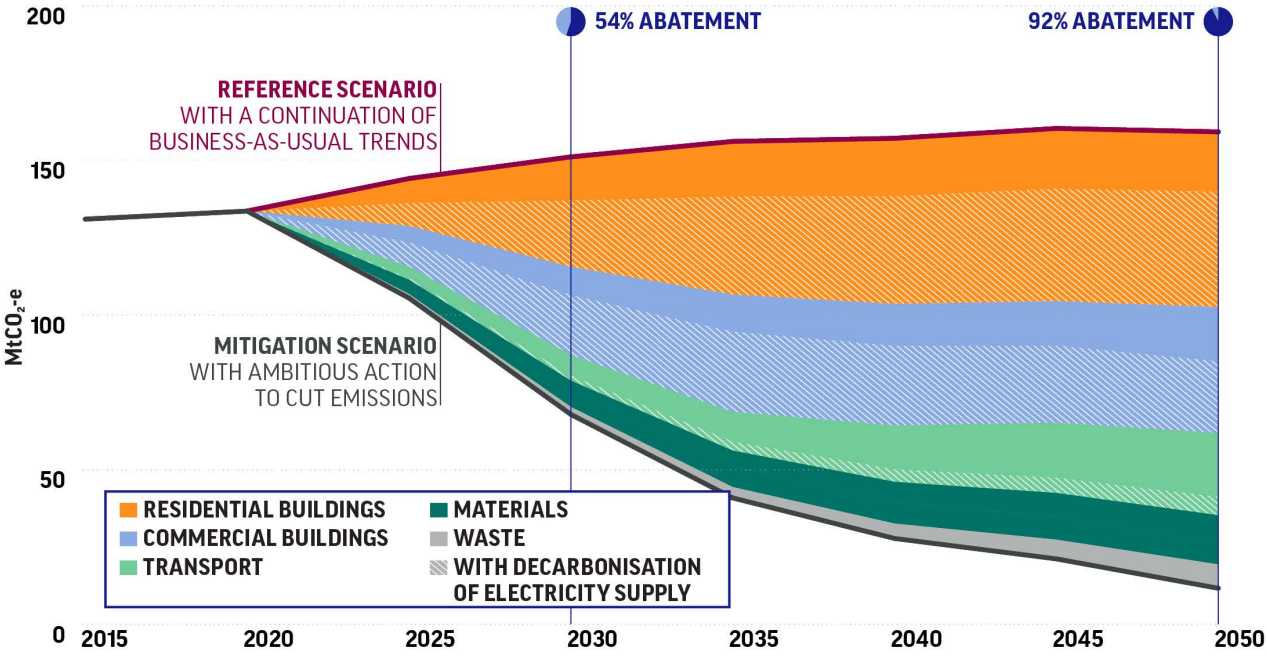
Figure 4. The economics of selected low-carbon measures in South African cities



Source: Modelling by Vivid Economics.[94] Note: These job and growth numbers are based on scenarios and are not forecasts of future outcomes. The job numbers in particular are subject to a high level of uncertainty, as explained in Annex 2*, and should be interpreted with caution.*

The vast majority of the abatement potential identified is in residential and commercial buildings, which the analysis shows account for 42% and 31% of the cumulative GHG reduction potential to 2050**.** Energy efficiency improvements in heating, cooling, water heating, appliances, lighting and cooking, as well as rooftop solar, would all contribute. But the most crucial step to reducing emissions from buildings is to decarbonise the electricity supply. Clean power is necessary to achieve 50.5% of the urban abatement potential, the modelling shows. This is not surprising, of course, given South Africa's heavy reliance on coal and other fossil fuels for electricity. As noted, the government is actively working to increase renewable generation capacity – in fact, in 2020, for the first time, renewable electricity surpassed nuclear power.[95] But coal power is still being added as well. For 2021, the ruling party, the African National Congress, has said it envisions adding 6.8 GW of wind and solar capacity, but also 1.5 GW of coal and 3 GW of gas power.[96]

Figure 5. Technically feasible potential to reduce GHG emissions from South African cities by 2050, by sector



Source: Modelling by the Stockholm Environment Institute for the Coalition.[97]

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, the economic modelling shows. 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.

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.[98] In the third quarter, unemployment hit 30.8%, the highest level since the national jobless survey began in 2008.[99] In late May 2021, facing a third wave of infections, and with only 1.5% of the population vaccinated, President Ramaphosa tightened public health restrictions again.[100] South Africa has the highest case count on the continent, with over 2.2 million cases and nearly 66,000 deaths as of mid July 2021.[101]

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,[102] including, as noted, support for fast-tracking the IRP and adding 11.8 GW of new power generation capacity, more than half from renewable sources, by 2022.[103] 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.[104] However, South Africa has also bailed out and supported high-carbon industries during the COVID crisis.[105] 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.[106] Cost, technical capacity and logistical challenges could also pose significant barriers, especially for smaller cities.[107] The national government can provide resources and connect municipalities with experts to help develop viable business models[108] 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; supporting the development of inclusive municipal climate plans – not only in the major metros, but in cities of all sizes – is a key next step. From rooftop solar PV and solar water heaters, to waste-to-energy and other circular economy solutions, there are many interventions that can create jobs with modest training requirements, improve living conditions and reduce GHG emissions. Proactively developing these opportunities is particularly crucial to communities that now depend on coal mining and coal power for large shares of employment and GDP.

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.

Revamp housing strategies to prioritise smaller-scale sustainable housing projects that can be built in city sub-centres and on providing well-connected, serviced sites

for construction. As a National Treasury analysis concluded in 2018, South Africa can never meet the overwhelming demand for urban housing with its current model of mega-developments on green fields.[109] Instead, the Treasury has recommended focusing on providing serviced sites for the private sector and households to build on, prioritising areas with easy access to jobs, as well as smaller projects around urban sub-centres. Subsidies and other incentives will be crucial both to attracting developers, and to making housing sustainable and affordable to lower-income South Africans, most of whom have little ability to borrow to buy a home. This should include subsidised rentals and changes in zoning and in the use of publicly owned land to prioritise the provision of housing close to jobs and other urban opportunities.

Provide targeted support for cities of different sizes and economic structures, helping them to overcome capacity and resource gaps and fostering mutual learning. South Africa's cities are very diverse – demographically, physically, economically, politically and culturally. Though they share many common challenges, they have distinct strengths and vulnerabilities. Achieving the vision of the IUDF will thus require tailored strategies to ensure a just transition in coal-dependent areas, for instance, develop locally appropriate decarbonisation strategies and build resilience.[110] The largest metros are likely to continue to be climate leaders, but smaller cities can also be pioneers. Technical support, capacity-building and opportunities for mutual learning will be crucial.

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.[111] Building resilience through nature-based solutions can also create new jobs.

Source: Angelo Moleele/Unsplash

ENDNOTES

[1] CUT, 2019, "Climate Emergency, Urban Opportunity: How National Governments Can Secure Economic Prosperity and Avert Climate Catastrophe by Transforming Cities."
[2] 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.
[3] Authors' calculations based on 2018 data from the International Energy Agency (total CO_2 emissions): https://www.iea.org/data-and-statistics.
[4] 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%.
[5] CUT, 2021, "Seizing the Urban Opportunity: How National Governments Can Recover from COVID-19, Tackle the Climate Crisis, and Secure Shared Prosperity through Cities."
[6] CUT, 2019, "Climate Emergency, Urban Opportunity: How National Governments Can Secure Economic Prosperity and Avert Climate Catastrophe by Transforming Cities."
[7] 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)."
[8] C40 Cities, 2020, "How to Build Back Better with a 15-Minute City."
[9] 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.
[10] UN DESA, 2018, "World Urbanization Prospects: The 2018 Revision." Note that South Africa's local governments can span large areas, including both urban and rural land. The eight largest are "metropolitan municipalities", entities that perform all the functions of local government for a given city or urban area. For example, eThekwini manages Durban and its broader urban area, including what used to be more than 40 jurisdictions before 1994. A recent analysis by the South African Cities Network, found that as of 2021, 67% of South Africa's population live either in the eight metros (40%, or 24 million people) or in intermediate city municipalities (ICMs), discussed further below (27% or 16 million). See SACN, 2021, "Profiling Intermediate Cities in South Africa."
[11] Parilla and Leal Trujillo, 2015, "South Africa's Global Gateway: Profiling the Gauteng City-Region's International Competitiveness and Connections."
[12] See Figure 16 in SACN, 2021, "Profiling Intermediate Cities in South Africa."
[13] Arndt, Davies, and Thurlow, 2019, "Urbanization, Structural Transformation and Rural-Urban Linkages in South Africa."
[14] Abrahams et al., 2018, "South Africa: National Urban Policies and City Profiles for Johannesburg and Cape Town."
[15] 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. And while in 2015, 53% of South Africa's urban population was in cities of 1 million or more residents, in 2035 that share is projected to be 59%. All data are from UN DESA, 2018, "World Urbanization Prospects: The 2018 Revision."
[16] UN DESA, 2018, "World Urbanization Prospects: The 2018 Revision."
[17] SACN, 2021, "Profiling Intermediate Cities in South Africa."
[18] ICMs vary greatly in urban-rural balance, from 98–99% in Emfuleni, Matjhabeng, Sol Plaatje and Metsimaholo, to less than 10% in Greater Tzaneen, Makhado, Ba-Phalaborwa, Greater Tubatse/Fetakgomo, Nkomazi and Bushbuckridge. See SACN, 2021, "Profiling Intermediate Cities in South Africa," Annexure F: Population living in urban areas (2016).
[19] AfAsia 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.
[20] National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation."
[21] Maharaj, 2020, "The Apartheid City," in *Urban Geography in South Africa: Perspectives and Theory*.
[22] Stats SA, 2019, "Inequality Trends in South Africa: A Multidimensional Diagnostic of Inequality."
[23] National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation."

[24] Duminy, Parnell, and Brown-Luthango, 2020, "Supporting City Futures: The Cities Support Programme and the Urban Challenge in South Africa."
[25] See World Bank data: https://data.worldbank.org/indicator/SI.POV.GINI.
[26] 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.
[27] Maharaj, 2020, "The Apartheid City," in *Urban Geography in South Africa: Perspectives and Theory*; Donaldson, Marais, and Nel, 2020, "Secondary Cities in South Africa," in *Urban Geography in South Africa: Perspectives and Theory*.
[28] SACN, 2021, "Profiling Intermediate Cities in South Africa."
[29] Maharaj, 2020, "The Apartheid City," in *Urban Geography in South Africa: Perspectives and Theory*, 48.
[30] National Planning Commission, 2012, "Our Future – Make It Work: National Development Plan 2030," 24.
[31] See p. 7 in National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation." South Africa's government has recognised the persistence of this problem, and a revamped approach to implementing the National Development Plan includes, among seven priorities, to "tackle the persistence of apartheid spatial development and create sustainable and safe settlements and effective local government". See Mthembu, 2020, "A Decade to Achieve Vision 2030," *The Mail & Guardian*.
[32] SACN, 2021, "Profiling Intermediate Cities in South Africa."
[33] Duminy, Parnell, and Brown-Luthango, 2020, "Supporting City Futures: The Cities Support Programme and the Urban Challenge in South Africa"; see also SACN, 2016, "State of South African Cities 2016"; Mhlongo, 2019, "The Gentrification of Soweto Hides Its Cruel Apartheid History," *The Guardian*.
[34] Bethuel S. Ngcamu, 2019, "Exploring Service Delivery Protests in Post-Apartheid South African Municipalities: A Literature Review."
[35] Stats SA, 2020, "General Household Survey 2019."
[36] SACN, 2016, "State of South African Cities 2016."
[37] Stats SA, 2020, "General Household Survey 2019." Though the data in all three categories represent access to formal municipal services, each includes limited forms of access to those services. Access to grid electricity includes both conventional and pre-paid in-house meters (the latter make up three-quarters of connections) and other sources that the household may or may not pay for. Access to piped water includes connections inside the house, outside (e.g. in the yard), or through a neighbour's or a communal tap. Improved sanitation is defined as flush toilets connected to a public sewerage system or a septic tank, or a pit toilet with a ventilation pipe. Nationwide, only 59.9% of households had toilets connected to a public sewerage system, and only in Gauteng Province and the Western Cape did the vast majority of households (84.8% and 92.2%, respectively) have this level of sanitation.
[38] 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."
[39] Janmohammed, 2019, "Road Safety in the South African Context," *SaferSpaces* (blog).
[40] Gedye, 2020, "Public Transport Inequality," *New Frame*.
[41] See Section 4 of National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation."
[42] van Ryneveld, 2018, "Urban Transport Analysis for the Urbanisation Review."
[43] See van Ryneveld, 2018, cited above, and graphics and further discussion in National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation."
[44] Analysis by the Marron Institute of Urban Management, New York University. See Annex 3 for a detailed methodology.
[45] Bradley, 2019, "Is South Africa's Most Fertile Farmland under Threat from Developers?" *The Guardian*.
[46] Ziervogel et al., 2016, "Flooding in Cape Town's Informal Settlements: Barriers to Collaborative Urban Risk Governance," *South African Geographical Journal*.
[47] SACN, 2016, "State of South African Cities 2016."
[48] SACN, 2017, "Spatial Transformation: Are Intermediate Cities Different?"

[49] Analysis for the Coalition by the Marron Institute of Urban Management, New York University. See Annex 3 for a full description of the data sources, approach and limitations: https://urbantransitions.global/urban-opportunity/seizing-the-urban-opportunity/annexes/.
[50] See Section 3 of National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation."
[51] Stats SA, 2020, "General Household Survey 2019." See Figure 8.2 and accompanying discussion.
[52] National Treasury, 2018, "Managing Urbanisation to Achieve Inclusive Growth: A Review of Trends in South African Urbanisation and Suggestions for Improved Management of Urbanisation."
[53] SACN, 2021, "Profiling Intermediate Cities in South Africa"; see also SACN, 2017, "Spatial Transformation: Are Intermediate Cities Different?" which includes case studies.
[54] SACN, 2021, "Profiling Intermediate Cities in South Africa."
[55] SACN, 2021, "Profiling Intermediate Cities in South Africa"; 2017, "Spatial Transformation: Are Intermediate Cities Different?"; Donaldson, Marais, and Nel, 2020, "Secondary Cities in South Africa," in *Urban Geography in South Africa: Perspectives and Theory*.
[56] For in-depth looks at the challenges of mining ICMs, see the eMalahleni case study in SACN, 2021, "Profiling Intermediate Cities in South Africa", which includes four scenarios for the city's future, and the case studies of Lephalale, Madibeng, Matjhabeng and Matlosana in SACN, 2017, "Spatial Transformation: Are Intermediate Cities Different?"
[57] Joubert and Ziervogel, 2019, "Day Zero: One City's Response to a Record-Breaking Drought."
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[59] Gajjar, 2020, "Nature-Based Solutions to Climate Change in Coastal Cities." Nature-based solutions can also have substantial job creation benefits. See, e.g., WWF and ILO, 2020, "Nature Hires: How Nature-Based Solutions Can Power a Green Jobs Recovery."
[60] CDP, 2019, "Cities at Risk: Dealing with the Pressures of Climate Change."
[61] SACN, 2016, "State of South African Cities 2016."
[62] See Theme 6 of Western Cape DEA&DP, 2018, "State of the Coast Report."
[63] Government of South Africa, 2020, "South Africa's Low-Emission Development Strategy 2050."
[64] Presidency of Republic of South Africa, 2020, "Presidential Climate Change Coordinating Commission Appointed," Media Room.
[65] See https://iudf.co.za for the policy and updates on its implementation. The African Centre for Cities (ACC) at the University of Cape Town that leads work systemic solutions for sustainable urbanization in Africa was instrumental in shaping the IUDF in close collaboration with the government. See https://www.africancentreforcities.net/programme/integrated-urban-development-framework-for-sa/
[66] See https://iudf.co.za/pdf_downloads/national-development-plan/.
[67] SACN, 2016, "State of South African Cities 2016."
[68] 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.
[69] See https://www.c40.org/other/southafrica.
[70] Sustainia and C40, 2017, "Cities100 2017: 100 Solutions for Climate Action in Cities."
[71] Gorelick, 2018, "Supporting the Future of Municipal Bonds in Sub-Saharan Africa: The Centrality of Enabling Environments and Regulatory Frameworks," *Environment & Urbanization*. Overall, South Africa's green bonds market is seen as promising, an integral part of the country's climate finance strategy, backed by best practices. See Amundi and IFC, 2020, "Emerging Market Green Bonds Report 2019: Momentum Builds as Nascent Markets Grow."
[72] Sustainia and C40, 2017, "Cities100 2017: 100 Solutions for Climate Action in Cities."
[73] Similar efforts have been launched successfully in Cape Town; in both cities, they diverted hundreds of tonnes of waste. See Packa-Ching, 2019, "Bring Ka-Ching at El's New Packa-Ching Mobile Buyback Centre."
[74] Ziervogel et al., 2016, "Flooding in Cape Town's Informal Settlements: Barriers to Collaborative Urban Risk Governance," *South African Geographical Journal*.
[75] See https://www.gcro.ac.za.
[76] See Section 4.5 in Government of South Africa, 2020, "South Africa's Low-Emission Development Strategy 2050." For a breakdown of waste streams and their current disposal, see Department of Environmental Affairs, 2018, "South Africa State of Waste: A Report on the State of the Environment."

[77] Nahman et al., 2012, "The Costs of Household Food Waste in South Africa," *Waste Management*.
[78] See Section 3.8 of Department of Environmental Affairs, 2018, "South Africa State of Waste: A Report on the State of the Environment."
[79] Cilliers et al., 2020, "Reflecting on the Potential and Limitations of Urban Agriculture as an Urban Greening Tool in South Africa," *Frontiers in Sustainable Cities*.
[80] Greben and Oelofse, 2009, "Unlocking the Resource Potential of Organic Waste: A South African Perspective," *Waste Management & Research*.
[81] The rest came from hydropower (2.2%) and very small amounts (0.3% combined) of bioenergy and oil-powered generation. See IEA "Electricity generation by source" data: https://www.iea.org/countries/south-africa.
[82] The 2023 review of the Carbon Tax Act offers an opportunity to expand the tax to include all sectors – including petrochemical industries – thus enabling a broader based of incentives for cleaner energy based urban economic activity.
[83] At the end of 2020, South Africa had 51.6 GW of wholesale/public nominal capacity, including 37.9 GW (73%) from coal, 3.4 GW from diesel, 3.3 GW from hydro (including 2.7 GW from pumped storage), 2.5 GW from wind, 2.0 GW from solar photovoltaics (PV), 1.9 GW from nuclear, and 0.5 GW from concentrated solar power (CSP). Over the course of 2020, the country added 723 MW of coal, 415 MW of wind and 558 MW of solar PV capacity. See Calitz and Wright, 2021, "Statistics of Utility-Scale Power Generation in South Africa in 2020."
[84] 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.
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[86] McCall et al., 2019, "Least Cost Integrated Resource Planning and Cost-Optimal Climate Change Mitigation Policy: Alternatives for the South African Electricity System."
[87] Department of Mineral Resources and Energy, 2020, "Electricity Regulation Act Regulations: New Generation Capacity: Amendment."
[88] Erasmus, 2021, "The Big Switch-off: This Is EThekwini's Vision to Dump Eskom," *Daily Maverick*; BusinessTech, 2021, "Stellenbosch Wants to Be the First Municipality in South Africa to Leave Eskom and Load Shedding Behind."
[89] BusinessTech, 2021, "Cape Town Says It's Ready to Leave Eskom and Load Shedding behind – but Needs National Government to Catch Up."
[90] Sustainable Energy Africa, Urban-Econ, and Sustainability Institute, 2018, "Low- and Middle-Income Grid-Connected Solar PV Approaches in South Africa: Discussion Paper."
[91] Strydom and Morar, 2018, "Rooftop Solar: While Municipalities Focus on Feed-in Tariffs, a Much Larger Problem Persists," *Sustainability Institute* (blog); Daniel, 2021, "You Can Sell Excess Solar Power Back to Govt – but It May Take around 7 Years to Break Even," *Business Insider SA*.
[92] Modelling for the Coalition by the Stockholm Environment Institute. See Annex 1 for a detailed methodology.
[93] Modelling for the Coalition by Vivid Economics. See Annex 2 for a detailed methodology.
[94] These estimates of annual returns and net present value are sensitive to discount rates, energy prices, learning rates, and other factors. Job creation estimates are only indicative and include direct, indirect and induced full-time equivalent jobs. For a detailed methodology and data sources, see Annex 2: https://urbantransitions.global/urban-opportunity/seizing-the-urban-opportunity/annexes/.
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This report should be cited as:

Coalition for Urban Transitions. 2021. "Seizing South Africa's Urban Opportunity." World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group. London and Washington, DC. Available at: https://urbantransitions.global/en/publication/seizing-the-urban-opportunity/

ACKNOWLEDGEMENTS

Co-authored by: Marion Davis, Britta Rennkamp, Shagun Mehrotra, Robin King, Alfredo Redondo, Anna Kustar, Christopher Gillespie, Freya Stanley-Price, Jessica Hanlon, Leah Lazer, Nick Godfrey (Programme Director), Pandora Batra, and Sophia Vitello.

With guidance, support and contributions from Stefanie Chetty, Anton Cartwright, Hastings Chikoko, Sithole Mbanga, Rogier van den Berg, Andrea Fernández, Andrew Steer, Angelo Angel Gomez, Ani Dasgupta, Catlyne Haddaoui, Giulia De Giovanni, Kalpa Taylor, Kerry LePain, Larissa da Silva, Manisha Gulati, Mark Watts, Rachel Spiegel and Tom Lindsay.

This report was written in consultation with the South African Department for Cooperative Governance and Traditional Affairs as well as the African Centre for Cities to whom we give special thanks for their invaluable guidance.

Modelling and related analysis were conducted by the following researchers:

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Expert reviewers

Our warm thanks to the many Coalition members and partners who reviewed and helped shape this report:

Aditi Maheshwari (UN Secretary-General's Office, Climate Action Team), Anjali Mahendra (World Resources Institute), Aykut Mert Yakut (Economic & Social Research Institute), Aziza Akhmouch (Organisation for Economic Cooperation and Development), Daniel Schensul (UN Secretary-General's Office, Climate Action Team), Harriet Tregoning (World Resources Institute), Helen Civil (The Resilience Shift), Juliet Mian (The Resilience Shift), Laura Malaguzzi Valeri (World Resources Institute), Mario Finch (World Resources Institute), Matthew Coghlan (UN Secretary-General's Office, Climate Action Team), Neelam Singh (World Resources Institute), Philipp Rode (LSE Cities), Rebecca Laberenne (The Resilience Shift), Seth Schultz (The Resilience Shift) and Tadashi Matsumoto (Organisation for Economic Cooperation and Development).

Reviewers from Her Majesty's Government—Department of Business, Energy, and Industrial Strategy, Cabinet Office and the Foreign, Commonwealth & Development Office—provided local expertise, guidance and support throughout this project as part of a consultation process with the COP26 high-level champions team and diplomatic actors in the six focus countries.

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PARTNERS

The Coalition partners listed endorse the general thrust of the arguments, findings and recommendations made in this report.*

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This material has been funded by the UK government; however, the views expressed do not necessarily reflect the UK government's official policies.

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