



African Green City Index

Assessing the environmental performance of Africa's major cities

A research project conducted by the Economist Intelligence Unit, sponsored by Siemens



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Expert advisory panel

A panel of global experts in urban environmental sustainability advised the Economist Intelligence Unit (EIU) in developing the methodology for the African Green City Index. The EIU would like to thank the panel for their time and valuable insight.



David Wilk
Climate Change Lead Specialist, Sustainable Energy and Climate Change Unit,
Inter-American Development Bank

David Wilk joined the Inter-American Development Bank (IDB) in early 2001 as an urban environmental senior specialist, with extensive international experience in the fields of land use and environmental planning, watershed management, sustainable urban transport, and environmental assessment of urban and regional infrastructure projects. At IDB, Mr Wilk led the development of the Environment Strategy and Policy (2003), the Sustainable Energy and Climate Change Initiative (SECCI) and the SECCI Funds (2007-08). More recently, Mr Wilk spearheaded the Climate Change Strategy (2011), a number of climate change policy-based loans in Mexico and Peru, and technical assistance programs for institutional strengthening and technical support for climate change adaptation and mitigation throughout Latin America and the Caribbean. He is part of the Sustainable and Emerging Cities Platform that will promote sustainable actions and climate resilience in mid-size cities in the region.



Mary Jane C. Ortega
Secretary General CITYNET

Mary Jane C. Ortega is the former mayor of the city of San Fernando, Philippines, and served the city from 1998 to 2007. She is now the secretary general of CITYNET, a network of 119 member cities and NGOs that works to improve living conditions in human settlements in Asia-Pacific. She was the charter president of the Solid Waste Management Association of the Philippines and was recently re-elected as president. Ms Ortega was a member of the executive committee of the United Nations Advisory Council on Local Authorities (UNACLA) from 2000 to 2007 and received the UN Habitat Scroll of Honour Award in 2000. She was recently elected member of the board of directors of Clean Air Initiatives-Asia (CAI-ASIA).



Hiroaki Suzuki
Lead Urban Specialist and Eco² Team Leader,
Corporate Finance Economics and Urban Department, World Bank

Hiroaki Suzuki has more than 20 years of operational experience in the infrastructure sector and public sector at the World Bank. Having worked in the East Asia and Pacific region as East Asia urban sector leader and China urban sector coordinator for the last five years, he joined the bank's Corporate Finance Economics and Urban Department in 2009 as lead urban specialist and Eco2 team leader. Mr Suzuki is the main author of "Eco2 cities: Ecological Cities as Economic Cities" (www.worldbank.org/eco2).



Pablo Vaggione
Founder, Design Convergence Urbanism

Pablo Vaggione is an urban specialist with over 15 years of experience. His cross-sector and multidisciplinary approach provides cities and actors in urban development with strategically integrated plans to respond to the challenges of sustainable urbanisation. He has worked in East and South-East Asia, Western Europe, and Latin and North America in the preparation of city development strategies, plans for the regeneration of historic urban areas, and blueprints for new districts. He is the lead author of the upcoming UN Habitat Guide for City Leaders on Urban Planning. Mr Vaggione was part of the team of the city of Madrid that received the World Leadership Award in 2007. Between 2007 and 2010 he served as the secretary general of the International Society of City and Regional Planners (ISOCARP), a professional organisation of planners from 70 countries.



Sebastian Veit
Senior Climate Economist African Development Bank

Sebastian Veit is senior climate economist at the African Development Bank. He is currently serving as the specialist on energy, environment and climate change in the bank's west Africa region, based in Dakar. While at the organisation he has focused on green growth strategies in Africa and renewable energy issues. In 2007 Mr Veit was a consultant to the United Nations Framework Convention on Climate Change and from 2004 to 2007 he was a consultant with the World Bank in Washington DC. At the World Bank he specialised in energy and water.



Nicholas You
Chairman, Steering Committee of the World Urban Campaign, UN Habitat

Nicholas You is chairman of, amongst others, the Cities and Climate Change Commission of the World Future Council, and the Assurance Group of the Urban Infrastructure Initiative of the World Business Council for Sustainable Development. After devoting a large part of his professional career to helping urban poor communities, he initiated UN Habitat's Best Practices and Local Leadership Programme as a means to help cities and urban communities learn from each others' success stories in meeting the social, economic and environmental challenges arising from rapid urbanisation. He was subsequently appointed senior policy and strategic planning adviser of UN Habitat, and spearheaded a major institutional reform plan. To help implement that plan, he was asked in January 2009 to lead UN Habitat's World Urban Campaign. Upon his retirement from the UN in July 2010, some 50 partners representing public, private and civil society institutions worldwide elected him as chairman of the Campaign's Steering Committee. Mr You was recently appointed as a member of the board of the African Medical Research Foundation (AMREF).



Introduction

African Green City Index

Africa's urban transition – approaching a tipping point

Africa is urbanising faster than any continent in the world, a distinction it has held for several decades. It started with a low absolute number of city dwellers, however, so even after large percentage increases in urban migration, it still remained mostly rural. That balance is starting to shift and the continent is approaching a tipping point. The number of urban residents more than doubled in the last two decades to over 412 million and they currently account for 40% of Africa's population, according to the United Nations Population Division. Within the next decade there will be more urban residents in Africa than in any other continent except Asia. And by 2035 the total number of those living in the continent's growing cities is expected to double again to 870 million, at which point half of all Africans will live in urban areas.

Growth will be particularly strong south of the Sahara. Lagos and Kinshasa, currently the 18th and 29th most populous cities in the world, will by 2025 have vaulted to 11th and 12th place,

respectively, easily surpassing Africa's current largest city, Cairo. In percentage terms, medium-sized cities will grow even faster. In the next ten to 15 years the populations of Dar es Salaam and Nairobi could double, and Addis Ababa is expected to grow by over 60%. More generally, according to UN Habitat*, cities in sub-Saharan Africa with a current population of 1 million or more will grow at an average rate of 32% over the next ten years. The only exceptions are the South African cities and Congo-Brazzaville (capital of the Republic of Congo).

Such expansion would be difficult to manage even with the best urban governance, yet too often African cities suffer from unplanned sprawl. The region has the highest proportion of city dwellers in informal settlements in the world. Infrastructure is stretched to its limits, with an urgent need for more reliable supplies of electricity and water, and services such as waste management and sanitation. According to UN Habitat's recent report on the state of African cities, "Not a single African government can afford to ignore the ongoing rapid urban transi-

tion. Cities must become priority areas for public policies."

With African governments focussing on so many urgent challenges – from health and security to unemployment and inequality – some may question whether they have the time or resources to devote to the daunting project of improving urban environments. However, those involved intimately with the continent's development over the years say that action on environmental sustainability must go hand-in-hand with solutions to the continent's social and economic problems. "Sustainable development policies at the city level in Africa are far from being a 'nice-to-have option'," says Nicholas You, chairman of the Steering Committee of UN Habitat's World Urban Campaign, in an interview for this report. "These policies will ultimately determine Africa's capacity to ensure sustainable development for society as a whole."

The African Green City Index, a research project conducted by the Economist Intelligence Unit, sponsored by Siemens, seeks to give gov-

ernments and other stakeholders in the region insight and understanding into these pressing environmental challenges. To do so, it measures and assesses the environmental performance of 15 major African cities across a range of criteria, and highlights green policies and projects that other cities can learn from.

This report presents the most important findings and highlights from the Index. It is divided into five parts: **First**, it examines the overall key findings. **Second**, it looks into the key findings from the eight individual categories in the Index: energy and CO₂, land use, transport, waste, water, sanitation, air quality and environmental governance. **Third**, the report presents the highlights of a variety of green initiatives under way across the continent. **Fourth**, it gives a detailed description of the methodology used to create the Index. **Finally**, an in-depth profile for each city outlines its particular strengths, challenges and ongoing environmental initiatives. These profiles rightly constitute the bulk of the report because the aim of the study is to share valuable experience.

What the Index measures: Evaluating cities with limited data

The 15 cities selected for the African Green City Index are capital cities as well as leading business centres chosen for their size and importance. The cities were picked independently rather than relying on requests from city governments to be included, in order to enhance the Index's credibility and comparability. Another decisive factor in the selection was the availability of data. Some large population centres, such as Kinshasa in the Democratic Republic of the Congo, with a population of roughly 9 million people, and Khartoum in Sudan, with about 5 million, or Algiers, Algeria, at about 3 million, had to be excluded due to a significant lack of available information.

The methodology, described in detail in a separate section in this report, has been developed by the Economist Intelligence Unit (EIU) in cooperation with Siemens. It relies on the expertise of both organisations, a panel of outside experts, and the experience from producing Green City Indexes for Europe, Latin America, Asia, and the US and Canada. There are 25 individual indicators for each city, and these indicators are often based on multiple data points. Each city is assessed in eight categories and placed within a performance band to indicate its relative results. The process is transparent, consistent, replicable, and reveals sources of best practice.

Obtaining consistent, reliable and accurate data on environmental performance across Africa is a substantial challenge. For example, key figures such as population numbers are disputed and accurate urban GDP figures do not exist for many leading cities. The EIU considered carefully whether to include each of the 12 quantitative indicators that appear in the African Green City Index. These data points came from transparent, reliable sources. The EIU chose indicators according to whether they could be compared across all 15 cities in the Index. For example, concentrations of air pollutants such as nitrogen oxide, sulphur dioxide or particulate matter may be available for some cities, but because they were not available for all 15 cities, they were excluded. The same was true for indicators included in previous regional Green City Indexes, such as the share of waste properly disposed of or the share of wastewater treated in the city. In the energy category, only electricity consumption figures from the electricity grid were available and could be incorporated. This only reflects part of the overall energy consumption. For example, diesel generators are common in many Index cities to generate electricity during blackouts or in the absence of access to the grid, but no comprehensive figures about this form of energy consumption exist. Thus, the Index does not include the amount of electricity or CO₂ emissions produced by diesel generators. Regarding informal settlements, it could not always be determined whether and to what extent informal settlements were covered in published data sources. In the end, the EIU made the judgment that it was necessary to include the best available data in an environmental index of African cities, even if coverage of informal settlements could not be exactly or uniformly defined. Full details are available in the methodology section.

Thirteen of the 25 indicators in the African Green City Index are qualitative assessments of each city's policies, regulations and ambitions – for example, its commitment to reducing the environmental impact of energy consumption, developing green spaces and conservation areas, reducing congestion or recycling waste. Data limitations in Africa mean that the African Green City Index relies more on qualitative assessments of policies than previous regional Indexes. Policies indicate commitments to reduce environmental impacts and for that reason, the rankings in the African Green City Index are weighted more toward an assessment of a city's potential future environmental performance than previous Indexes.

Finally, data limitations for African cities raise an important point for the future of sustainability efforts on the continent as a whole. Effective policy making depends on accurate information and improved information gathering must be a priority along with other sustainability efforts. Africa-based specialists agree: "There is a need to set up programmes to develop, access and use environmental data on African cities," says Alfred Omenya, professor of architecture at the University of Nairobi and an expert in urban planning and climate change. "Currently, this data is captured in a fragmented way by all sorts of agencies. More importantly, there is no system to ensure it can be used to deal with urban sustainability challenges."

* UN Habitat, The state of African cities 2010: Governance, inequality and urban land markets, November 2010.

Results

African Green City Index



Overall results

well below average	below average	average	above average	well above average
Dar es Salaam Maputo	Luanda Nairobi	Addis Ababa Alexandria Cairo Lagos Pretoria	Accra Cape Town Casablanca Durban Johannesburg Tunis	

Category results

Energy and CO₂

well below average	below average	average	above average	well above average
	Cape Town Durban Maputo Nairobi Pretoria Tunis	Alexandria Cairo Dar es Salaam Luanda	Accra Casablanca Johannesburg	Addis Ababa Lagos

Transport

well below average	below average	average	above average	well above average
Luanda	Accra Addis Ababa Dar es Salaam Maputo Nairobi	Alexandria Casablanca Lagos	Cairo Cape Town Durban Johannesburg Pretoria Tunis	

Water

well below average	below average	average	above average	well above average
Luanda	Alexandria Maputo	Accra Cairo Dar es Salaam Johannesburg Lagos Nairobi Pretoria Tunis	Addis Ababa Cape Town Casablanca Durban	

Air quality

well below average	below average	average	above average	well above average
	Addis Ababa Dar es Salaam Luanda Maputo Nairobi	Alexandria Cairo Lagos	Accra Cape Town Casablanca Durban Johannesburg Pretoria Tunis	

Land use

well below average	below average	average	above average	well above average
Luanda	Alexandria Dar es Salaam Lagos Maputo	Accra Cairo Nairobi Pretoria Tunis	Addis Ababa Casablanca Durban Johannesburg	Cape Town

Waste

well below average	below average	average	above average	well above average
Dar es Salaam Pretoria	Cairo	Accra Addis Ababa Casablanca Johannesburg Luanda Maputo Nairobi	Cape Town Durban Lagos Tunis	Alexandria

Sanitation

well below average	below average	average	above average	well above average
Dar es Salaam Maputo	Addis Ababa Pretoria	Alexandria Cairo Cape Town Johannesburg Lagos Luanda Nairobi	Accra Casablanca Durban Tunis	

Environmental governance

well below average	below average	average	above average	well above average
Luanda	Addis Ababa Dar es Salaam Maputo Nairobi	Alexandria Cairo Casablanca Lagos Tunis	Cape Town Durban Johannesburg Pretoria	Accra



Overall key findings

African Green City Index

There is no single leader in the Index. Six cities score above average, with South African and North African cities outperforming the rest.

None of the 15 cities in the Index placed in the highest possible band of “well above average”, suggesting that even the best-performing cities in the continent have room to improve their environmental footprint. Among the six “above average” cities, two groups, those from South Africa and those from North Africa, perform better than sub-Saharan cities (excluding South Africa), for reasons set out below.

South African cities: good with governance
Three of the six above average cities are South African – Cape Town, Durban and Johannesburg. On quantifiable metrics such as electricity consumption, waste generation and water con-

sumption, none of them perform very well and indeed they have among the highest CO₂ emissions from electricity in the Index, mainly because they remain highly dependent on coal to produce electricity.

But they more than make up for drawbacks on consumption with consistently strong envi-

ronmental policies – the Index’s qualitative assessments of the strategies, codes and plans to monitor and improve the urban environment. Cape Town, for example, has established a comprehensive Energy and Climate Change Action Plan to improve green performance in many of the eight Index categories. In land use particu-

larly, it places well above average for the strength of its policies to contain urban sprawl and protect green space. Durban and Johannesburg also generally perform well for environmental policies. As the city portraits in this report demonstrate, when it comes to governance, the South African cities have strong local structures in place. While in many of the North African and sub-Saharan African cities policy is run from afar at the national or provincial level, South African cities have city departments, often under the direction of a city council, to directly oversee and implement policies at the urban level.

Africa experts say South Africa’s attention to environmental policies can be attributed mainly to its level of economic development. Carole Rakodi, Africa specialist and professor emeritus at the University of Birmingham’s School of Government and Society, notes that the environmental challenges of South African cities are starting

to resemble those more familiar in Western countries. “They have working services and can solve the most basic problems – water supply, waste management, human health, that whole round of things that go together,” she says. “Now they are starting with the next round of sustainability problems.” These include the need for more environmentally conscious resource consumption, smarter planning, limiting the reliance on dirty fossil fuels and increasing recycling.

Professor David Simon, head of the geography department at the University of London, and expert on urban sustainability in Africa and other developing regions, adds that stronger environmental policies have been a key part of the post-Apartheid reforms. “South African cities have been able to use the political capital of post-Apartheid reconstruction to address the environmental problems that were part of that legacy,” he says. These problems included deliberately designing black townships on the periph-

eries of cities, far away from basic municipal services.

North African cities: Connecting residents to water and power

Although North African cities do nearly as well as South African ones in overall performance, their strengths are different. In policy terms, they tend to do slightly worse. In the environmental governance category, for example, all of the South African cities score above average and all of the North African ones are average. However, regarding access to services North African cities tend to do better. The two above average cities in the Index from North Africa, Casablanca and Tunis, for example, are very strong on access to electricity, potable water and sanitation, with rates approaching 100%. Cairo and Alexandria, although average overall, have strong access figures as well. Tunis in particular has been proactive in recent years in connecting

Overall results: South African and North African cities lead the Index

well below average	below average	average	above average	well above average
Dar es Salaam Maputo	Luanda Nairobi	Addis Ababa Alexandria Cairo Lagos Pretoria	Accra Cape Town Casablanca Durban Johannesburg Tunis	
■ South African cities	■ North African cities	■ Sub-Saharan cities		



households to the electricity grid. The city has also invested heavily in its light rail and suburban trains. In Casablanca, the authorities handed over management of key services such as electricity provision, water, waste management and sanitation services to private contractors in 1997. The move has not been without its critics but the city can point to successes in access and service quality over that time. The uprisings around the Arab world have also led to a renewed sense of optimism that more democratic, responsive governments will continue to accelerate improvements.

Most sub-Saharan African cities struggle in the Index, reflecting different challenges compared with their neighbours in the north and south.

In a different league

None of the sub-Saharan cities (excluding South Africa) except Accra finished better than “average” overall. Two cities, Dar es Salaam and Maputo, were even “well below average”. They face social, economic and environmental problems that are in a different league from North African and South African cities. Dar has enor-

mous environmental challenges to overcome, particularly in waste and sanitation. In the absence of regular waste collection, many residents simply burn their waste. And although more than half of the population has access to some form of sanitation, only an estimated 7% of households are connected to the sewer system and only an estimated 10% of sewage is treated before being released. Likewise, in Maputo a significant percentage of the population lacks access to basic services for water, waste management or sanitation. These two cities also have among the highest percentage of their populations living in informal settlements, at an estimated 70% for Maputo and an estimated 68% for Dar, compared with the Index average of 38%.

Africa specialists confirm that these issues exist across the sub-Saharan region to varying degrees. Ms Rakodi notes that for many cities in the region the problems include “not having a working water supply, extremely poor sanitation, and a complete inability to deal with waste management or manage the process of land use change.” She adds that in contrast, South African municipalities have a high level of autonomy and considerable resources of their own.

Some North African cities are similar. In sub-Saharan Africa, she says, “city governments on the whole lack autonomy and, even when they have it, city politics are unstable and shaky.”

Brown versus green

In the sub-Saharan region, the environmental emphasis is on the so-called “brown agenda”, which focuses on human health and poverty reduction, as distinguished from the “green agenda”, which looks to improve the sustainability of ecosystems. The two agendas should go hand in hand, as Mr You of UN Habitat’s World Urban Campaign (see interview, page 20) and others have pointed out, but Mr Simon of the University of London notes that the immediate demands of survival in sub-Saharan cities tend to prevent a focus on sustainability. “One reason why environmental issues are often not prioritised by political elites is that, by definition, sustainability is a long-term issue, requiring investment now for a longer-term benefit in a resource-constrained environment. If you have a queue outside your office with people struggling to meet basic needs of food, shelter, and water, those sorts of immediate priorities trump longer-term ones.” In addition, the climate change agenda is sometimes viewed with suspi-

cion when it comes from outside Africa. Still, the effects of climate change on Africa – from impacts on crop production to natural disasters – could be devastating in the long term, and the challenge will be to find the right balance between addressing immediate and longer-term problems.

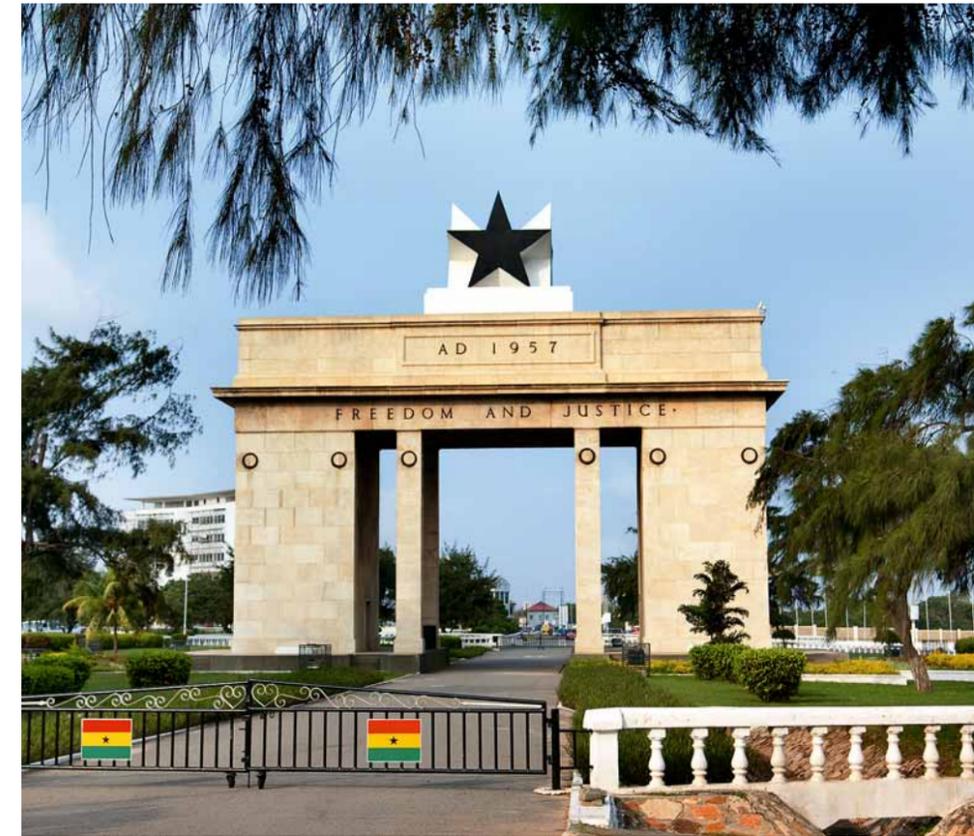
Good performance in the Index is strongly correlated with fewer people living in informal settlements. What explains the link?

Among the 15 Index cities, the average percentage of the population living in informal settlements is nearly 40%, but this includes a wide range, from an estimated 15% in Casablanca to an estimated 70% in Maputo. It turns out that there is a strong correlation in the Index between a city’s environmental performance and the percentage of residents living in informal settlements. In brief, the fewer residents in a city living informally, the better the city performs.

The impact of wealth on environmental performance is unclear

One possibility is wealth. In other Green City Indexes, there is a frequent connection between higher per capita GDPs and better environmental performance. Unfortunately, consistent data on per capita GDP was unavailable across the 15 African Index cities. Still, South African cities have fewer informal settlements on the whole than in the rest of the continent, which seems to indicate a relationship between wealth and the presence of informal settlements. But UN Habitat reports that North African cities have made strides in reducing the numbers of informal urban dwellers through more effective policies, independent of economic growth. So at best, the link between the presence of informal settlements and wealth is unclear at this point.

In fact, in cities in the developing world, increasing wealth does not necessarily solve environmental issues, and can indeed often lead to more sustainability challenges, especially with regard to resource consumption. “While institutional frameworks and governance need resources,” says Mr Omenya of the University of Nairobi, “the reverse, that the presence of resources will automatically lead to better management of environment, is not true ... As cities in Africa have grown and become richer, their environments have degenerated.” Anton Cartwright, an economist at the African Centre for Cities in Cape Town, agrees: “The notion that you can grow your way from poverty to greenness is questionable,” he says. “Wealth does make the provision of formal water and sanitation services affordable, but this is a small proportion of greenness. For the rest, in Africa,



Index results: Spotlight on Accra

Although six of the seven sub-Saharan cities (excluding South Africa) finish average, below or well below average overall, Accra comes in above average. What sets it apart from other sub-Saharan cities?

Accra’s standout category in the Index is environmental governance, where it ranks well above average relative to its Index peers. It has strong scores for environmental management, with structures in place for local assemblies to work with the national government in implementing policies. It also scores relatively well for environmental monitoring and policies on public participation. In addition, the city has policies in place addressing air quality and sanitation, and has a high rate of renewable energy – 74% comes from hydropower.

Africa specialists said that although policies may be in place for the city, which is an indicator of their performance in the future, they are not necessarily a complete reflection of the current situation on the ground. A recent UN Habitat profile of the city found that it suffers from an “urban divide” between the rich and poor. Policies, it seems, have not always turned into practical action, especially in terms of delivering municipal services to poorer residents.

However, Accra has received considerable outside investment in transport, water and sanitation infrastructure from the World Bank and the European Commission in recent years. Residents in Accra’s informal settlements are also more likely to have “tenure” (a form of land ownership), which provides more access to municipal services and encourages residents to upgrade facilities themselves. Although Mr Omenya of the University of Nairobi would caution against calling Accra “above average” on anything but the relative scale of the Index, he says, “Accra does have unique attributes that may enable it to outperform most of the sub-Saharan African cities, especially because of security of tenure.”



indeed, while informal settlements have many environmental problems, he suggests, “they also have high density, low CO₂ emissions, low water consumption, high levels of resource efficiency and relatively high levels of collective coherence compared to atomistic suburbs.”

To improve urban environmental governance, political power needs to be decentralised, but in many regions of Africa, the reverse is happening.

Experts agree that decentralisation of power from the national to the local level is crucial for effective planning, but the path to get there is difficult. Mr Simon says one of the elements of success can be political will. He notes that Lagos State has been active in improving urban infrastructure and the environment. Lagos State – the state is in effect the metropolitan government – in particular has a growing reputation for addressing “things which were in a parlous state, in particular relating to sanitation, environmental aesthetics, and remediation generally. There has been dramatic change.” Indeed, for sub-Saharan cities, adds Susan Parnell, professor at the African Centre for Cities at the University of Cape Town, “the big error is to assume that they are not powerful. They have control over some of the most critical levers of change, sometimes unwittingly, things like land use management.”

Unfortunately, according to Edgar Pieterse, director of the African Centre for Cities at the University of Cape Town, there is a trend towards national governments taking more authority over decisions about cities. “In many countries there has been a recentralisation of functions; and very seldom, except for South Africa, has there been adequate fiscal decentralisation to match functional devolution,” he says. “This goes to the heart of the governance question.”

The Index raises many questions about the future challenges of sustainability in Africa, from providing basic services to poor residents, to upgrading and integrating informal settlements or even working to give the “green” agenda the same priority as other pressing necessities. But experts agree that addressing the green agenda – and convincing public officials that they need to address it along with the other issues they face – will be the crucial task in the years to come. “Urban sustainability is not a luxury; it is a time bomb,” Mr Omenya says. “The issues of poverty, under-development and governance are now becoming increasingly urbanised. This is where the battle for progress in African countries must be located.”

more affluence currently correlates with more emissions, more urban sprawl, lower density, more cars.”

Governance is key

The Index suggests another factor may be at work: good governance. Experts say the institutional ability to run a city efficiently and intelligently matters more than wealth or the level of economic development. This idea is powerful on a continent where many cities may wait decades for the kind of wealth levels common in other

regions of the world, but where environmental challenges cannot wait.

Dr Joan Clos, Executive Director of UN Habitat and former mayor of Barcelona, suggests that institutional capacity is the first step: “The cities need political institutions that can take the lead in urban planning and design” he says. “Once you have that, investment, job creation and improving quality of basic services for citizens will come.”

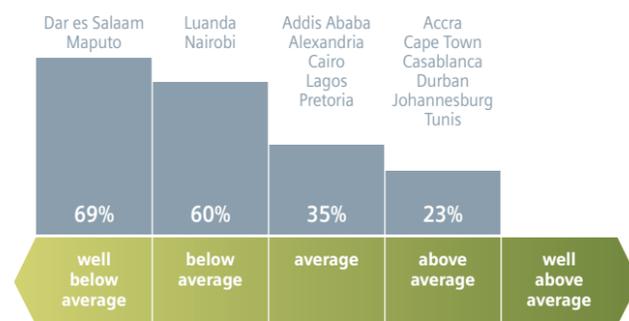
“Governance is key, and more importantly, for the way the city plans and approaches ‘infor-

mality,’” says Mr Omenya. He adds that there are regional differences for how African cities cope with informal settlements: South Africa has relatively well planned informal settlements. In West African cities, they are mainly undisputed tribal lands, which the owners are able to upgrade themselves and which receive basic infrastructure and services. Eastern Africa, on the other hand, tends to have informal settlements set on public land. These are targets for eviction rather than upgrades, and as Mr Omenya adds, “they hardly attract good policy and programmatic interventions.”

The cutting edge of policy: Blurring the lines between informal and formal neighbourhoods

Current thoughts on informal settlements take the idea of “upgrades” even further, actually eliminating the distinction in the city between “formal” and “informal”. Indeed, it is often difficult to distinguish between the two in some places, as cities begin to deliver municipal services to these neighbourhoods. “Planning and governance in African cities no longer sees this dichotomy as relevant,” Cartwright says. And

Percentage of residents living in informal settlements by overall result bands



Action for today: Low-cost priorities to aid urban sustainability

Although some environmental strategies do cost money, certain policies – such as obtaining energy from existing landfill sites or providing legal protection for waste pickers – cost relatively little but can make an immediate difference. What low-cost improvements would be most beneficial for African cities?

“It is about policies and programmes,” says Mr Omenya of the University of Nairobi. “For example, power consumption can be limited by having good controls on development. Good planning can ensure that in areas with adequate daylight solar power can be used to remove domestic consumers from the national grid. Good planning and development controls can ensure that rainwater harvesting takes place and people are not travelling long distances across the city, polluting the environment in their wake. Currently planning seems to overtly support unsustainable consumption.” He suggests the following policies should be low-cost priorities for African cities:

- Slum upgrading policies
- Rainwater harvesting
- Effective public transport policies that promote non-motorised transport
- Open space systems, conservation of urban greenery and buffer zones
- Waste management policies
- Development control, planning and land use policies
- Domestic clean energy policies promoting, for example, solar energy



Key findings from the categories

African Green City Index

Energy and CO₂

The results in energy and CO₂ highlight the varying levels of economic development on the continent, particularly between South Africa and the other sub-Saharan African cities in the Index. The performance of the four South African cities (Cape Town, Durban, Johannesburg and Pretoria) is held back because CO₂ emissions from electricity consumption are substantially higher than in the other 11 cities and they have among the highest per capita electricity consumption figures in the Index. However, they perform much better for energy policies. It should be noted that due to data limitations, this category was only able to take into account energy in the form of electricity, and had to exclude power sources such as diesel generators, for example, or liquid fuels, which are prevalent in many African cities.

→ The average amount of CO₂ emissions from electricity consumption for the South African cities is 3 tonnes per person, more than five times the figure for North African cities (Tunis,

Casablanca, Cairo and Alexandria) and 60 times the figure for the other seven cities in sub-Saharan Africa (Accra, Addis Ababa, Dar es Salaam, Lagos, Luanda, Maputo and Nairobi). This reflects the differences in sourcing electricity. South Africa is mainly dependent on coal, while the other cities largely rely on natural gas and hydropower.

→ On policy, however, South African cities are among the best performers. Johannesburg, the only South African city to finish above average in the category, combines high policy scores with the lowest electricity consumption among the four South African cities.

→ All of the seven sub-Saharan cities (excluding South Africa) in the Index have very low levels of electricity consumption. On average, they consume 2.3 gigajoules per person annually compared with 9.9 gigajoules for the other eight cities in the Index. This, combined with the widespread use of hydropower in these countries (on average 69% of electricity generation), leads to low CO₂ emissions. On average

cities emit 49 kg of carbon per person from electricity each year.

→ The four North African cities have relatively high electricity consumption and access levels, with much of their electricity generated through natural gas. This combination puts their resultant annual CO₂ emissions from electricity consumption at 570 kg per person on average. Their policies are also relatively weak: none of these cities obtains full marks for any energy policy indicator.

→ In general, exact data for CO₂ emissions is lacking since they are not directly measured. CO₂ figures for the Index had to be estimated.

Land use

African Index cities have had some success in maintaining green space but are generally marked down for low-density sprawl and the significant numbers of residents living in informal settlements.

→ On average the 15 African Index cities have 74 square metres of green space per person,

which is nearly double the figure for the Asian Index, at 39 square metres, but less than the figure for the Latin American Index, at 255 square metres per person.

→ In some cases, this may be more a result of good fortune than policy. Only eight of the 15 African Index cities receive full marks for their green space protection policies. And only three of the five cities with the most green spaces in the Index have these policies. In addition, only four get full marks for protecting environmentally sensitive areas. Without more stringent policies, population growth is likely to threaten their green space.

→ Urban sprawl is an issue in African Index cities. The 15 cities have an average population density of about 4,600 people per square kilometre. Cairo, at 19,100 people per square kilometre, is the densest city in the African Index, and without it, the average density falls to 3,500 people per square kilometre. In contrast, the 22 major cities evaluated in the Asian Green City Index have an average population density of

8,200 people. And only four African cities receive full marks for policies to address urban sprawl.

→ A more pressing problem is when sprawl takes the form of informal settlements. Even though every city in the Index has some sort of slum redevelopment policy, on average 38% of Index city populations remain in informal settlements. According to UN Habitat, Africa as a whole has the most people living in informal settlements in the world. The organisation also reports that North African cities have made substantial progress in reducing the percentages in recent decades. For example, Casablanca has the lowest figure for the entire Index, at an estimated 15%. But dramatic population growth expected for sub-Saharan Africa threatens to exacerbate the situation in many cities.

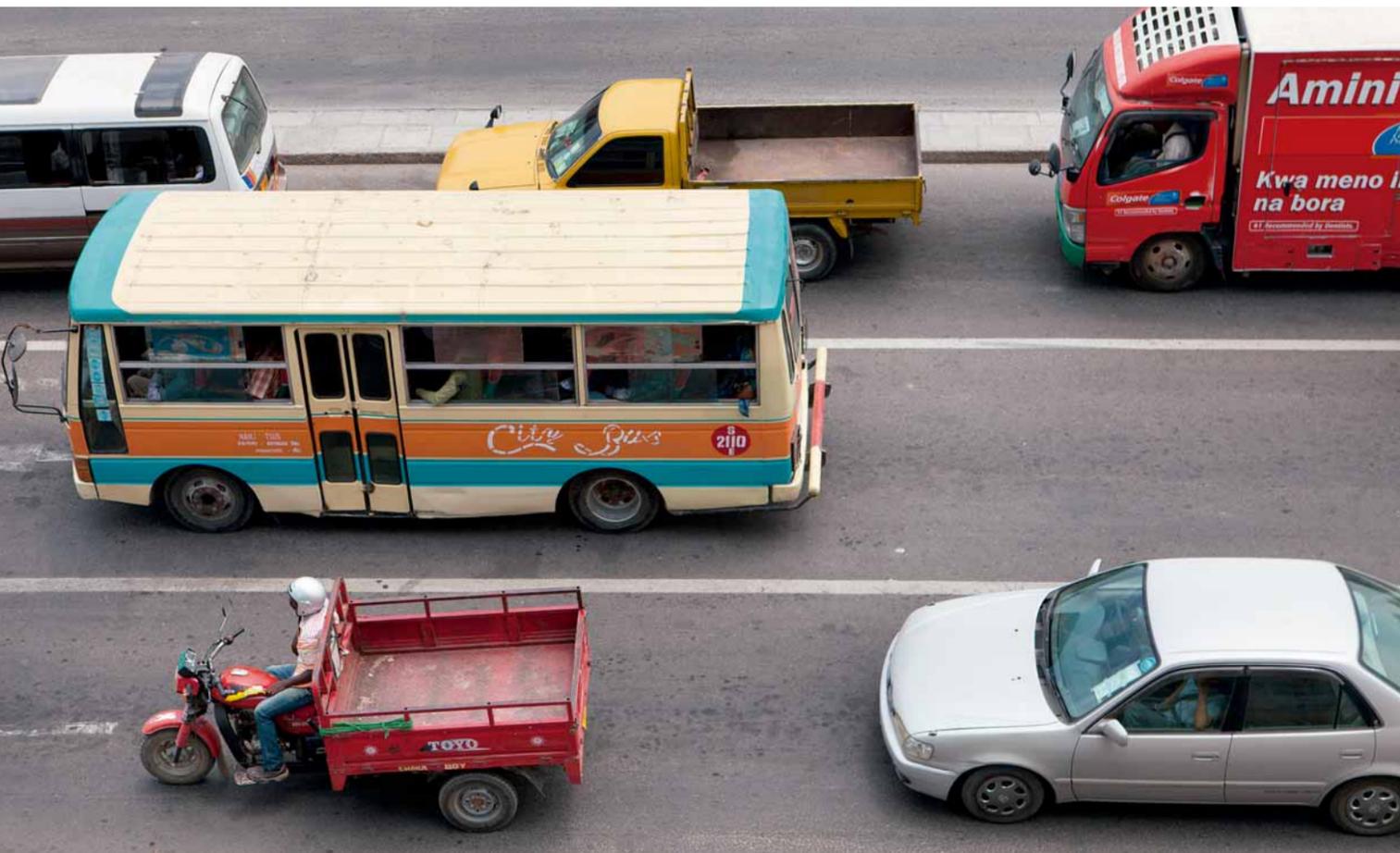
Transport

Given the resources needed to build and maintain a public transport network, it is no surprise that many African Index cities do not have exten-

sive advanced systems such as metro lines. The Index shows that cities could improve in policy areas though, for example by establishing more initiatives to reduce traffic congestion. It should be noted that the public in African cities relies extensively on private transport – taxis and private minibuses, for example, and these forms of transport could not be included in this category due to lack of data.

→ On average the 15 African Index cities have 2.7 kilometres of public transport (official bus lines) per square kilometre. They also have an average of 0.07 kilometres of superior transport networks, defined as metros, trams or bus rapid transit lines. This is shorter than in the Latin American Index, at 0.1 km per square kilometre, and Asia, at 0.2 km.

→ A related difficulty is a lack of consistency in mass transport policies. No city has a completely integrated pricing system for its public transport system. Only Cairo gets full marks for investments to reduce emissions from urban mass transport. And just three cities – Cape Town,



Dar es Salaam and Tunis – receive full marks for promoting greener forms of transport such as walking or cycling.

→ Congestion reduction measures such as car-pooling lanes, no-car days or toll roads are mostly missing. Only park-and-ride schemes have been adopted by seven of 15 cities and traffic light sequencing is present in 12 Index cities.

Waste

African cities vary widely in figures for waste generation and many cities could benefit from more active policies. However, there are hopeful signs in the area of recycling.

→ Waste production figures vary between 160 kg per capita each year in Addis Ababa and more than 1,000 kg in Pretoria. On average, residents of African Index cities generate 408 kg of waste per capita. This figure is less than the Latin American Index average of 465 kg, but more than the Asian Index average, at 375 kg. However, comparisons across continents should be

treated with caution because in Africa it is often unclear to what extent figures include waste produced in informal settlements.

→ Recycling is becoming more common on the continent. Nine cities have on-site collection or central collection points, and one more city, Dar es Salaam, has plans for central collection points. Plastics are recycled, or soon will be, in 14 Index cities, paper in 13 cities and glass in 11.

→ Waste policies, such as an overall waste management strategy or environmental standards for landfills, are less widespread. Just Alexandria, Cairo and Cape Town get full marks for having a strategy aimed at reducing, reusing and recycling waste in place, and only Alexandria – the one city in this category to finish well above average – regulates waste pickers (residents who informally scavenge for recyclables and reusable items).

Water

Water consumption is relatively low in African cities. But this is likely a reflection of factors

such as more limited access to piped water and high prices, which are issues for most cities in the Index. On a policy level, cities' codes covering water quality and conservation could be strengthened.

→ African Index cities consume on average 187 litres per person per day, less than in the Latin American Index, at 264 litres or the Asian Index, at 278 litres.

→ The average level of access to potable water in the African cities is 91%, although the definition of access for Africa does not necessarily mean water piped directly to households or a 24-hour supply, and can include access to a communal tap, for example.

→ Leakage rates are high, at 30%, although not as high as for the Latin American Index, at 35%. The average for the Asian Index was 22%. It is unclear to what extent leakages or unaccounted-for water in informal settlements are taken into account in the African city data.

→ Strong water policies are not widespread. For example, only seven of 15 cities receive full

marks for improving surface water quality; just five get full marks for monitoring water quality, and only two fully enforce water pollution standards for local industries.

→ Robust water efficiency initiatives, such as public promotion of conservation or grey water recycling, are also not very common. The exception is metering or tariffs, which are in place or planned for 14 of the 15 Index cities.

Sanitation

Sanitation access rates vary widely, from an estimated 49% in Maputo to an estimated 99% in Casablanca. In addition to the need to improve access, in general most cities face challenges in implementing sanitation codes and policies as well as treating wastewater before discharging it.

→ On average 84% of residents of African Index cities have access to sanitation, although as with access to potable water, definitions of access to sanitation do not always include household connections to the sewerage system.

The type of access also varies widely across the Index cities.

→ On policy African cities tend to lag behind. Only four cities are given full marks in the Index for having a code covering sanitation standards and infrastructure. Thirteen cities have wastewater treatment standards in place and conduct some monitoring, but only six score full marks for their efforts in these areas.

→ There is also a lack of enforcement of the existing policies. For example, only Tunis has regular monitoring of on-site treatment facilities in homes or communal areas, whereas ten cities have very limited monitoring or do not monitor these sites.

→ Figures on the share of wastewater treated were not available throughout the 15 African cities, but in several cities only a small percentage of the sewerage is treated before being discharged into the rivers or sea.

Air quality

There is no emissions data in many African cities,

so unlike in previous Green City Indexes, the air quality category in the African Index is evaluated only on the basis of policies. Regarding these regulations, the more developed cities in South Africa tend to be more active, while in much of sub-Saharan Africa, air quality appears to receive relatively little attention from governments.

→ All cities in South Africa finish above average in this category, with each gaining full marks for their air quality codes and pollution monitoring, and all but one for setting standards for specific pollutants.

→ Six of the seven sub-Saharan cities (excluding South Africa) are not covered by an air quality code and five of the seven do not conduct monitoring.

→ The four North African cities are slightly less active than South Africa, but Casablanca and Tunis are still above average and the other two, Cairo and Alexandria, fall into the average band in this category.

→ Comprehensive, comparable data on air quality was not available to include in the African Green City Index. Yet individual studies and evidence from experts suggest that even when policies are in place African cities face huge challenges in actually reducing pollution, which often reaches unhealthy levels.

Environmental governance

Environmental policy in African Index cities tends to be set at the national, state or provincial level, instead of at city level, which means that in general environmental issues receive less attention than if they were overseen locally. The four South African cities are notable for their relative independence to manage the environment at the urban level. In general, even if policies are in place, execution of those policies can be lacking.

→ Eleven of 15 Index cities are covered by a dedicated environmental department, although this is often a national or state-level body. Where these departments exist, they usually have a wide remit typically covering most or all of the environmental areas evaluated in the Index.

→ Five cities publish environmental performance data regularly, and five cities have also completed wide-ranging baseline environmental reviews. Efforts in these areas in the remaining cities are partial or non-existent.

→ All but one city involve citizens, non-governmental organisations and other stakeholders in some way, however limited, in making environmental decisions.

→ Citizens interested in engaging with the authorities face difficulties in getting better data. Only two cities get full marks for ease of access to information and ten cities receive no marks.

“Far from a nice-to-have option”:

Green policies are central to economic and social progress in African cities



An interview with Nicholas You, sustainable urban development expert

The path to greener cities, says Nicholas You, requires rethinking how we manage them. Holistic planning too often suffers from a sector-by-sector approach across competing jurisdictions, and policymakers fail to see the city as a single entity. Mr You, based in Nairobi, is chairman of the Steering Committee of UN Habitat’s World Urban Campaign, a platform for private and public organisations to share sustainable urban policies and tools. He also leads several other global sustainable development initiatives, and served on the expert panel that advised the Economist Intelligence Unit (EIU) on the methodology for the African Green City Index. He spoke to the EIU about the results of the Index, the difficulty of measuring the environmental impact of informal settlements and the necessity to administer cities as “living organisms”.

Africa faces many complex and difficult challenges. In this context, urban environmental sustainability could be seen as “nice-to-have” or even irrelevant until other more pressing problems are solved. Given the continent’s many challenges, how much attention should officials give to urban environmental sustainability?

Africa is the most rapidly urbanising region in the world. It is undergoing a radical transformation in the way it uses land, water and energy, as well as food production, consumption and distribution. This transformation requires a concerted set of social, economic and environmental policies that places the city and urbanisation at the centre of the agenda. Drought and flooding may or may not be directly caused by human activity, but the resulting famine, human displacement and impoverishment are a direct consequence of poor planning and risk management; inadequate infrastructure and services; inefficient markets and regulatory mechanisms; just to mention a few. These urban functions are critical to sustainable development in both the cities and rural environments. Sustainable development policies

at the city level in Africa are far from being a “nice-to-have option”. These policies will ultimately determine Africa’s capacity to ensure sustainable development for society as a whole.

Although wealth is important for environmental performance, what kinds of initiatives or activities can lower income cities undertake to improve their environmental performance?

In economic terms, cities in lower income countries have the most to gain from adopting environmentally sound and sustainable policies and practices. Such initiatives can substantially reduce waste, improve efficiency, and create jobs and income-generating opportunities. A typical example is waste recycling and reuse. In many cities in developing countries, this is carried out by scavengers working and living in deplorable conditions. The right mix of policies, participation and empowerment could result in win-win situations whereby waste is recycled into usable products; methane is captured to produce green energy; and the scavengers no longer have to work in life-threatening conditions.

Are there any practical policy improvements in Africa that can make a large impact without costing too much money?

One of the most compelling policy initiatives that is transforming the lives of millions of people as we speak is mobile banking in Kenya. The regulatory authorities in Kenya have had the foresight to allow Kenyans to transfer money, for a nominal fee, through mobile phones. This has made transactions accessible to millions of people who were excluded by conventional banking practices. This initiative has procured immeasurable social and economic benefits for all, and at minimal cost. One can only hope that lessons learned from this policy initiative, in terms of deregulation and empowerment, will be applied to other sectors such as energy and water.

In other regions covered by the Green City Index series (eg, Europe, Asia, the Americas) more wealth is linked to better environmental performance. In the African Green City Index, however, where income levels are well below other parts of the world, there seems to be a strong link rather between good governance and

environmental performance. To what extent do you think better governance is related to improving the environment in Africa’s cities?

Wealth creation and governance go hand-in-hand and, as we have seen in other regions, as societies become wealthier, people demand better quality of environment. While many countries in Africa are experiencing appreciable rates of economic growth, this is largely the result of those countries having adopted more liberal and pro-business policies within the last decade. This “dividend” will not last forever. In order to sustain economic growth and ensure equitable benefits of that growth, better governance is required. There should be no distinction between improving urban environmental sustainability, lifting people out of poverty and empowering people to take part in decisions affecting their livelihoods.

How can African cities make their consumption more sustainable as they grow richer?

It is about consuming more intelligently, with less waste and less energy intensity. Rapid growth has many potential advantages, especially in African cities which have yet to create the infrastructure they need for today and tomorrow. Proper planning and well-informed technology choices – integrating the full benefits of smart growth, smart infrastructure and smart services, for example – could allow these cities to leapfrog more mature societies. But smart technologies also require smart systems, including better governance.

Informal settlements clearly affect a city’s environmental footprint and some cities in the African Green City Index have more than half of their populations living informally. Yet by their nature, informal settlements are not well covered by statistics. How exactly do informal settlements affect the environmental performance of a city?

Informal settlements are, by definition, unsustainable. They represent a high degree of social and economic exclusion. Milton Santos, one of the most advanced thinkers of his time, said that poverty is the worst form of pollution. In-

formal settlements are living proof that we are not planning our cities well.

Often statistical agencies and city authorities report high levels of access to basic services, such as potable water, waste collection and sanitation, when the situation on the ground may be very different because of the presence of informal settlements. What are the challenges in trying to get an accurate picture through data?

If you are looking at indicators, such as water consumption per capita or waste generation per capita, and leave out informal settlements, you’re leaving out part of the picture. The water company has a remit, and the sewage company has a remit, and their remits do not typically include informal settlements. They may rightly say “100% coverage”, while the city as a whole may drop down to 70% access. Since the Green City Index is comparative within a region, that is, comparing African cities with each other, the distortion won’t be that serious. If we compare across regions, for example, between Africa and Asia, we have to be a little more careful. Let me give you an example. A slum in Nairobi has piped water supply to within 50 metres of households. People theoretically have access to piped water supply, but when the water is only switched on at certain times of the day, you begin to see that people are queuing up for water for hours. There is a gender issue as well. Most of the people in the queue are older women and young girls. If young girls are waiting to fetch water, they are not going to school, which leads to a snowball effect. Another example: slums in Nairobi may have one toilet for 200 people – a statistician will say they have access to sanitation.

Can we identify any common approaches in the way cities are addressing the challenge of informal settlements?

I believe that we are beginning to see an emerging pattern which favours upgrading buildings and services in informal settlements, as opposed to removal and demolition. Slums are communities with their own social, cultural and economic networks. A lot of the reason why

people don’t move from the informal settlement is because it provides them with access to jobs, or services they would otherwise have to pay considerably more for. Also, in terms of location, they are ideal. Most slums started their life located on the margins of the city. Over time, with rapid growth, the slum actually finds itself located in the middle of the city. Removal or relocation of informal settlements is also asking people to move from a neighbourhood where they have lived a good part of their life, if not their whole life.

What can national governments in Africa do to support cities in their efforts to achieve environmentally sustainable growth?

The most important step that national governments in Africa should take is the formulation of a national urban policy. They should also give a dedicated government ministry the responsibility for executing the policy. For the moment only a handful of African countries have adopted urban development policies and, even in some of those countries, the responsibility for monitoring, reporting and implementation remains split between different government entities. The result is poor coordination and poorly informed decision making.

What are the most important steps that cities in Africa and the rest of the world have to take to become more environmentally sustainable?

We have to take planning seriously. I don’t mean ‘sectoral’ planning, where each sector – water, energy, waste, sanitation – plans independently. We must look at the city or the metro region as a whole. Competing jurisdictions are one of the biggest obstacles to sustainable urbanisation. Most metropolitan areas cut across many jurisdictions, with different elected bodies and local government structures. You could be busy trying to green your city, but half of the population that depends on your city may fall under different planning and regulatory regimes, and service providers that are engaged in establishing the next shopping mall, the next golf course, the next suburb. The city is a living organism that needs to be managed as a single entity, and just like any living organism, it needs to develop holistically.



Best green initiatives

African Green City Index



Energy and CO₂ : Reducing the carbon footprint in Cape Town

Cape Town's below average score in the energy and CO₂ category comes in part from the second highest rate of electricity consumption in the Index, but even more from the type of energy it uses to meet this demand: 93% of the city's electricity comes from coal. The result is that Cape Town's annual per capita emissions from electricity consumption, at an estimated 4,099 kg, are more than four times the Index average of 984 kg. To a large degree the causes of Cape Town's problems are beyond its control. Eskom, the company that dominates South Africa's power generation, still relies mainly on coal, although with the support of the national government it has recently begun to look for cleaner sources of fuel.

What makes the city unique is its impressive efforts to address its carbon footprint. Cape Town, with the best clean energy policies in the Index, began early. In 2003 it was the first African city to create an Integrated Metropolitan

Environmental Policy, which set a vision and strategy to improve in several areas such as waste management, open spaces and energy policy. In 2006 it adopted a Climate Change Strategy (updated in 2010), which includes more than 100 projects around the city and renewables targets. The city's efforts start with energy conservation. Its goal is to reduce electricity consumption by 10% by 2012. Efforts to meet this target include an electricity saving campaign aimed at individuals, the creation of an Energy Efficiency Forum for business, and substantial retrofitting of the city's own building and traffic lights.

Cape Town has also made commitments to renewable energy, with a target to derive 10% of its power from renewables by 2020. At the domestic level, it has launched a programme to install 300,000 solar water heaters over the next four years. The city has also built the country's first commercial wind farm, which started feeding clean energy into the national grid in 2008. The Darling wind farm will soon not be so

unique. The provincial government of Western Cape (Cape Town is the capital of the province) is considering applications to build 40 more wind farms in the province.

Highlights from other cities:

Accra: Ghana's national government, which oversees environmental policy throughout the country, remains committed to hydropower as its main renewable power source. However, the state-owned power company, the Volta River Authority, has also initiated a project to generate 100 megawatts of wind and solar power by the end of 2011 through the installation of solar plants in three northern regions of Ghana and a coastal wind farm.

Lagos: Although efforts are in the early stages, officials have been looking at ways to capitalise on global carbon-credit trading schemes such as the Kyoto Protocol's Clean Development Mechanism, under which developed countries can invest in developing nations in exchange for carbon emissions credits. As part of this the Lagos

State Environmental Protection Agency has established a Carbon Credit Centre to deal with carbon credit consultations, transactions, applications and trading, and also to promote potential clean energy deals.

Pretoria: During the past two years the city has installed more than 12,000 solar water heaters in a number of communities in the metropolitan area through an investment by the national Department of Energy. As well as reducing energy consumption and associated emissions, the water heaters have no cost apart from their initial installation and are popular among lower-income households.

Land use: Combining social, economic and environmental revitalisation in Johannesburg

Ten years ago the heart of Johannesburg had many dangerous, dilapidated neighbourhoods and business generally stayed away. Since then a dramatic turnaround has taken place in no small part due to the work of the Johannesburg

Development Agency (JDA). The city set up the agency in 2001 with the remit to regenerate decayed inner city areas, and promote economic development and quality of life. The agency's work has integrated urban environmental improvements with social and economic development. Environmentally, the agency's efforts are helping to curb urban sprawl by drawing residents back to the rehabilitated city centre. In these central neighbourhoods, the city has built new mixed-income houses, has increased access to municipal services and extended the public transport network, including bus rapid transit.

The JDA has brought together a wide range of stakeholders and city departments on its projects. In particular, it has focussed on using the existing assets of neighbourhoods in order to create a vibrant city. The regeneration in the Constitution Hill neighbourhood, for example, used the new home of the country's Constitutional Court as an anchor. The Jeppestown Station Precinct Project created a more secure area

friendly to pedestrians, revived an existing transport interchange and drove business to the local market.

Perhaps the best known JDA project was the transformation of Newtown, an inner-city area that had the feel of a derelict wasteland. As first steps, the agency boosted the sense of security in the neighbourhood by installing closed-circuit television cameras and refurbishing public buildings. It continued by improving access through projects such as the now iconic Nelson Mandela Bridge. In addition, more than 2,000 housing units have been built or are planned. The core of the redevelopment is an investment in culture, refreshing the historic Market Theatre and attracting visitors to Museum Africa, the country's national history museum. The JDA's efforts are creating urban neighbourhoods that are attractive to business as well as to individuals. In 2009 it estimated that the Constitution Hill and Newtown projects had each received around US\$300 million in private investment after regeneration efforts began.



Highlights from other cities:

Addis Ababa: The city master plan calls for reforestation of surrounding mountains, the recovery of existing city parks and the establishment of new ones. The most significant new green space will be a pedestrian linear park winding some 5 km through the city centre.

Casablanca: In the past two years officials have been running pilots throughout the metropolitan area to test the viability of “urban agriculture”, which incorporates green space into urban centres and provides another food source for the city. The project receives funding from the German government’s Ministry of Education and Research.

Nairobi: The Kenya Wildlife service in partnership with private companies is managing the Green Line Project, an initiative to plant forest along 30 km of the perimeter of Nairobi National Park in the south of the city. The hope is to create a visible boundary between the park and surrounding new developments, and to discourage lobbying by developers to cut slices off the park.

Dar es Salaam: The Aga Khan Foundation, an international non-governmental organisation, is trying to introduce traditional Swahili building methods, which include using shade and breezes to cool buildings, and using local mud and thatch instead of imported steel and glass. Although these will be difficult to realise on a large scale, some of the principles of Swahili architecture can help show the way for superior and greener new developments.

Transport: Investing billions in the public transit network in Cairo

Traffic in Cairo has a bad reputation. Roughly 80% of intersections in central Cairo and Giza are saturated, the city has a high accident rate, especially among pedestrians, and public transport is under-developed by international standards. However, Cairo is above average among the 15 cities in the African Green City Index for the length and relative sophistication of its metro system. The city has the only substantial metro system. And the national government, which oversees environmental policy in Egypt, is

trying to address its transport problems through investments and new policies.

To begin with, the metro is in the middle of a US\$3.7 billion extension that will create two east-west lines to complement the existing ones that run broadly north-south. Construction of phase one of a third line began in 2006 and a second phase started in 2009. The first phase is due to open in January 2012. The ministry of transport expects that when the second phase is complete within the next two years, the capacity of the whole metro system will rise from 2.5 million passengers daily to 4.5 million. Moreover, the government is upgrading and extending the nearly century-old tram system and this may involve connections with the metro.

Buses will also see improvement. Egypt has received funding for the Urban Transport Infrastructure Development Project from the World Bank. Initially, this will involve replacing the existing energy inefficient buses with 1,100 compressed natural gas ones. The first 200 of these took to the road in June 2010, with the rest scheduled to appear by 2012.

Finally, the Carbon Finance Vehicle Scraping and Recycling programme aims to get nearly 50,000 taxi drivers with vehicles more than 20 years old to replace them with new ones. So far the scheme has been very successful, with 20,000 vehicles replaced in 2009 alone. This is the first transport programme in the world to be registered with the UN Framework Convention on Climate Change’s Clean Development Mechanism. There is no one solution to making Cairo’s transportation sustainable, but progress on a wide number of fronts should slowly help.

Highlights from other cities:

Johannesburg and Pretoria: The high-speed train line, the Gautrain, which links downtown Johannesburg to Pretoria, is already operational and work is underway on one final station. For Pretoria, the new service offers a long-awaited alternative to driving between the cities and will greatly reduce the amount of traffic.

Tunis: The city is investing US\$2 billion in public transport network improvements. In November 2008 the city completed a 6.8 km extension to the

light rail network in the south of the city and a 5.3 km western extension was completed in December 2009. Two further extensions are also under way. An additional suburban network is planned by 2016. The city also has plans to introduce 14 new bus rapid transit corridors, totalling 90 km.

Lagos: In March 2008 bus rapid transit was introduced by the Lagos State government in conjunction with the private sector. This was promoted as an affordable, reliable and safe means of travelling while significantly reducing congestion on the city’s roads. The buses, running in dedicated lanes, can reduce journey times by 30%. In 2010 there were 220 buses in operation. In its two years of operation 120 million passengers have used the system, reducing carbon emissions by an estimated 13%.

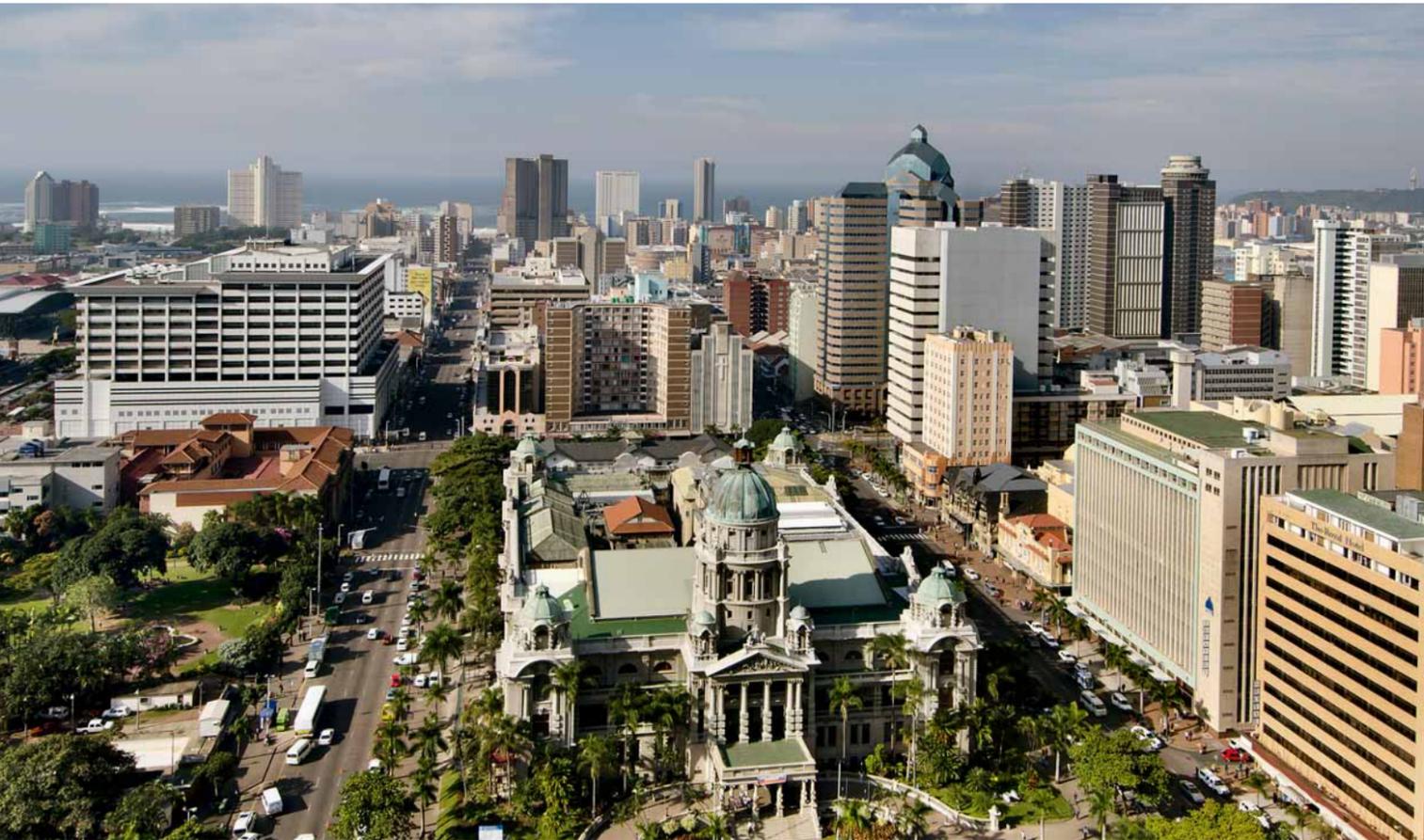
Waste: Lagos turns waste into wealth

Before 2005 the amount of waste piling up on the streets of Lagos regularly led commentators to talk of a crisis. The situation has improved to such an extent that when former US President

Bill Clinton came to the city in April 2011, he praised the great strides that the state government had made in this area.

The challenge of waste management remains, but the government has been actively implementing a new strategy through its re-branded department, the Lagos Waste Management Authority (LAWMA). Under LAWMA’s waste-to-wealth programme, waste is treated not only as a problem but as a potential asset. As a result, currently around 10% of the city’s waste is converted to other uses. Programs include recycling facilities that turn 30 tonnes a day of plastic and nylon waste into shopping bags, among other items. A paper waste processing plant recycles 10 tonnes of waste daily.

The effort has only just begun. The state government hopes to nearly triple the rate of waste conversion to 35% by 2015. It recently announced that it would be setting up 1,000 recycling banks around the city. To deal with what residents leave in these containers, a new recycling facility will be built in cooperation with the Clinton Climate Initiative. When complete, it will be able to



recycle or compost 300,000 tonnes of solid waste annually. By tackling waste aggressively, Lagos has become not only a better place to live, but a more sustainable one.

Highlights from other cities:

Cape Town: The city has a number of ongoing initiatives and plans to reduce waste generation: For example, it is running a pilot scheme in some suburbs to have residents separate waste from recyclables before collection. There is also an internet-based Integrated Waste Exchange website, which allows businesses and the public to exchange potentially useful waste materials. And the city has published a detailed Smart Living Handbook encouraging residents to reduce, reuse and recycle waste in their homes.

Maputo: In 2007 the city piloted a waste management project in informal settlements that lack paved roads. The city contracted with micro-enterprises to collect household waste on foot, going door-to-door with plastic bags. By December 2010 the program was extended to include the majority of the informal neighbourhoods, according to city officials.

Alexandria: In August 2011 the national government in partnership with Korean investors opened a new chemical waste management plant in Alexandria. The plant is the first of its kind in the region to deal primarily with mercury waste, which is found in fluorescent lamps. The government first proposed the plant in 2007 to combat the problem of mismanaged mercury disposal, which is harmful to plant life and fish. According to the national government Egypt produces 40 million fluorescent bulbs annually and 8 million are discarded as general waste.

Durban: In a bid to increase recycling and create local income, informal waste-pickers are allowed to rummage through the Bisasar Road landfill site for items they perceive to be of value. They can then sell their items at various buy-back centres, which are run by both private recycling companies and the city.

Water and sanitation: International agencies invest in African cities

Delivering clean water and sanitation services to urban households is one of the continent's biggest challenges. Many cities in the Index are

receiving assistance from outside agencies to invest in plans and policies for long-term advances. Here are highlights of some of these programmes:

Accra: In 2006 the European Commission spearheaded a strategic planning process for urban water management and involved multiple stakeholders. This process culminated in an integrated vision and planning document released in April 2011, which called for a target of 100% access to uninterrupted water supply in the city by 2030. The European Commission also helped define a 2030 vision for improved sanitation in Accra, calling for increased access to acceptable sanitation and emphasising the importance of improved coordination among the municipal assemblies in greater Accra.

Alexandria: A major research project known as SWITCH Urban Water, funded by the European Commission, has provided an assessment of Alexandria's water requirements and examined options for meeting expected demand up to 2037. The project aims to reduce extractions from the Nile by 20%. The research looked at a range of options to better meet Alexandria's

water requirements, including improved water efficiency and the upgrading of wastewater plants.

Dar es Salaam: UN Habitat has run several initiatives in the city in the past decade, including a programme to identify and protect the city's water sources. A key element is a campaign of water education for Dar es Salaam residents that provides a clearer understanding of the value of conserving water.

Maputo: The improvement of sanitation services is a priority of the World Bank-funded PROMAPUTO plan over the next five years. The city is in the process of developing a Citywide Sanitation Strategy through consultation with donors and non-governmental organisations. Though strategies and plans have proliferated at the national level, a city sanitation strategy is a necessary first step to creating synergy among public officials, communities and non-governmental organisations.

Highlights from other cities:

Cairo: The Aga Khan Trust for Culture has undertaken a programme to rehabilitate water and

sanitation facilities in the Darb al-Ahmar quarter of Cairo's Old City. The sewerage system, which previously did not reach all the houses, has been extended, and lead pipes have been replaced.

Casablanca: Lydec, the city's private contractor in charge of water and sanitation services, has upgraded the city's water network and improved the supply of drinking water to a number of sectors. It has also implemented a programme to improve the wastewater network and eliminate the discharge of waste into the sea.

Durban: In 2000 the city's water service launched a sewage education programme in a bid to reduce damage to the city's sewerage network. The campaign, which includes toolkits, road shows and street theatre performances, appears to have had a positive impact, with blockages in the system down significantly. Durban's water department was invited to create a toolkit to be used in urban Kenya and then possibly elsewhere on the continent.

Environmental governance: Imagining a more sustainable Durban

Durban, already among the Index leaders in

environmental governance thanks to its large environmental management department, is also blazing trails by engaging civil society to build a long-term vision for the city. To that end, the city council introduced the Imagine Durban initiative on integrated, long-term planning. Imagine Durban is a comprehensive programme aimed at improving all aspects of life in the city from safety, accessibility and culture to environmental sustainability.

A wide range of goals have already been set in collaboration with citizens, non-governmental organisations and other civil society players. These include a 20-year target to become a zero-waste city and a goal to become carbon-neutral by 2050. Imagine Durban has created toolkits that advise businesses and individuals on how to reduce their carbon footprints. It also runs a Facebook page intended to engage a broader spectrum of local residents. The initiative is being implemented in conjunction with Sustainable Cities, a Canadian non-governmental organisation, and the PLUS Network, a network of 35 cities in the US, Canada, South America and around the world sharing experiences in sustainability planning.

Highlights from other cities:

Accra: As part of Ghana's participation in the UN Convention on Climate Change, the national environmental protection agency is preparing a national greenhouse gas inventory report that will identify greenhouse gas emissions from the different sources between 1990 to 2006. Work on the inventory began in 2008 and the report was expected to be released in late 2011. The results of the study will be used to develop a national climate change mitigation policy.

Luanda: In July 2010 the national Ministry of Environment began working on a national environment database as part of a project being financed by the African Development Bank; work on this is still ongoing.

Maputo: In 2011 the Maputo municipal council's environmental department launched an awareness campaign to educate students about the importance of protecting the environment. According to the department's director, representatives have visited most of Maputo's schools, highlighting the importance of planting trees and keeping beaches clean. The department also initiated a tree-planting programme in schools.

Nairobi: Numerous new technology initiatives are tracking Nairobi's environmental conditions. A government online data portal announced in July 2011 will allow Kenyans to identify spending on water and energy, and to keep track of the state of the hydropower dams that provide the city most of its energy.



Methodology

African Green City Index

The African Green City Index measures the environmental performance of 15 major African cities and their commitment to reducing their environmental impact. Cities were chosen with a view to representing major African countries, and include capital cities or leading business capitals selected on the basis of size, geographical spread and data availability. In cases where there was a significant lack of data relating to a city, the city was omitted from the ranking, as was the case with Algiers, for example.

The Economist Intelligence Unit (EIU) developed the methodology in cooperation with Siemens. An independent panel of international experts in the field of urban sustainability provided important insights and feedback on indicator selection. The methodology builds on the

work of previous Green City Indexes (Europe, Germany, Latin America, Asia, and US and Canada) and aims to closely follow their structure. However, to be applicable to Africa, the EIU has adapted the methodology to accommodate variations in data quality and availability, and environmental challenges specific to the region.

The Index scores cities across eight categories – energy and CO₂, land use, transport, waste, water, sanitation, air quality and environmental governance – and is composed of 25 individual indicators. Twelve of the indicators are based on quantitative data and aim to measure how a city currently performs – for example, its level of CO₂ emissions from electricity consumption, proportion of population living in informal settlements, level of waste production

and access to sanitation. The remaining 13 indicators are qualitative assessments of each city's policies, regulations and ambitions – for example, its commitment to reducing the environmental impact of energy consumption, development of green spaces and conservation areas, reducing congestion, and recycling waste.

Data collection
A team of contributors from the EIU collected data between April 2010 and May 2011. Wherever possible, the data were taken from publicly available official sources, such as national or regional statistical offices, local city authorities, local utilities companies, municipal and regional environmental bureaux, and environmental ministries. The data are generally for the year

2009-2010, and where not available, from previous years.

Data quality
The EIU made every effort to integrate the most recent and most comparable figures. The data providers were contacted in cases where uncertainties arose regarding individual data points. Despite all these steps, the EIU cannot rule out having missed an alternative reliable public source or more recent figures.

However, in comparison with other Green City Indexes, the availability and comparability of data across cities was far more limited in Africa. For example, in the air quality category, sufficient data on levels of air pollutants such as sulphur dioxide and nitrogen dioxide were not

available for all 15 cities, and therefore could not be included in the Index category "air quality".

Figures for access to electricity, potable water and sanitation were taken primarily from UN Habitat's State of African Cities report 2010. This source did not include data for all cities in the Index, and in this case other reliable, verifiable sources were used (these are included in the data tables within each city portrait). According to UN Habitat, some attempt was made to include "access" figures for informal settlements, but these remain estimates based on sampling. It is unclear and could not be determined whether the other published sources made an attempt to include informal settlements. In the end, the EIU made the judgment that including the best available data on access

was necessary in an environmental index of African cities, even if the definition of access and access within informal settlements for each source was not exactly or uniformly defined. Definitions of access in Africa do not imply convenient access or quality, and certainly do not necessarily imply piped supplies to every home. The EIU has reflected this in the city portraits.

The EIU found that cities use varying definitions for some of the data points. This applies in particular to definitions on green spaces, population living in informal settlements and water leakage. In all instances the team of researchers sought to standardise the definition used for the indicator to its maximum extent. However, the EIU cannot rule out that some differences may still exist amongst the data used.



In some cases where there were data gaps the EIU applied theoretically robust techniques to calculate estimates. Regarding the indicator on CO₂ emissions, for example, the EIU used international CO₂ coefficients provided by the UN Intergovernmental Panel on Climate Change to estimate the CO₂ emissions produced by the city's electricity consumption. The national electricity generation mix – as recorded by the International Energy Association – was generally used as a proxy for the city-level electricity generation mix.

Scoring of indicators

In order to compare data points across cities and to calculate aggregate scores for each city, the data gathered from various sources had to be made comparable. For this purpose the quantitative indicators were "normalised" on a scale of zero to ten, with the best city scoring ten points and the worst scoring zero. In some cases, reasonable benchmarks were inserted to prevent outliers from skewing the distribution of scores. In these cases, cities were scored against either an upper or a lower benchmark or both. For example, the EIU introduced an upper bench-

mark of 10,000 inhabitants per square kilometre for the indicator "population density" to prevent Cairo – a significant outlier – from skewing the distribution of scores.

Qualitative indicators were scored by EIU analysts with expertise in the city in question, based on objective scoring criteria that consider cities' targets, strategies and concrete actions. The qualitative indicators were again scored on a scale of zero to ten, with ten points assigned to cities that meet the criteria on the checklist. In the case of the "clean air policy" indicator, for example, cities were assessed according to whether they have a code or policy to sustain or improve local ambient air quality and the degree to which such codes are enforced.

Index construction

The Index is composed of aggregate scores of all of the underlying indicators. It is first aggregated by category – creating a score for each area of infrastructure and policy (for example, energy and CO₂ emissions) – and finally, overall, based on the total of the category scores. To create the category scores, each underlying indicator was

aggregated according to an assigned weighting. The indicators receive the same weighting within the respective categories. The category scores were then rebased onto a scale of zero to 100. To build the overall Index scores, the EIU assigned even weightings to each category score; that is, no category was given greater importance than any other. The Index is essentially the sum of all category scores, rebased to 100. This equal weighting reflects feedback from the expert panel.

Owing to concerns that the availability and quality of data are not sufficient enough to allow a detailed ranking of Index results, the African Green City Index results are presented in five performance bands. The cities were assigned to the five groups based on their underlying scores. These bands are built around the mean score and the standard deviation. The standard deviation is a statistical term which describes to what extent approximately 68% of the values differ from the mean. The bands are defined as follows:

Well above average: Cities score >1.5 times the standard deviation above the mean

Above average: Cities score between 0.5 and 1.5 times the standard deviation above the mean

Average: Cities score between 0.5 times the standard deviation below and 0.5 times the standard deviation above the mean

Below average: Cities score between 0.5 and 1.5 times the standard deviation below the mean

Well below average: Cities score >1.5 times the standard deviation below the mean

Clusters

In order to conduct a deeper analysis of city trends, the 15 cities in the Index were clustered based on population, area and density. These included:

→ Population: "small population", with a population below 3 million; "mid population", with a population between 3 million and 5 million; and "high population", with a population exceeding 5 million inhabitants.

→ Area: "small area", with an administrative area smaller than 500 square kilometres; "mid area", with an administrative area between 500 and 2,000 square kilometres; and "large area", with an administrative area larger than 2,000 square kilometres.

→ Density: "low density", with a population of fewer than 2,000 people per square kilometre; "mid density", with a population between 2,000 and 5,000 people per square kilometre; and "high density", with a population of more than 5,000 people per square kilometre.

List of categories, indicators and their weightings in the African Green City Index

Category	Indicator	Type	Weighting	Description	Normalisation technique*
Energy and CO ₂	Access to electricity	Quantitative	25%	Percentage of households with access to electricity.	Min-max.
	Electricity consumption per capita	Quantitative	25%	Total electricity consumption, in GJ per inhabitant (1 GJ = 277.8 kWh).	Zero-max.
	CO ₂ emissions from electricity consumption per capita	Quantitative	25%	CO ₂ emissions, in kg per capita.	Zero-max.
	Clean energy policy	Qualitative	25%	Measure of a city's efforts to reduce carbon emissions associated with energy consumption.	Scored by EIU analysts on a scale of 0 to 10.
Land use	Population density	Quantitative	25%	Population density, in persons per km ² .	Zero-max; upper benchmark of 10,000 persons per km ² inserted to prevent outliers.
	Population living in informal settlements	Quantitative	25%	Percentage of the population living in informal settlements.	Zero-max.
	Green spaces per capita	Quantitative	25%	Sum of all public parks, recreation areas, greenways, waterways, and other protected areas accessible to the public, in metres squared per inhabitant.	Zero-max; upper benchmark of 150 m ² per person inserted to prevent outliers.
	Land use policy	Qualitative	25%	Measure of a city's efforts to minimise the environmental and ecological impact of urban development.	Scored by EIU analysts on a scale of 0 to 10.
Transport	Public transport network	Quantitative	33%	Consists of two equally weighted sub-indicators: 1) Length of superior transport network, including bus rapid transit, trams, light rail and subway, in km per km ² of city area. 2) Length of mass transport network, including dedicated public and private bus routes, in km per km ² of city area.	1) For superior transport network: Zero-max; to prevent outliers upper benchmark of 0.2 km/km ² inserted. 2) For mass transport network: Zero-max.
	Urban mass transport policy	Qualitative	33%	Measure of a city's efforts to create a viable mass transport system as an alternative to private vehicles.	Scored by EIU analysts on a scale of 0 to 10.
	Congestion reduction policy	Qualitative	33%	Measure of a city's efforts to reduce congestion.	Scored by EIU analysts on a scale of 0 to 10.
Waste	Waste generated per capita	Quantitative	33%	Total annual volume of waste generated by the city, including waste not officially collected and disposed, in kg per capita per year.	Zero-max.
	Waste collection and disposal policy	Qualitative	33%	Measure of a city's efforts to improve or sustain its waste collection and disposal system to minimise the environmental impact of waste.	Scored by EIU analysts on a scale of 0 to 10.
	Waste recycling and re-use policy	Qualitative	33%	Measure of a city's efforts to reduce, recycle and re-use waste.	Scored by EIU analysts on a scale of 0 to 10.
Water	Access to potable water	Quantitative	20%	Proportion of population with access to potable water.	Min-max.
	Water consumption per capita	Quantitative	20%	Total water consumption, in litres per person per day.	Min-max; cities that consume between 50-100 l/capita/day score full points; cities that consume less than 20 l/capita/day score zero points because their consumption levels are below the UN standard for basic subsistence-level water requirements.
	Water system leakages	Quantitative	20%	Share of water lost in transmission between supplier and end-user, excluding illegally sourced water or on-site leakages, expressed in terms of total water supplied.	Zero-max.
	Water quality policy	Qualitative	20%	Measure of a city's policy towards improving the quality of surface water.	Scored by EIU analysts on a scale of 0 to 10.
	Water sustainability policy	Qualitative	20%	Measure of a city's efforts to manage water sources efficiently.	Scored by EIU analysts on a scale of 0 to 10.
Sanitation	Population with access to improved sanitation	Quantitative	50%	Share of the total population either with direct connections to sewerage, or access to on-site sources.	Min-max.
	Sanitation policy	Qualitative	50%	Measure of a city's efforts to reduce pollution associated with inadequate sanitation.	Scored by EIU analysts on a scale of 0 to 10.
Air quality	Clean air policy	Qualitative	100%	Measure of a city's efforts to reduce air pollution.	Scored by EIU analysts on a scale of 0 to 10.
Environmental governance	Environmental management	Qualitative	33%	Measure of the extensiveness of environmental management undertaken by the city.	Scored by EIU analysts on a scale of 0 to 10.
	Environmental monitoring	Qualitative	33%	Measure of the city's efforts to monitor its environmental performance.	Scored by EIU analysts on a scale of 0 to 10.
	Public participation	Qualitative	33%	Measure of the city's efforts to involve the public in environmental decision-making.	Scored by EIU analysts on a scale of 0 to 10.

* Cities score full points if they reach or exceed upper benchmarks, and zero points if they reach or exceed lower benchmarks.



Accra Ghana

African Green City Index

Background indicators

Total population (million)	2.3
Administrative area (km ²)	200
Population density (persons/km ²)	11,700

Accra is Ghana's capital city. Stretching along the Atlantic coast, the city covers just 200 square kilometres, which is the smallest administrative area among the 15 cities in the African Green City Index. Accra's estimated population of 2.3 million (extending to some 4 million when neighbouring urban agglomerations are taken into account) makes the city the second densest in the Index, behind Cairo. Although Ghana is viewed as one of sub-Saharan Africa's development success stories, many challenges remain for its capital. The city suffers from what UN Habitat calls an "urban divide" between the rich and poor, especially when it comes to accessing affordable housing and municipal services. Urbanisation was more sudden and rapid than Ghana's post-colonial government predict-

ed, and as a result the city was unprepared to meet the surging demand for housing and services.

Despite the visible challenges, Accra ranks above average overall in the Index. The city's standout category is environmental governance, where it ranks well above average relative to its Index peers, with strong scores for environmental management, monitoring and public participation. Other strong areas are air quality and sanitation, where it ranks above average, bolstered by air quality promotion and monitoring, and a robust policy aimed at promoting sanitation. Energy and CO₂ is another above average category for Accra, driven by a high rate of renewable electricity and low electricity consumption, but limited supplies and steep prices

have access to electricity, equal to the Index average, though residents in the city's numerous informal settlements typically pay three times more for electricity than do residents in wealthier neighbourhoods. Several projects are underway to increase Ghana's power-generation capacity. The national government has contracted with a Chinese company to build a new source of hydroelectric power – the Bui dam on the Black Volta River in the northwest region. The dam is scheduled for completion in 2013 and is expected to produce 1,000 gigawatt hours per year. Following the discovery of natural gas fields, the national government is also diversifying away from hydropower; the majority of power generation increases in the coming years will come from gas-fired power plants.

Green initiatives: Although the national government's main renewable priority is hydropower, the state-owned power company, the Volta River Authority (VRA), has also initiated a project to generate 100 megawatts of wind and solar power by the end of 2011 through the installation of solar plants in three northern regions and a coastal wind farm.

Land use: Average
Accra has the second highest population density in the Index, at 11,700 people per square kilometre, versus the Index average of 4,600. Over the past two decades officials have struggled to keep up with the sprawling metropolitan area, and the city's policies to contain sprawl and protect green spaces could be improved. An estimated 42% of the city's population lives in informal settlements, slightly above the Index average of 38%. There was no available data for the amount of green spaces per person in Accra, but there are pleasant green areas on the

city's fringes, which are used for urban agriculture and supply 80% of fresh vegetables in the city.

Transport: Below average
Public transport is extremely limited in Accra and the city's inhabitants rely heavily on private vehicles, primarily tro-tros (minivans). Some buses operate informally but few people use them, opting instead for smaller and more nimble vehicles to weave through the city's congested traffic. A lack of dedicated routes also limits the appeal of buses, although plans are in place to build a bus rapid transit route (see "green initiatives" below).

Green initiatives: In 2007 the national government adopted an urban transport policy, financed by the World Bank. One of its objectives is to promote more environmentally sustainable transport in Accra through the creation of a bus rapid transit (BRT) route in the city. The city began construction in February 2011 and the project is expected to be operational in 2012 serving about 12,000 passengers during peak hours.

Waste: Average
Accra generates an estimated 440 kg of waste per year on a per capita basis, just above the Index average of 408 kg. The city scores well for the range of materials it adequately disposes of and recycles, which includes household hazardous waste, paper and plastic. Accra also collects and adequately disposes of medical, chemical and construction waste. Yet unlike the city's middle- and high-income communities, which typically pay for house-to-house waste collection, residents in informal settlements have to carry their rubbish to container sites. The sites

partly explain the city's relatively low consumption. Accra's weakest category is transport, where it ranks below average, largely because of underdeveloped infrastructure and policies.

Energy and CO₂: Above average
An estimated 49 kg of CO₂ is emitted per person in Accra through electricity consumption, well below the Index average of 984 kg. The relatively low CO₂ emissions are due in part to a heavy reliance on renewable energy. Nearly three-quarters of Accra's electricity comes from hydropower. Electricity consumption per capita, at 2.6 gigajoules, is less than half the Index average of 6.4 gigajoules. However, supply limitations and high prices partly explain the relatively low usage. An estimated 84% of households

Performance



are few in number and often difficult to reach. Over the past few years, local groups have stepped up their demands for improved waste collection and disposal. In response, in 2010 the national government reaffirmed its commitment to increasing the private sector's role in handling waste and sanitation, and the private sector is making investments to improve the city's waste management system (see "green initiatives" below).

Green initiatives: The private waste collection company operating in Accra has nearly completed construction of a multi-million dollar waste processing plant in the city that will handle 1,200 tonnes of solid waste per day for sorting, recycling and composting. The plant is expected to be operational by March 2012.

Water: Average

An estimated 80% of Accra's residents have some form of access to potable water, compared

of water provided by these various merchants is not regulated, and water bought this way can cost five to ten times more than piped water. Accra's consumption rate, at 121 litres per person per day, is below the Index average of 187 litres, but the lack of supply is a clear factor. Regarding policies, the city has not embarked on any public promotional campaigns to encourage greater water efficiency. Accra has a relatively high level of water scarcity relative to other cities in the Index, leading it to source water from less sustainable sources such as imported bottled water. Accra is marked up in the Index, however, for having some measures in place to conserve water, such as regulations limiting the amount of water that can be taken from local lakes and rivers.

Green initiatives: The national government is investigating strategies to increase the distribution of piped water in Accra. In 2006 the European Commission spearheaded a five-year,

to sanitation facilities earn Accra an above average weighting in this category. Accra is covered by a code outlining strategies and policies to manage sanitation in the city, and the national government works with local agencies to implement the policies. The code is backed by public awareness campaigns around the efficient and hygienic use of sanitation systems. An estimated 88% of the city's population has access to some form of sanitation, more than the Index average of 84%. However, there is still much work to be done in improving the city's sanitation facilities. Accra's sewer system only covers a tiny part of the city, around the government ministries and central market. Moreover, the vast majority of the wastewater treatment plants associated with the sewer system either are not functional or are operating below capacity. Indeed, although Accra performs generally well in some of the policy areas covered in the Index, it is marked down for its monitoring of wastewater treatment plants. In addition, a

strategy to increase sanitation coverage over the next five to ten years.

Air quality: Above average

Unlike the majority of Index cities, Accra informs citizens about the dangers of air pollution. Air monitoring is also relatively rigorous. Checks are made at various locations throughout the city for levels of nitrogen dioxide, suspended particulate matter, suspended fine particulate matter and carbon monoxide. The transport sector, primarily consisting of the tro-tros, is the dominant source of air pollution in Accra. Authorities take air pollution seriously, particularly from the transport sector, and are taking steps to tackle the problem (see "green initiatives" below). The city benefits from the location of major industries in the neighbouring city of Tema, about 30 kilometres east of Accra.

Green initiatives: In 2006 the national Environmental Protection Agency (EPA) conducted

an assessment of carbon dioxide emissions from the transport sector. On the basis of this study, the agency drafted a plan for an annual vehicle certification regime that would include CO₂ emissions. The EPA is exploring collaborations with private companies in order to implement the plan. In addition, the government's bus rapid transit project aims to reduce air pollution from the transport sector.

Environmental governance: Well above average

Accra is the only city in the Index to place well above average in the environmental governance category. The city's local government works in partnership with the national EPA to implement environmental policies. The city's assembly has the power to implement environment-related regulations, and has a relatively wide remit, encompassing all the main category areas monitored by the Index, including sani-

tation, land use, informal settlements and waste management. In addition, each of those main category areas has been subject to a baseline review within the last five years. Accra provides public information on environmental projects and performance. The city also has a process to involve non-governmental organisations and other stakeholders in public meetings on projects that have a major environmental impact.

Green initiatives: One of Ghana's most noteworthy environmental initiatives is its participation in the UN Convention on Climate Change. As part of this process, the EPA is preparing a national greenhouse gas inventory report, which will identify greenhouse gas emissions by source from 1990 to 2006. Work on the inventory began in 2008 and the report was expected to be released in late 2011. The results of the study will be used to develop a national climate change mitigation policy.



with the Index average of 91%, and only about 40% have a supply piped into their homes. Just under a third of the water supply is lost due to leakages in the system, which is equal to the Index average. Rapid urbanisation combined with underinvestment in infrastructure has meant that many people must purchase water separately for washing and drinking from private and community service producers. These private vendors distribute water through several mechanisms: sachets (treated water in half-litre plastic sachets), which are sold in shops and on the streets; tanker services, which directly sell water to households from tanker trucks; and domestic vendors, who purchase water from tankers and resell it to households in smaller 15-litre to 20-litre containers. The price and quality

multi-stakeholder strategic planning process for urban water management. This process culminated in an integrated vision and planning document released in April 2011, which called for a target of 100% access to uninterrupted water supply in the city by 2030. Also, in 2011 an agreement was signed with the Export-Import Bank of China for a US\$270 million loan to double the capacity of the Kpong water treatment plant (on the Volta River, downstream of the Akosombo Dam) – an improvement that will increase the supply of piped water in Accra by 50%. The project is scheduled for completion in 2014.

Sanitation: Above average

The presence of sanitation policies evaluated in the Index and the relatively high level of access

large percentage of the sludge from the city's septic tanks is dumped untreated into nearby streams and the sea. Those living in informal settlements have to use public facilities, which are limited in number for the populations they serve.

Green initiatives: The European Commission-funded strategic planning process for urban water management defined a 2030 vision for improved sanitation in Accra, calling for increased access to acceptable sanitation by 2030 and emphasising the importance of improved coordination among the municipal assemblies in greater Accra. The national government, led by the Ministry of Water Resources, Works and Housing, is nearing completion of a

Quantitative indicators

Category	Indicator	Average	Accra	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	84.3 ^e	2003	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	2.6	2009	Ghana Energy Commission
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	49.2 ^{1e}	2009	Ghana Energy Commission
LAND USE	Population density (persons/km ²)	4,578.1	11,710.0	2000	EIU calculation
	Population living in informal settlements (%)	38.0	42.0 ^{2e}	2010	UN Habitat
	Green spaces per person (m ² /person)	73.6	0.0 ³	n/a	No data available
TRANSPORT	Length of mass transport network (km/km ²)	2.7	0.0 ⁴	2010	Metromass Transit Ltd
	Superior public transport network (km/km ²)	0.07	0.00 ⁵	2010	Metromass Transit Ltd
WASTE	Waste generated per person (kg/person/year)	407.8	439.8 ^{6e}	2010	Accra metropolitan assembly presentation
WATER	Population with access to potable water (%)	91.2	80.0 ^e	2007	International water management institute report
	Water consumption per person (litres per person per day)	187.2	121.0	2010	Aqua-Viten Rand Ltd
	Water system leakages (%)	30.5	30.0 ^e	2007	International water management institute report
SANITATION	Population with access to sanitation (%)	84.1	88.0 ^e	2007	International water management institute report

All data applies to Accra unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National electricity generation mix used to estimate city level CO₂ data. 2) National data used as proxy for city data. 3) Negative marking used. 4) There are no dedicated bus routes in Accra. 5) There are no subway, tram, light rail or BRT lines. 6) Accra Metropolitan Area



Addis Ababa_Ethiopia

African Green City Index

Background indicators

Total population (million) ^e	2.7
Administrative area (km ²)	500
Population density (persons/km ²) ^e	5,200

^e = EIU Estimate

Addis Ababa is the capital city of Ethiopia. It has one of the smallest administrative areas in the African Green City Index, covering 500 square kilometres. Combined with Addis Ababa's estimated population of 2.7 million, it is one of the densest cities in the African Green City Index, alongside Cairo and Accra. Unlike most other African cities, Addis Ababa has no colonial heritage; rather it was founded by the Ethiopian Emperor Menelik II in 1886 on a mineral spring. Today it is the headquarters for the African Union, an organisation promoting greater political and social-economic integration across the continent, and whose new skyscraper headquarters will open in 2012. A building boom is under way, but air quality, sanitation and public transport remain challenges for the city. Although eucalyptus forests on the Entoto

Mountains encircling the city are protected and provide a watershed, there is a lack of public green space.

Addis Ababa ranks average overall in the Index. The city's best category performance is in energy and CO₂, where it performs well above average. Water and land use are also strong areas in which Addis Ababa achieves above average ranks. On a per capita basis, it has one of the lowest water consumption rates and generates the least waste in the Index. CO₂ emissions from electricity consumption also fall below the Index average. The city ranks below average in transport, sanitation, air quality and environmental governance. Challenges here are an underdeveloped public transport network, one of the lowest sanitation access rates in the Index and limited policies to improve air quality.

Energy and CO₂: Well above average

Addis Ababa's performance in this category is driven by very low rates of electricity consumption and CO₂ emissions from electricity. Electricity consumption per capita is among the lowest in the Index, at 1.8 gigajoules, compared with the overall average of 6.4 gigajoules. Estimated CO₂ emissions per capita from electricity consumption are 16 kg per capita, versus the Index average of 984 kg. Nearly 90% of Addis Ababa's electricity is produced from renewable energy sources, the bulk of which is hydropower. An increase in dam construction is ensuring cheaper electricity to Addis and an estimated 97% of its households have access to electricity. Prime Minister Meles Zenawi is particularly proud of the proposal for the Renaissance Dam on the Nile, which he claims will supply enough electric-

ity for Addis to become a "green industrial city". However, critics say that Ethiopia's rush to hydropower may falter because of the difficulty in keeping prices affordable for customers. Blackouts and brownouts are less common than in other African cities, but some 85% of Addis residents still cook meals using wood fire.

Green initiatives: Although most of the city's renewable efforts are focused on large hydro projects, a small-scale pilot is under way to provide solar street lights in Addis Ababa. A US-based private company has won a contract from the city to operate the pilot, which was set to begin in January 2011 with the replacement of ten street lights in the city.

Land use: Above average

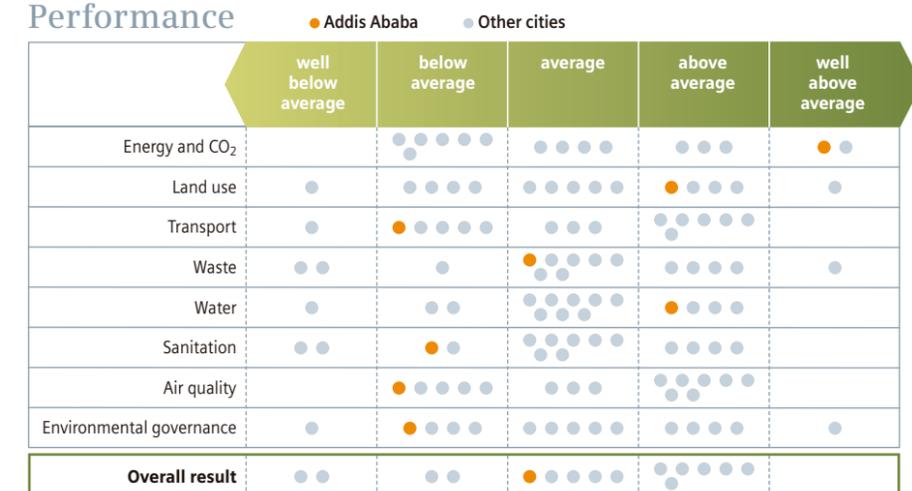
Addis Ababa has a relatively high population

density of about 5,200 residents per square kilometre – the third highest in the Index. According to official figures, an estimated 18% of the city population lives in informal settlements, well below the Index average of 38%. However, depending on definitions of informal settlements, other sources put the figure higher. Green spaces are limited, at 37 square metres per person in the city, versus the Index average of 74 square metres. While the city generally scores well for land use policy, particularly on urban sprawl containment, Addis Ababa could further improve green space protection. The city says it plans to establish new parks (see "green initiatives") but the opportunistic building of hotels and apartment blocks remains a problem. A unique characteristic of Addis within Africa is the integration of the poor. Most African cities

separate poor and rich like a "sunny-side up egg", according to experts, but Addis is more like "scrambled egg". The city is razing slums and building apartment blocks in their place. Some 70,000 housing units are being offered under a government-sponsored lottery in which winners pay subsidised prices for new flats.

Green initiatives: The city master plan calls for reforestation of surrounding mountains, the recovery of existing city parks and the creation of new parks. The most significant new green space will be a pedestrian linear park winding some 5 km through the city centre. In addition, the master plan calls for the planting of indigenous trees along other rivers and streams in the city, and the establishment of urban agriculture, with households and neighbourhoods composting organic waste. Regarding buildings, one of

Performance



The order of the dots within the performance bands has no bearing on the cities' results.

density of about 5,200 residents per square kilometre – the third highest in the Index. According to official figures, an estimated 18% of the city population lives in informal settlements, well below the Index average of 38%. However, depending on definitions of informal settlements, other sources put the figure higher. Green spaces are limited, at 37 square metres per person in the city, versus the Index average of 74 square metres. While the city generally scores well for land use policy, particularly on urban sprawl containment, Addis Ababa could further improve green space protection. The city says it plans to establish new parks (see "green initiatives") but the opportunistic building of hotels and apartment blocks remains a problem. A unique characteristic of Addis within Africa is the integration of the poor. Most African cities

the city's most important initiatives is an attempt by the Ethiopian Institute of Architecture, Building Construction and City Development (EiABC) to develop green building codes. Supported by the Swiss Federal Institute for Technology, the EiABC has contracted local private developers to design cheap and green building materials. In particular, the organisation focuses on substituting Chinese-imported steel and glass with local stone, wood and adobe (a mix of sand, clay and straw) to cut building costs by up to a third, and raise environmental and aesthetic standards.

Transport: Below average

Underdeveloped public transport infrastructure and policy shortcomings account for Addis Ababa's performance in this category. The city's



public transport system relies heavily on Anbessa, the state-owned bus company, which has a fleet of more than 500 buses, complemented by 12,000 private minibuses. The length of the city's mass transport network is not far behind the Index average – an estimated 2.2 km per square kilometre, versus the Index average of 2.7 km. But the system itself is outdated and unable to meet demand. Addis Ababa is also one of five Index cities yet to build any form of superior public transport, such as subways, trams, light-rail or bus rapid transit lines. Addis benefits from a relatively cohesive culture, with income disparity lower than in many other African cities. This means that the city's office workers are more likely to travel to work on public transport

than in other African cities. For example, some 40% of commuters use the Anbessa buses. By 2020, with population growth, Anbessa estimates it will be serving 6 million customers in and around Addis. In addition, Addis Ababa does have a relatively sophisticated traffic management system, but has yet to introduce any car-pooling lanes, no-car days or other congestion-reduction initiatives. The city also drops points for not taking any steps to reduce emissions from mass urban transport, as well as failing to encourage citizens to take greener forms of transport.

Green initiatives: Addis has seen major Chinese-funded investment in its city roads – an amount estimated at over US\$1 billion by 2015. Traffic congestion has eased with the completion of the Chinese-backed Gotera Interchange on the city's planned ring road. Additionally, plans are underway to build a light rail line, expected to transport 20,000 passengers a day, though no concrete dates for this project have been announced.

Waste: Average

Addis Ababa generates the least waste in the Index, at 160 kg per person, on average, per year. Although much lower than the Index average of 408 kg, the city still struggles to cope. There is only one main landfill site, at Koshe-Repi in southwest Addis, which dates back to the 1960s. City-wide waste collection is absent; instead, city neighbourhoods ("kebeles") are responsible for collecting rubbish. This is done in partnership with private companies, but collection costs remain high. In policy areas, Addis Ababa is one of only three cities in the Index that does not encourage proper waste management by citizens, failing to impose basic measures such as bans on littering and making waste dumping illegal. Collection points for recyclable material are also absent. Addis Ababa fares slightly better in the collection and disposal of special waste, having facili-

ties to cope with chemical and pharmaceutical rubbish. As with the majority of cities in the Index, however, Addis Ababa has no collection and disposal facilities for household hazardous waste.

Green initiatives: The city says it is committed to opening new landfill sites in the Doro, Dertu-Mojo, Bole and Yeka Abado districts distributed across the city. The government has also announced its intention to limit the use of plastic in local packaging and increase composting, in an effort to reduce the amount of waste destined for landfills. However, details are scarce. Recycling remains limited but is likely to increase with the establishment of central recycling depots for metal and plastic, the authorities say, within the next year.

Water: Above average

Addis Ababa has one of the lowest rates of per capita water consumption in the Index, measuring 57 litres per day, compared with the Index average of 187 litres. An estimated 99% of the city's population has access to some form of potable water, according to UN Habitat, above the Index average of 91%. However, the water delivery infrastructure in Addis is badly built and often does not adequately serve the poor. The actual water supply is plentiful, with an abundant water table and reservoirs. In Index cities where drinking water is so widely available, water consumption is typically much higher than in Addis Ababa. Water delivery could improve with better management and if payment of bills using mobile phones were more widespread in Ethiopia. The city also has a water system that is less profligate than that of most cities covered in the Index – it loses 20% to leaks, versus the Index average of 30%. In terms of policies and initiatives surrounding water efficiency, the city has room for improvement.

Sanitation: Below average

There are major sanitation challenges in Addis Ababa. Access to sanitation is limited to 72% of the population, according to estimates by UN Habitat, but access for many people means shared toilets and communal washing facilities. Often there are not enough of these, and water-borne diseases are common as a result of defecation on open ground, and directly into streams and rivers. Even in richer neighbourhoods, overflowing sewers are not an uncommon sight. The city lacks adequate wastewater treatment facilities, with an estimated less than 20% treated, and there is no regular monitoring of sanitation facilities. However, the city is making some attempts to impose regulations requiring new apartment buildings to manage their own sewage according to stricter guidelines.

Air quality: Below average

Air quality in Addis Ababa is widely regarded as among the poorest in Africa, largely because of

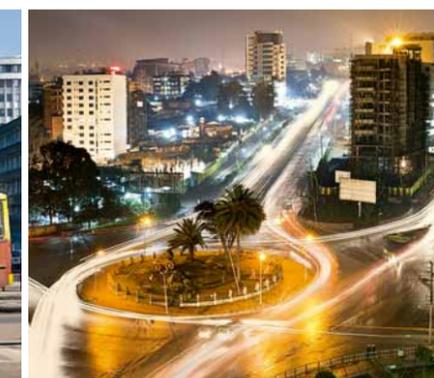
air entrapped by the mountains, heavy traffic and high emissions from older vehicles. Studies by the Ethiopian Forum for the Environment show that more than 65% of the vehicles on the road in Addis are over 15 years old – many are Russian Lada cars that form the majority of Addis's taxi fleet. The burning of rubbish and open fires is another contributor. The city has relatively weak air quality policies to improve the situation – there is no code to improve air quality, for example, nor any monitoring of air pollutants.

Green initiatives: The Ethiopian government acknowledges the problem and has plans to gradually replace automobiles in the city with electric-powered cars, using tax incentives, although details are limited.

Environmental governance: Below average

While Addis Ababa has a department dedicated to green issues and policy implementation, it

fails to meet any of the criteria set by the Index for either environmental monitoring or public participation. No baseline environmental review has been conducted in the last five years, and no information has recently been published on environmental performance and progress. Addis Ababa is also the only city in the Index that does not involve citizens, non-governmental organisations or other stakeholders in decision-making surrounding projects of major environmental impact. Despite its environmental department, the city of Addis has only limited control of its environmental future. It serves as a loyal arm of the national government. However, given the government ambition to limit imports and improve efficiencies, and the communal nature of the city, there are good prospects for improved environmental governance. The bigger challenge for the city will be translating laws into meaningful enforcement, especially laws regulating state-run enterprises and ministries that are not used to oversight.



Quantitative indicators

Category	Indicator	Average	Addis Ababa	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	96.9 ^e	2005	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	1.8	2009	The Ethiopian Electric Power Corporation
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	15.7 ^{1e}	2009	2006 IPCC Guidelines for National Greenhouse Gas Inventories
LAND USE	Population density (persons/km ²)	4,578.1	5,196.3 ^e	2007	EIU calculation
	Population living in informal settlements (%)	38.0	18.3 ^e	2007	Addis Ababa City Administration, Land Administration Office
	Green spaces per person (m ² /person)	73.6	36.5	2007	Addis Ababa Environmental Protection Authority
TRANSPORT	Length of mass transport network (km/km ²)	2.7	2.2 ^{2e}	2009	Anbessa City Bus Service Enterprise
	Superior public transport network (km/km ²)	0.07	0.00 ³	2009	Federal Transport Authority, Addis Ababa Branch Office
WASTE	Waste generated per person (kg/person/year)	407.8	160.0	2004	Ethiopian Development Research Institute
WATER	Population with access to potable water (%)	91.2	99.0 ^e	2005	UN Habitat
	Water consumption per person (litres per person per day)	187.2	56.7	2009	Addis Ababa Water and Sewerage Authority
	Water system leakages (%)	30.5	20.0	2009	Addis Ababa Water and Sewerage Authority
SANITATION	Population with access to sanitation (%)	84.1	71.8 ^e	2005	UN Habitat

All data applies to Addis Ababa unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National electricity generation mix used to estimate city level CO₂ data, 2) Number of bus routes (88) multiplied by average length of bus route (13.5 km), 3) There are no subway, tram, light-rail or BRT lines



Alexandria_Egypt

African Green City Index

Background indicators

Total population (million)	4.4
Administrative area (km ²)	2,300
Population density (persons/km ²)	1,900

Alexandria is the second most populous city in Egypt after Cairo. Located between the Mediterranean Sea and Lake Mariout, Alexandria has a population of 4.4 million across a metropolitan area covering 2,300 square kilometres. This makes it one of the least densely populated cities in the African Green City Index. Alexandria has grown significantly in the past 40 years, spurred on by rural-urban migration. It is home to 40% of Egypt's industry, which includes iron and steel, petroleum, cement and petrochemicals. Around 60% of Egypt's foreign trade is handled through Alexandria's port and the nearby El Dekheila port. The city is also an important historical, cultural and religious hub in Egypt, second only to Cairo. Alexandria is ranked average overall in the Index. The city is well

above average in the waste category, with some of the best waste management policies among the 15 cities evaluated in the Index. It has also been assisted in this area in recent years by foreign aid. Alexandria is average in the categories of energy and CO₂, transport, sanitation, air quality and environmental governance, with relatively high rates of access to electricity and potable water. The city falls to below average in the water category because of a high rate of consumption and less developed policies in this area.

Energy and CO₂: Average
It is estimated that almost 100% of households in Alexandria have access to electricity. Still, CO₂ emissions and electricity consumption are relatively low. Based on national figures, it is esti-

ated that Alexandria generates nearly 70% of its electricity using natural gas, with 12% coming from renewable sources. The city emits an estimated 353 kg of CO₂ per capita from electricity consumption against an Index average of 984 kg. Electricity consumption, at an estimated 5.7 gigajoules per capita, is marginally below the Index average of 6.4 gigajoules. Energy strategy in Egypt is driven by the national government, which is investing in numerous projects (see "green initiatives" below). However, the city is only undertaking limited efforts to source energy from renewable sources.

Green initiatives: Green initiatives in energy happen at the national level in Egypt. The country as a whole is a beneficiary of the Clean Tech-

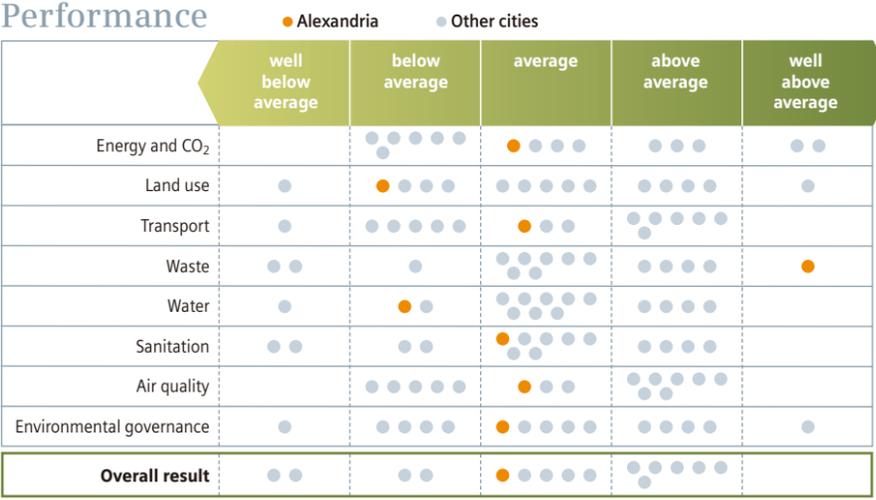
nology Fund (CTF), a multi-donor trust fund providing financing for low carbon technologies with potential for reducing greenhouse gas emissions. Egypt has its own US\$350 million CTF Investment Plan, which involves a combination of renewable energy production and clean transport projects, although it is unclear how much of the budget will be allocated to projects in or around Alexandria. Under the renewable energy scheme, Egypt hopes to meet 20% of its energy needs from renewable energy by 2020, and to build 7,200 megawatts of wind generation capacity alone. Of this, construction of facilities to generate 400 megawatts has already been financed and plans have been developed for facilities to generate another 600 megawatts.

Land use: Below average
Alexandria is marked down in the Index for having a relatively low population density at 1,900 people per square kilometre compared with the Index average of 4,600 and also for having fewer green spaces than other cities in the Index. Alexandria offers less than 1 square metre per person versus an Index average of 74 square metres. Much of the green space that does exist in Alexandria is along the beachfront and is privately owned. 31% of Alexandria's population lives in informal settlements, compared with the Index average of 38%. Regarding policies, there is some protection for green space and environmentally sensitive areas, and a strategy is in place to connect informal settlements to municipal services such as street lighting and pedestrian walkways.

Green initiatives: Between 2004 and 2006 the World Bank helped Alexandria create its first city development strategy, using a grant from the

Cities Alliance, a multi-donor trust fund run by the World Bank and UN Habitat. Local and international consultants compiled five reports detailing a development strategy for Alexandria through to 2017. One of the major results of the work was the Alexandria Governorate Pole Project, which focused on sustainable economic growth. The project's objectives include environmental regeneration, supporting private development and improving access to basic services for people living in informal settlements. This includes upgrades to six informal neighbourhoods in the city by improving infrastructure and basic services, setting up community facilities, and increasing access to credit and business support. A number of new projects have been developed as a result of the strategy, including a policy to ensure the protection of coastal areas and a pollution abatement project.

Transport: Average
Of all cities in the Index, Alexandria has the most comprehensive traffic management measures in place, including traffic light sequencing and traffic information systems, among others. It is also relatively strong on congestion reduction measures, including pedestrian zones. But it is marked down in the Index for a relatively under-developed public transport network. At just under 1 km per square kilometre, the city's mass transport network falls short of the Index average of 2.7 km per square kilometre. Alexandria's superior transport network – defined in the Index as comprising subways, trams, light-rail or bus rapid transit lines – consists of two tramways measuring 0.02 km per square kilometre, compared with the Index average of 0.07. The government 20 years ago announced the intention to build a 44 km metro system along the coast, but these plans have not moved forward.



The city has several main thoroughfares; the coastal road, which runs parallel to the sea and is the main traffic artery in the city, experiences severe traffic congestion during rush hours.

Green initiatives: The national government is considering rolling out its taxi scrapping and recycling scheme in Alexandria, which has had considerable success in Cairo. Under the Cairo scheme, taxis more than 20 years old are being recycled with the aim of replacing around 45,000 to 50,000 over the course of the project. In April 2009 the Ministry of Finance launched the taxi scrapping scheme with the initial focus on private taxis. The scheme will be expanded to mass transport vehicles over time. Alexandria is one of the cities on the list for potential expansion but no further plans have been announced.

Waste: Well above average

Alexandria has particularly strong policies on waste recycling and reuse when compared with the other 14 cities in the Index. It has on-site and central collection points for recyclables, and accepts a wide range of materials for recycling. The city also enforces environmental standards for waste disposal sites and is the only city in the Index to regulate waste pickers – residents who informally scavenge for recyclables and reusable items. The amount of waste generated by the city's inhabitants, at an estimated average of 209 kg per year, is around half the Index average of 408 kg. Since 2000 Alexandria has employed international contractors, with financial assistance from the US Agency for International Development (USAID), to collect and dispose of the city's waste. In addition, the government has focused on enhancing private sector participation in the cleaning process and on integrated solid waste management. This privatised system limits the government's role to monitoring while at the same time involving citizens by adding collection fees to residents' electricity bills.

Green initiatives: In August 2011 the national government in partnership with Korean investors opened a new chemical waste management plant in Alexandria. The plant is the first of its kind in the region to deal primarily with mercury waste, which is found in fluorescent lamps. The government first proposed the plant in 2007 to combat the problem of mismanaged mercury disposal, which is harmful to plant life and fish. According to the national government Egypt produces 40 million fluorescent bulbs annually and 8 million are discarded as general waste. Furthermore, landfills used by the city have two methane gas capture projects, which were established in 2006 by a private contractor. Methane is captured and disposed of through

flaring, which limits the amount of greenhouse gases released into the atmosphere. The project is estimated to have prevented approximately 171,000 tonnes of CO₂ emissions from escaping into the atmosphere between February 2010 and April 2011.

Water: Below Average

According to UN Habitat, an estimated 99% of Alexandria's population has access to potable water. The city relies heavily on the River Nile for its water supply and has a relatively high level of consumption, at 351 litres per person per day, versus the Index average of 187 litres. The city also loses 36% of its water through leakages, compared with the Index average of 30%, although some effort is made by city authorities to encourage greater water efficiency. However, Alexandria's regulations on water pollution standards for local industry are not always strictly enforced.

Green initiatives: A major research project funded by the European Commission, known as SWITCH Urban Water, has provided an assess-

ment of Alexandria's water requirements and examined options for meeting expected demand up to 2037. The project aims to reduce extractions from the Nile by 20%. The research looked at a range of options to better meet Alexandria's water requirements, including improved water efficiency and the upgrading of wastewater plants. Among those that were examined in more detail were minimising losses from the pipe network, maximising household water use and increasing the cost of water to customers. The study encouraged the government to introduce standards for appliances such as toilets, showers, taps, washing machines and dishwashers at a national level. These remain recommendations at this point. Additionally, in 2010 the World Bank approved a US\$7.2 million

Sanitation: Average

Global Environmental Facility grant for the Alexandria Coastal Zone Management Project. The project aims to improve institutional management of the Alexandria coastal zone and reduce pollution in the Mediterranean Sea and Lake Mariout. A relatively large percentage of Alexandria's population has access to sanitation, at an estimated 94%, compared with the Index average of 84%. However, despite investment by outside agencies (see "green initiatives" below), which has improved the situation, the city's wastewater treatment standards could be better. Alexandria is also marked down for a lack of monitoring of on-site sanitation facilities in homes and communal areas.

Green initiatives: Since 1987 the US Agency for International Development (USAID) has run a programme to support improvements in wastewater collection, pumping, treatment and disposal. The agency invested an initial US\$425 million in the construction of 211 km

treatment plants. The aim was to fully prevent the discharge of raw waste into the lake. The programme also worked to prevent the dumping of industrial waste in the lake by installing filters and treatment plants.

Air quality: Average

Alexandria scores well for regularly monitoring air quality in different city locations and for measuring a wide range of pollutants. The city is marked down for a lack of public awareness campaigns around air pollution, although the same can be said about the majority of Index cities. The air quality in Alexandria is poor, largely because of traffic congestion and industry, but its proximity to the Mediterranean Sea helps disperse some air pollution.

Green initiatives: The Egypt Pollution Abatement Project is a scheme to help the country reduce industrial pollution. The programme, which is sponsored by the World Bank, encourages voluntary environmental management and sustainable financing, as well as introducing mechanisms for the enforcement of environ-

mental legislation. Under the project, public and private businesses receive help to bring their emissions in compliance with the country's environment protection law. Specific projects carried out under the scheme have included minimising waste, preventing pollution and adopting clean technology. The programme also has made a number of recommendations to the authorities, including the strengthening of partnerships between banks and international organisations, the promotion of community participation in environmental issues and the encouragement of businesses to adopt cleaner policies and practices. In addition, a vehicle exhausts inspection programme has been implemented in 12 governorates, including Alexandria, in cooperation with the Ministry of Interior. The Ministry of Environmental Affairs has also implemented a programme to change the fuel used by public transport vehicles to natural gas.

Environmental governance: Average

The national government sets environmental policy for the city. It has an executive arm

responsible for drafting and implementing environmental policy. Alexandria scores well for regularly publishing reports on its environmental performance and progress – it is one of only a few cities in the Index to do so. Moreover, Alexandria recently conducted a baseline environmental review in the water and air quality categories. However, like most cities in the Index, Alexandria does not offer its citizens a central contact point for information on environmental performance and projects. The city's governance has benefitted from outside intervention by aid agencies mentioned above, including outlining strategies for development, waste and water system upgrades.

Green initiatives: In May 2011 the national government announced plans to discuss creating an environmental information sharing system between Europe and Arab countries in the southern and eastern Mediterranean regions. The goal would be to develop common environmental indicators, environmental reporting norms and processes for data sharing between these countries.



Quantitative indicators

Category	Indicator	Average	Alexandria	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	99.9 ^e	2005	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	5.7 ^{1e}	2006	Egyptian Electricity Holding Company
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	352.7 ^{2e}	2006	Egyptian Electricity Holding Company
LAND USE	Population density (persons/km ²)	4,578.1	1,895.8	2010	EIU calculation
	Population living in informal settlements (%)	38.0	31.2	2007	SWITCH stakeholder analysis report for Alexandria
	Green spaces per person (m ² /person)	73.6	0.4 ^{3e}	2006	CAPMAS
TRANSPORT	Length of mass transport network (km/km ²)	2.7	1.0	2008	CAPMAS
	Superior public transport network (km/km ²)	0.07	0.02 ⁴	2008	Alexandria Passenger Transport Authority
WASTE	Waste generated per person (kg/person/year)	407.8	209.2 ^e	2007	Egyptian Environmental Affairs Agency
WATER	Population with access to potable water (%)	91.2	98.8 ^e	2005	UN Habitat
	Water consumption per person (litres per person per day)	187.2	350.7	2009	SWITCH urban system water modelling report for Alexandria
	Water system leakages (%)	30.5	36.3 ⁵	2007	SWITCH urban system water modelling report for Alexandria
SANITATION	Population with access to sanitation (%)	84.1	94.1 ^e	2005	UN Habitat

All data applies to Alexandria unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National data used as proxy for city level data. 2) National electricity generation mix used to estimate city level CO₂ data. 3) Data refer to gardens and public parks only. 4) There are no subway or BRT lines. 5) Data refer to "unaccounted for water"



Cairo_Egypt

African Green City Index

Background indicators

Total population (million) ^e	7.1
Administrative area (km ²)	370
Population density (persons/km ²) ^e	19,100

e = EIU Estimate

Cairo is the capital city of Egypt. Located alongside the River Nile, Greater Cairo is home to just under 20 million people and encompasses the governorates of Cairo, Giza and Qalyubia. For reasons of data availability and comparability, data included in the African Green City Index are based on a mix of statistics for Greater Cairo and the inner Cairo Governorate. An estimated 7.1 million inhabitants occupy the 370 square kilometre area within Cairo Governorate; it is consequently the most densely populated city in the Index, with an estimated 19,100 people per square kilometre, compared with the Index average of 4,600.

Cairo is average overall in the Index. The city ranks above average in the transport category, thanks largely to the length of its metro system, operational since 1987, although chronic traffic

congestion is still a serious problem. Cairo also performs well for having a relatively high share of the population with access to electricity and potable water. The city ranks average in most other categories. The social upheaval in early 2011 that led to the resignation of President Mubarak ushered in multiple changes of government and a continually shifting political landscape. However, already this year the national government has announced several environmental initiatives that are detailed below.

Energy and CO₂: Average

UN Habitat estimates that almost all households in Cairo have access to electricity, but the city fares less well in curbing electricity consumption. On average, Cairo consumes 8.0 gigajoules

of electricity per capita, compared with the Index average of 6.4 gigajoules. Despite high electricity consumption, CO₂ emissions from electricity are an estimated 477 kg per capita, less than half of the Index average of 984 kg. Nearly 70% of the city's electricity production is based on natural gas. During the summer months, the use of energy rises and the government in March 2011 announced measures to meet the soaring demand with generators powered by natural gas. Plans are under way to increase the country's use of renewable energy (see "green initiatives"), which today accounts for around 12% of national electricity production.

Green initiatives: Egypt is a beneficiary of the Clean Technology Fund (CTF), an international,

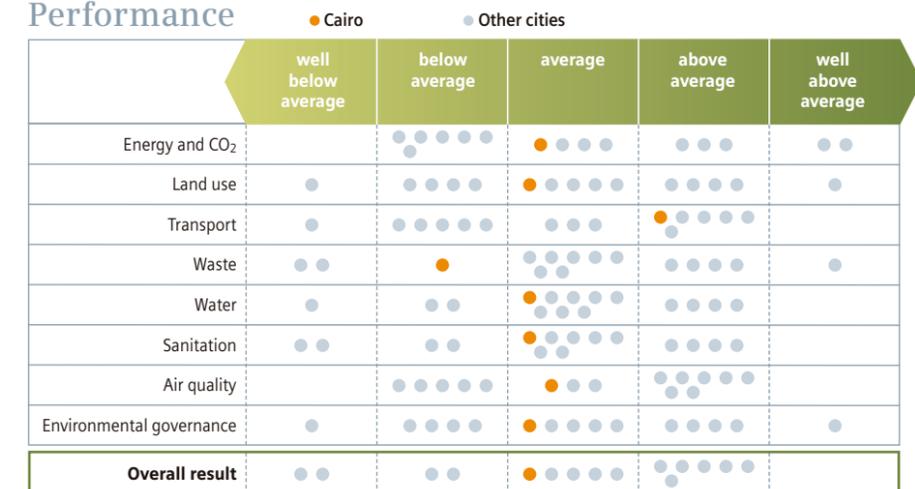
multi-donor trust fund to provide financing for low-carbon technologies with the potential for reducing greenhouse gas emissions. Egypt announced a US\$350 million CTF investment plan in April 2011 that involves a combination of renewable energy production, clean transport and solid waste management projects. Under its renewable energy scheme, Egypt hopes to meet 20% of its energy needs from renewable energy by 2020 and to build 7,200 megawatts of wind generation capacity alone. Of this, construction of facilities to generate 400 megawatts has already been financed and plans have been developed for facilities to generate another 600 megawatts. In addition, the government has announced it will construct three pilot waste-to-energy plants in partnership with a private company.

In 2009 it attracted more than two million visitors and has contributed to improving the city's air quality. The Al-Azhar park development was carried out by the Aga Khan Trust for Culture, an agency of the Geneva-based Aga Khan Development Network, in partnership with the Governorate of Cairo.

Transport: Above average

Cairo benefits from a relatively long mass transport network as well as a new metro system. The Greater Cairo area has the second longest superior public transport network in the Index (defined as metro, trams, light rail or bus rapid transit), at 0.2 km per square kilometre, compared with the Index average of 0.07 km, and it is being expanded. The first stations on the city's third metro line will be operational in 2012. By

Performance



Land use: Average

Cairo's high population density bolsters its performance in the land use category. On the other hand, with less than an estimated 1 square metre of green space per person the city falls well below the Index average of 74 square metres. Around a third of Cairo's population is estimated to live in informal settlements, primarily located in the city's outskirts and historic centre.

Green initiatives: For centuries, the Al-Darrasa site, located outside the boundary of historic Old Cairo, was used as a place for dumping debris and rubble from the city. With the 2005 inauguration of the Al-Azhar Park, a 30-hectare development in Al-Darrasa, this has changed. The park, which provides a 360-degree panoramic view of historic Cairo, has been a huge success.

2022 the city is planning to add another three metro lines; it is hoping to attract new funding as part of a public-private investment partnership. The well-run metro system apart, the city's public transport services are otherwise overcrowded and often unreliable. Traffic on the roads can be chaotic and congested. With outside funding assistance, however, plans are now in place to tackle traffic pollution and congestion (see "green initiatives" below). The government has also announced plans to invest in several improvements to the city's transport infrastructure, including new roads, river-based transport and encouraging cycling.

Green initiatives: A major programme is under way to improve traffic congestion and reduce polluting emissions from public transport vehi-

cles. The work is being carried out through two schemes – the Egypt Urban Transport Infrastructure Development Project and the Carbon Finance Vehicle Scrapping and Recycling Programme. Both initiatives are being developed with financial assistance from the World Bank and the multi-donor Clean Technology Fund. The urban transport project includes the provision of 1,100 new fuel-efficient buses to replace the old fleet, the construction of six bus rapid transit corridors and improvements to the traffic management system. In addition, the government wants to promote the use of the river for commercial transport as an alternative to using the countries' roads, and thereby reducing traffic congestion. Plans include funding a management system to help coordinate river transport, and a committee has been established at the national level to improve safety for river travel. The government has also launched a pilot scheme in an area of Greater Cairo to encourage residents to ride bicycles, including a public information campaign to encourage cycling, the installation of bicycle racks and the sale of bicycles at discounted prices.



Waste: Below average

Cairo generates an estimated 457 kg of waste per person per year, more than the Index average of 408 kg. Waste collection is a challenge and piles of waste are commonplace, particularly in the poorer parts of the city's historic centre. The prevalence of informal settlements has made waste collection difficult. While several private waste collection companies operate in the city, zabbaleen, waste-collectors from the poorer neighbourhoods who try to make a living from informal payments, also contribute significantly to waste collection and are considered more efficient than private companies. Despite the challenges, Cairo has introduced a policy aimed at encouraging recycling and reuse of waste.

Green initiatives: The government has succeeded in transferring 15 million cubic metres of accumulated municipal waste from the residential areas of greater Cairo to controlled dumping sites, according to the Egyptian Environmental Affairs Agency. In another initiative, a German government agency, GIZ, is carrying out a project to help improve waste management in two poor urban areas in Greater Cairo: Khanka and Khossos. The project includes an analysis of the current system for waste collection, segregation and recycling, and the development of a new solid waste management strategy that emphasises the role of the informal sector. The Bill and Melinda Gates Foundation has provided a grant of US\$5.3 million towards the project.

Water: Average

Cairo consumes 237 litres of water per capita per day, more than the Index average of 187 litres. This is coupled with an above average high leakage rate of 35%. Although UN Habitat estimates that almost 100% of residents have access to potable water, compared with the Index average of 91%, the quality of water in Cairo is sometimes poor. Wealthier residents have their own water filtration systems, while visitors to the city drink

bottled water. Those who cannot afford such measures are susceptible to a variety of water-borne diseases. Cairo's residents should benefit, however, from a national initiative to improve the water quality of the River Nile (see "green initiatives" below), Cairo's main source of drinking water.

Green initiatives: The national government has adopted 12 programmes for the protection of the River Nile. Measures include: preventing the flow of industrial effluents into the Nile; preventing sanitary drainage; managing waste from Nile river vessels; treatment of agricultural waste; solid waste management; periodic monitoring of water cleanliness; and developing a water quality database. Five plants have been established to receive waste from river cruisers, including one at Cairo. The plants are equipped to safely dispose of the waste in the sanitary drainage networks.

Sanitation: Average

An estimated 98% of Cairo's population has access to sanitation. Even so, the standard of sanitation services can vary enormously. In some parts of the city, such as Ma'adi and Zamalek, sanitation is provided to a high standard. In other parts, particularly in the historic centre, sanitation is provided to a lower standard, with one facility serving many people or facilities not connected to the sewage system. The government is hoping to fund new wastewater projects as part of an overarching public-private partnership investment which was announced recently.

Green initiatives: The Aga Khan Trust for Culture has undertaken a programme to rehabilitate water and sanitation facilities in the Darb al-Ahmar quarter of Cairo's Old City. The sewerage system, which previously did not reach all the houses, has been extended, and lead pipes have been replaced. The programme was carried out in conjunction with measures to

improve awareness of health and environmental issues, to provide education and training to local residents, and to restore historic buildings in the quarter.

Air quality: Average

During the past decade the national government set up 13 air pollutant monitoring stations in Greater Cairo, and parts of the Nile delta and upper Egypt region. Of these, six are in the governorates of Cairo and Giza. Although air quality is monitored in different parts of the city, a combination of severe traffic pollution and dust from the desert south of the city makes air quality in Cairo extremely poor. In the autumn smoke from farmers burning rice straw following the harvest also contributes to air pollution. However, the fact that the bulk of the city is paved, particularly in central districts, means that dust generated from the city itself is not as severe as in many African cities. The city's performance in this category is also bolstered by the presence of a strategy to improve local air quality. The government recently reported that it had achieved the best air quality in a

decade in the city following investments in air quality improvements (see "green initiatives" below).

Green initiatives: The national government spent US\$1.2 billion to improve air quality in Greater Cairo and the rest of the country between 2006 and 2010. There were several projects involved in the programme, including moving polluting industries out of populated areas, increasing waste collections in informal areas (and thereby reducing waste burning in informal settlements), tree planting and improving Greater Cairo's network of air monitoring stations. The national government is trying to limit vehicle emissions by converting government cars from petrol to compressed natural gas (CNG), introducing unleaded petrol, creating a national programme for vehicle testing and rehabilitating old taxis. The government has instituted fines for the burning of rice husks, which contributes to air pollution in the autumn after the harvest, and has also provided several hundred special compressors to farmers as an alternative to disposing of the husks.

Environmental governance: Average

National agencies oversee environmental policy and monitoring in Cairo. The national environment ministry is responsible for the formulation and application of environmental policies. The ministry has an executive arm that is responsible for elaborating environmental policy, overseeing implementation of policy, and carrying out pilot projects designed to preserve natural resources and prevent pollution. The city's performance in this category is helped by its regular monitoring of environmental performance, and some inclusion of citizens and non-governmental organisations in the decision-making process on environmental projects.

Green initiatives: In May 2011 the national government announced plans to discuss creating an environmental information sharing system between Europe and Arab countries in the southern and eastern Mediterranean regions. The goal would be to develop common environmental indicators, environmental reporting norms and processes for data sharing between these countries.

Quantitative indicators

Category	Indicator	Average	Cairo	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	99.7 ^e	2005	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	8.0	2006	Egypt Information Portal
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	477.0 ^{1e}	2007	Egypt Information Portal
LAND USE	Population density (persons/km ²)	4,578.1	19,083.5	2010	EIU calculation
	Population living in informal settlements (%)	38.0	31.3 ^e	2005	IDSC Egypt Information and Decision Support Centre
	Green spaces per person (m ² /person)	73.6	0.8 ^e	2007	CAPMAS
TRANSPORT	Length of mass transport network (km/km ²)	2.7	7.3 ²	2008	CAPMAS
	Superior public transport network (km/km ²)	0.07	0.24 ^{2,3}	2008	CAPMAS
WASTE	Waste generated per person (kg/person/year)	407.8	456.9 ^e	2007	Egyptian Environmental Affairs Agency
WATER	Population with access to potable water (%)	91.2	99.6 ^e	2005	UN Habitat
	Water consumption per person (litres per person per day)	187.2	237.0 ²	2009	OECD
	Water system leakages (%)	30.5	35.0 ^{2e}	2007	Egyptian Holding Company for Water and Wastewater
SANITATION	Population with access to sanitation (%)	84.1	98.2 ^e	2006	Egypt Information Portal

All data applies to Cairo unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National electricity generation mix used to estimate city level CO₂ data. 2) Greater Cairo area. 3) There are no light rail or BRT lines





Cape Town_South Africa

African Green City Index

Background indicators

Total population (million)	3.7
Administrative area (km ²)	2,500
Population density (persons/km ²)	1,500

Cape Town is the second most populous city in South Africa behind Johannesburg. Its 3.7 million inhabitants occupy a metropolitan area of just below 2,500 square kilometres, which is the second largest area in the African Green City Index behind Lagos. Aside from Pretoria, Cape Town is the least densely populated city in the Index. Located at the northern end of the Cape Peninsula and with a mild climate, it is one of the most popular tourist destinations in Africa. The city is also a base for IT and manufacturing companies, and has undergone a recent construction boom largely due to the 2010 World Cup. The legislative capital of South Africa, Cape Town is also home to the country's parliament.

Cape Town ranks above average overall in

the Index. The city has some of the most robust environmental policies among Index cities in most categories, which bolsters its strong performance. In some categories – such as energy and CO₂, and waste – Cape Town does not perform well on quantifiable metrics, yet scores very well on policy. Its best category performance is in land use, where it is the only city that places well above average. In this category strong policies go hand in hand with abundant green spaces and a relatively low percentage of people living in informal settlements. Underpinning much of Cape Town's policy efforts is the city's Energy and Climate Change Action Plan, which has set multiple targets and recommended various initiatives to improve green performance.

Energy and CO₂: Below average

Cape Town is marked down for having the highest CO₂ emissions per capita from electricity consumption in the Index, producing an estimated 4,099 kg, around four times the Index average of 984 kg. The city relies heavily on electricity produced from coal, which accounts for 93% of total supply. Only 2% of electricity production is generated by renewable sources. Electricity consumption is also relatively high, at an estimated 13.9 gigajoules per capita, compared with the average of 6.4 gigajoules. This is in part due to high consumption in wealthier households and cheap residential electricity prices in recent years that have not encouraged conservation. An estimated 90% of households have access to electricity, compared with the

Index average of 84%. Although Cape Town is marked down for its CO₂ emissions and electricity consumption, the city has the most robust clean energy policies in the Index, including its Energy and Climate Change Action Plan (see "green initiatives" below). It is also making efforts to source more renewable energy, including wind power.

Green initiatives: City officials have drafted a comprehensive Energy and Climate Change Action Plan, which identifies 11 key objectives. While the plan covers a broad range of sectors, including transport and education, the first objective calls for a 10% reduction in electricity use city-wide by 2012; in the second objective the city aims to source 10% of its energy from renewable sources by 2020; and the third mandates a 10% reduction in energy consumption from council operations by 2012. Already 130 projects are under way across the city as a result of the plan. Programmes to achieve its goals include installing 300,000 solar water heaters across the city by 2015 and retrofitting public buildings with energy efficient lights.

Land use: Well above average

With just 1,500 people per square kilometre, versus an overall average of 4,600, Cape Town has the second lowest population density in the Index. It has grown rapidly over the past decade and faces the challenge familiar to other African cities of finding the right balance between environmental sustainability and economic necessity. The city has approached this dilemma proactively, implementing measures to contain urban sprawl that are currently being updated (see "green initiatives"). Home to multiple nature reserves containing some of the world's rarest plant species, Cape Town has the most green

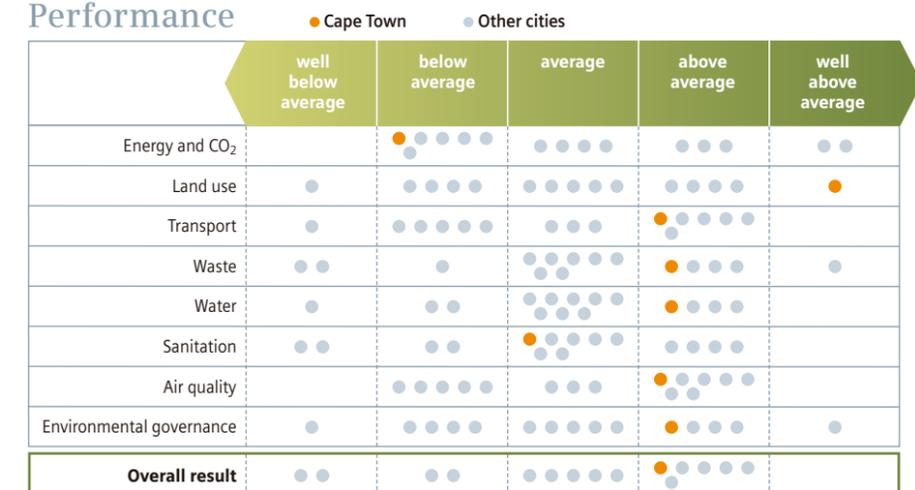
space in the Index. The city boasts an estimated 289 square metres of green space per person, about four times the Index average of 74 square metres. A local environmental resource management department oversees Cape Town's green spaces and environmentally sensitive areas. The city also has a robust set of policies to protect these areas. Furthermore it has the second lowest share of its population living in informal settlements, at an estimated 17% compared with the Index average of 38%.

Green initiatives: As part of the Climate Change Action Plan, the city has updated its development guidelines, which address urban sprawl, among many other issues. The new plan, currently with the Western Cape provincial government for approval, also promotes sustainable building design, construction and renovation. The city is looking to adopt urban planning principles that encourage non-motorised transport and create more open spaces that can be used for recreation.

Transport: Above average

Cape Town has invested US\$5.8 billion over the last six years in developing a new bus rapid transit (BRT) network (see "green initiatives"). As a result, it is among the top cities in the Index for the length of superior forms of transport, such as metro, tram or BRT lines. The city's superior public transport system measures 0.11 km per square kilometre, compared with the Index average of 0.07 km. Transport, however, is still dominated by private vehicles, taxis and minibuses, and congestion remains a challenge. While there is an extensive network of suburban rail lines, these are not adequately maintained and rapidly growing areas in the west of the city are poorly served. New investment in this network

Performance



The order of the dots within the performance bands has no bearing on the cities' results.

has been announced, although it will be driven by the national government. The city's performance in this category is bolstered by policies aimed at encouraging commuters to take greener forms of transport and by the existence of dedicated mass transport lanes.

Green initiatives: In 2009, ahead of the World Cup, the city launched the first phase of its new BRT network, known as MyCiti. The first phase included an inner city loop, a commuter service route serving the West Coast, and links to the airport. By 2012 a network of nine permanent BRT bus routes is expected to be launched in the central city. By 2013 it is hoped that an express service between the townships of Mitchells Plain and Khayelitsha on the Cape Flats will link to the central business district.

Waste: Above average

Waste generation in Cape Town on a per capita basis is the second highest in the Index, at 573 kg, compared with the Index average of 408 kg. Despite this, the city's good performance in this category is due to strong policies relative to the other 14 cities in the Index. Cape Town monitors and enforces standards for industries to properly dispose of hazardous waste, for example. In addition, a number of schemes are in place to reduce waste generation (see "green initiatives"). Recycling facilities are widely available, with on-site and central collection points, including several community drop-off facilities for large items, construction rubble and recyclables. Nevertheless, population growth is putting pressure on waste management and the city is rapidly running out of land-fill space at its three main sites.

Green initiatives: The city has a number of ongoing initiatives and plans to reduce waste generation. It is running a pilot scheme in some suburbs to have residents separate waste from recyclables before collection. There is also an Integrated Waste Exchange website, which allows businesses and the public to exchange potentially useful waste materials. Furthermore, under Cape Town's Extended Producer Responsibility policy, city procurement guidelines favour companies that operate take-back programmes for items they sell, such as used printer cartridges and glass bottles. In addition, the city has published a detailed Smart Living Handbook encouraging residents to reduce, reuse and recycle waste.

Water: Above average

Cape Town performs very well for its policies related to water quality and sustainability. A code is in place to monitor and sustain surface

water quality, and industrial water pollution standards are enforced. The 2011 Water Services Development Plan sets a target to provide water to all residents by financial year 2015/2016. However, with an estimated 91% of residents having access to potable water (which is on par with the Index average), Cape Town will need to make considerable progress in this area in the coming years. While the city consumes 225 litres of water per capita each day, compared with the Index average of 187 litres, it aims to reduce water consumption to 180 litres per capita per day by 2014. To this effect, the city is targeting water leakages. Although it already has the lowest leakage rate in the Index, losing 10% of volume, compared with the Index average of 30%, Cape Town is nonetheless try-



access figures are lower, especially in informal settlements. When it comes to wastewater treatment, rapidly developing commercial and residential areas have placed a strain on many dated treatment facilities. The city has acknowledged the issue and steps are being taken to upgrade facilities (see "green initiatives" below). Already, Cape Town is one of six cities in the Index that has a policy aimed at setting standards for treatment and monitoring of wastewater.

Green initiatives: The city has a rolling ten-year programme to upgrade its wastewater treatment facilities by 2014. Its goal is to bring all wastewater treatment facilities close to national wastewater management standards. Some progress has already been made and in

ing to improve the efficiency of its water system (see "green initiatives" below).

Green initiatives: The city has an ongoing programme to help residents of poorer households reduce high water bills by fixing water leaks themselves. The city provides information booklets with practical information on how to fix leaks, as well as promotional flyers printed in English, Afrikaans and Xhosa, three of the country's 11 official languages. In addition, more than 45,000 water meters have been installed in houses since the end of 2010 to alert owners when water consumption has reached unaffordable levels.

Sanitation: Average

An estimated 94% of Cape Town's population has access to sanitation, according to government figures, which is above the Index average of 84%. However, some studies have suggested

2010, eight of Cape Town's 23 wastewater facilities were given the Department of Water and Forestry's "Green Drop" award for high standards in wastewater management.

Air quality: Above average

Cape Town has the most robust clean air policies in the Index, with ongoing air monitoring at 13 sites around the city and public information campaigns. Air quality checks are made at various locations throughout the city and most of the air pollutants highlighted in the Index, including sulphur dioxide, nitrogen dioxide, suspended particulate matter and carbon monoxide, are measured. Despite this, air pollution levels in Cape Town are high, especially in informal areas. Air pollution is caused by a number of factors, including vehicle emissions, smoke from wood or coal-burning fires, industrial processes and wind-blown dust. Another contributing fac-

tor is a meteorological condition known as low-level temperature inversion, whereby cooler air just above the ground becomes trapped under a layer of warm air and cannot rise until the wind blows. During winter, when the region is less windy, brown-coloured smog hovers over the city. Cape Town has announced a goal of becoming the African city with the cleanest air and is aware that implementation of current policies will help it achieve this vision.

Green initiatives: The city's 2005 Air Quality Management Plan established 11 objectives to control air pollution. The plan includes increased monitoring, improving air quality, specifically in informal areas, stepping up enforcement of existing air quality legislation and limiting vehi-



cle emissions. A diesel vehicle testing programme is under way whereby traffic officials have the power to conduct spot checks. The council has also produced a booklet explaining what residents can do to reduce air pollution.

Environmental governance: Above average

The city has conducted an environmental baseline review for areas such as water and sanitation, waste, energy, and climate change within the last five years. Regular reports are also published on green performance and progress. Environmental policy is overseen by the city government. Its Environmental Resource Management (ERM) department is directly responsible and works in close collaboration with other core departments such as Electricity, Water and Sanitation, Transport, Solid Waste Management, and City Health. There are committees to address energy issues and climate change, and they often collaborate across departments under named remits such as "energy security" and "carbon mitigation".

Green initiatives: Cape Town runs environmental awareness trainings, including sessions for 23,000 city staff members on how to implement sustainability advice contained in the Smart Living Handbook. Officials have proposed building a Smart Living Centre that would include exhibits and educational activities for the public relating to sustainability. The proposal is still at the planning permission stage, but organisers have proposed several facilities within the centre, including an organic farmers' market and a recycling centre.

Quantitative indicators

Category	Indicator	Average	Cape Town	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	89.7 ^e	2009	General Household Survey 2009
	Electricity consumption per capita (GJ/inhabitant)	6.4	13.9 ^e	2009	City of Cape Town, Electricity Department
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	4,098.6 ^e	2006	State of Environment Report 2008
LAND USE	Population density (persons/km ²)	4,578.1	1,509.5	2009	EIU calculation
	Population living in informal settlements (%)	38.0	17.0 ^e	2009	City of Cape Town, Environmental Resource Management Department
	Green spaces per person (m ² /person)	73.6	289.5 ^e	2010	City of Cape Town GIS data
TRANSPORT	Length of mass transport network (km/km ²)	2.7	1.9 ^{1e}	2010	Golden Arrow Bus Company
	Superior public transport network (km/km ²)	0.07	0.11 ²	2010	Cape MetroRail & MyCiti BRT
WASTE	Waste generated per person (kg/person/year)	407.8	572.9	2010	City of Cape Town Solid Waste Minimisation and Disposal Statistics Database
WATER	Population with access to potable water (%)	91.2	91.4 ^e	2009	General Household Survey 2009
	Water consumption per person (litres per person per day)	187.2	225.2	2009	City of Cape Town, Environmental Resource Management Department
	Water system leakages (%)	30.5	10.0 ³	2009	City of Cape Town, Environmental Resource Management Department
SANITATION	Population with access to sanitation (%)	84.1	94.1 ^e	2009	General Household Survey 2009

All data applies to Cape Town unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) Number of bus routes (182) multiplied by average length of route (26.1 km). 2) There are no subway or tram lines. 3) Unaccounted for water = 24.5%



Casablanca_Morocco

African Green City Index

Background indicators

Total population (million) ¹	3.4
Administrative area (km ²) ¹	1,000
Population density (persons/km ²)	3,300

¹) Greater Casablanca

Casablanca is Morocco's chief port and largest city, with 3.4 million people across the metropolitan area. Situated on the Atlantic Ocean, the city is a conglomeration of several urban centres and has a large industrial presence. It is the fourth largest port in Africa, handling more than 500,000 containers a year. In all, the city is responsible for 60% of Morocco's trade and is home to 40% of the country's workforce. Casablanca relies heavily on a private concessionaire to deliver a range of essential services, such as electricity, water and sanitation. Privatisation has led to a range of investments in public infrastructure in recent years. On the whole this arrangement has worked well, which is reflected in the city's performance in the African Green City Index. Indeed, the concessionaire, rather

than the city itself, is responsible for many of the green initiatives detailed in this city portrait. One downside to this policy is that without direct control, city authorities do not always have a quick remedy when things go wrong.

Casablanca ranks above average overall in the Index, and places above average for five individual categories: energy and CO₂, land use, water, sanitation and air quality. It does not fall below average in any category. Particular strengths when compared with the other 14 cities in the Index include relatively high levels of access to electricity, potable water and sanitation, and a relatively low number of residents living in informal settlements. Policies in these areas are also comparatively strong. Challenges include making waste collection and disposal

more consistent across the city, and the need for improvement in overall environmental monitoring. There is some hope that the uprisings around the Middle East and North Africa, which also centre on providing better services and living conditions for the population, may help to accelerate improvements.

Energy and CO₂: Above average

An estimated 99% of households in Casablanca have access to electricity, one of the highest percentages in the Index and above the Index average of 84%. Electricity, water and sanitation services are provided by Lydec, a private-sector consortium. Although Lydec has improved the city's power network since it began operations there in 1997 (see "green initiatives"), there have

been complaints about high prices. Electricity consumption remains relatively low, measuring 5.0 gigajoules per capita versus an Index average of 6.4 gigajoules. CO₂ emissions from electricity consumption are also lower than the average, at an estimated 405 kg per capita versus the Index average of 984 kg. Leaving aside the four South African cities in the Index, which push up the average considerably, Casablanca has one of the higher volumes of CO₂ emissions per capita from electricity consumption in the Index. That's because more than half of the city's electricity production is generated from coal, while only 8% comes from renewable sources.

Green initiatives: Lydec, operating in Casablanca since 1997, has upgraded the city's power network and expanded access to areas that previously lacked electricity. According to the company, improved monitoring of the power network has reduced the number of outages as well as the average time to restore power after a cut from 33 minutes to ten minutes.

Land use: Above average

Historically Casablanca has been well planned and its growth over the past 50 years has largely followed a deliberate pattern. But the urban sprawl that makes up greater Casablanca, which used to consist of 27 different municipalities, is less organised and there is a great disparity in standards of living in different parts of the city. Casablanca has the smallest proportion of its population living in informal settlements in the Index, at an estimated 15%, considerably below the Index average of 38%. Land use policies are also strong, particularly regarding green space protection, with city authorities focused on integrating more green space into urban areas. The city has an estimated 55 square metres of green

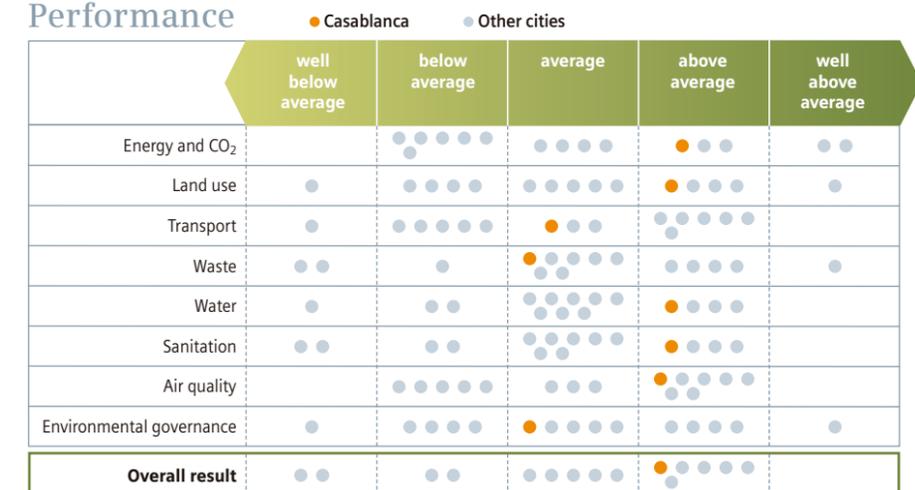
space per person across the metropolitan area, compared with the Index average of 74 square metres. Although in general the city lacks sufficient green space, the main exception is the Arab League Park in central Casablanca. Planted in 1918, the park features palm trees and café terraces for refreshments. There has been discussion of another new large park but this is yet to be realised.

Green initiatives: The government has a development strategy that aims by 2030 to rehabilitate the city centre, bring more balance in living standards between the eastern and western regions of greater Casablanca, and improve conditions in informal settlements, including building new parks. In the past two years, officials have been running pilot programmes around the metropolitan area to test the viability of "urban agriculture", which incorporates green space into urban centres and provides another food source for the city. The project receives funding from the German government's ministry of education and research. A new football stadium is also under construction. The development of the 80,000-seat stadium, a high-profile project for the city, includes plans for the creation of green space, a new element of urban planning in Casablanca.

Transport: Average

The city's public transport network measures 1.4 km per square kilometre, less than the Index average of 2.7 km. Transport connections are concentrated on the city centre with few links to peripheral areas, meaning that commutes on public transport from the suburbs are often lengthy and complicated. On a policy level, the city has made little effort on initiatives to tackle traffic congestion and there are no exclusive bus

Performance



The order of the dots within the performance bands has no bearing on the cities' results.

lanes that might encourage greater take-up of public transport. However, the city's first tramway is under construction (see "green initiatives" below).

Green initiatives: Casablanca's first 30-km tramway will have just under 50 stops and connect Sidi Moumen in the east, to Hay Hassani and the Quartier des Facultés in the west via the city's historic centre. The government says the line will carry 250,000 passengers a day; operations are slated to begin in December 2012. Another 150-km line, along with a suburban rail link, is eventually planned to connect Mohammedia in the north of greater Casablanca with Nouaceur in the south. Additionally in 2011 the Moroccan government began works on a high-speed TGV train linking Casablanca to Rabat and Tangiers.

Water: Above average

While it is estimated that all Casablanca residents have access to potable water, the city's consumption level, at 89 litres per person per day, is about half the Index average of 187 litres. The efficiency of the city's water system, which is run by Lydec, is about average by the standards of the Index. The system loses an estimated 28% of volume to leaks, compared with the Index average of 30%, but work is under way to improve that performance (see "green initiatives"). Policy areas are also relatively strong. Casablanca is one of only a few cities in the Index with a code aimed at reducing strain on its water resources and consuming water more efficiently. Water quality standards have also been set, which is relatively rare among the other 14 cities in the Index.

remain. Some of the country's biggest industrial facilities, located at Mohammedia in greater Casablanca, often pump waste and wastewater directly into the sea, a problem that Lydec is trying to address (see "green initiatives" below). An inability to drain rainwater effectively during periods of heavy rainfall is also an ongoing problem for the city.

Green initiatives: Lydec has implemented a programme to improve the wastewater network, eliminate the discharge of waste into the sea at Mohammedia and transfer wastewater from Bouskoura Ouled Saleh for treatment. The programme involves the rehabilitation and extension of the sewerage system and wastewater collection facilities, the rehabilitation of wastewater treatment stations, and the con-



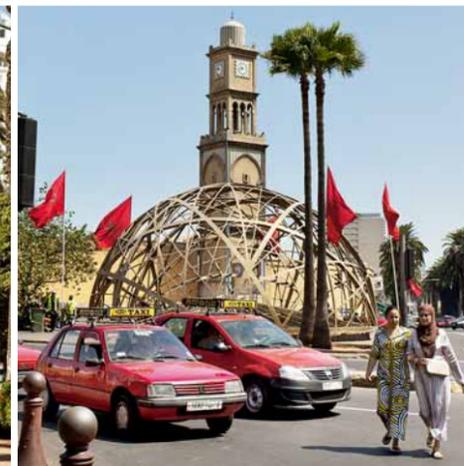
reduce the sulphur content in the country's petroleum from about 10,000 parts per million (ppm) to just 50 ppm. In addition, until two years ago there was no inspection system for vehicles in Casablanca, and therefore nothing to prevent owners from running highly polluting automobiles. In the past two years, however, there has been a major effort to address the problem. A Swiss private firm has been contracted to ensure that proper inspections are carried out and it has introduced a computerised record system that bans highly-polluting vehicles from the roads.

Environmental governance: Average

Casablanca performs relatively well for environmental management and it has a department dedicated to environmental issues. However,

relatively little information has recently been published on environmental performance and progress, and Casablanca could also do more to increase public participation in environmental affairs. As mentioned above, a number of areas of environmental policy – electricity, water and waste management – are managed by public private partnerships (PPPs) in which the government grants a concession to a private company to run the service in a certain region of the city for a set period of time. By and large, the use of PPPs has proved an effective way of improving public services, but it means that policy is not necessarily consistent across the city, and there has been some popular opposition to the strategy, particularly in the waste management sector.

Green initiatives: As part of its management of Casablanca's water, wastewater and power utilities, Lydec has introduced state-of-the-art computer technology to help improve oversight of the city's key services. The systems are monitored electronically, and data is transmitted to a control room known as the Multifluid Central Coordination Bureau. In an effort to improve reliability, Lydec has installed more than 300 remote control points on the network to give early warning of the necessity of maintenance and repair work on the system, helping prevent leaks and outages. The systems are monitored 24 hours a day. Lydec has also sought to improve community engagement. It has organised local communication days, set up a new division focussed on skills development, and held campaigns and exhibitions for the public in general and schoolchildren in particular.



The 350-km train line, scheduled to be operational in 2015, will cut travelling time from Casablanca to Tangiers from five to just over two hours.

Waste: Average

Casablanca generates an estimated 474 kg of waste per capita versus the Index average of 408 kg. Recycling policies are relatively underdeveloped compared with the other 14 cities in the Index. In general, waste collection has improved in the last five years, but the quality of service varies widely across the city, with responsibility split between three private contractors who dispose of waste at one site. Casablanca fares better in the Index for special waste collection and disposal. Facilities are available for medical, chemical and construction waste. Casablanca is marked down in the Index, however, for a lack of onsite collection points for recyclable material and a limited range of items accepted.

Green initiatives: Lydec has upgraded the city's water network and improved the supply of drinking water to a number of sectors. The Merchich pipe, which supplies water to Mohammed V, the city's main airport, has also been renovated. In addition, work is under way to minimise system leakages by installing flow meters to better monitor water volumes.

Sanitation: Above average

An estimated 99% of the city's population has access to sanitation, exceeding the Index average of 84%. Sanitation policies are generally robust as well. Casablanca has a sanitation code in place and it has also set minimum standards for wastewater treatment, backed up by regular monitoring. Lydec has been responsible for many of the improvements in sewage management in recent years. Even so, challenges

construction of a flood relief channel for the Oued El Maleh River.

Air quality: Above average

Casablanca has comparatively strong clean air policies. There is a code to improve ambient air quality, and monitoring in different city locations regularly takes place. The city also measures a wide range of air pollutants. However, Casablanca is in need of strong policies as its air quality suffers from traffic congestion and pollution from large industrial facilities nearby in greater Casablanca, including the Samir oil refinery.

Green initiatives: After years of delays and negotiations, in 2009 the national government completed the conversion of the Samir refinery at Mohammedia to low-sulphur diesel, bringing the refinery's petroleum products into line with international standards. The conversion helped

Quantitative indicators

Category	Indicator	Average	Casablanca	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	99.2 ^e	2004	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	5.0 ¹	2009	Centre d'Etudes et de Recherches Démographiques
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	405.3 ^{1,2e}	2006	2006 IPCC Guidelines for National Greenhouse Gas Inventories
LAND USE	Population density (persons/km ²)	4,578.1	3,287.5	2009	EIU calculation
	Population living in informal settlements (%)	38.0	14.6 ^{1e}	2008	Development Innovations Group Report – Best practices in slum improvement, the case of Casablanca
	Green spaces per person (m ² /person)	73.6	55.5 ^{3e}	n/a	Department of Agriculture & Department of Water and Forests
TRANSPORT	Length of mass transport network (km/km ²)	2.7	1.4 ^{1,4}	2005	ONCF (National Office for Railways in Morocco)
	Superior public transport network (km/km ²)	0.07	0.03 ^{1,5e}	2010	ONCF (National Office for Railways in Morocco)
WASTE	Waste generated per person (kg/person/year)	407.8	474.4 ^e	2009	Estimate by GESI (private contractor running the city's landfill)
WATER	Population with access to potable water (%)	91.2	100.0 ^e	2004	UN Habitat
	Water consumption per person (litres per person per day)	187.2	89.0 ¹	2004	Office National de l' Eau Potable
	Water system leakages (%)	30.5	28.0 ^e	2005	World Bank
SANITATION	Population with access to sanitation (%)	84.1	98.9 ^e	2004	UN Habitat

All data applies to Casablanca unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) Greater Casablanca. 2) National electricity generation mix used to estimate city level CO₂ data. 3) Metropolitan area. 4) Number of bus routes (56) multiplied by average length of bus route for other cities in the Index (26 km). 5) There are no subway, tram or BRT lines



Dar es Salaam Tanzania

African Green City Index

Background indicators

Total population (million)	3.0
Administrative area (km ²)	1,400
Population density (persons/km ²)	2,200

Dar es Salaam, more commonly known as Dar, is the largest city in Tanzania. It has a population of 3 million, a number expected to double by 2020. Located on a natural harbour on the Indian Ocean, Dar is the country's trading hub. Like many other Tanzanian cities, it has experienced a construction and population boom in recent years, putting a strain on the city's resources and infrastructures. Dar es Salaam is among the top-ten fastest growing cities in the world, and this too will bring huge challenges, especially as more than two-thirds of its population already lives in informal settlements. Dar es Salaam ranks well below average overall in the African Green City Index. Its best category results are in energy and CO₂ as well as water, where it ranks average. The city has some enormous environmental challenges to overcome, particularly in waste and sanitation, where it ranks well below average. DAWASCO, Dar's water and sewerage provider, is struggling to cope with demand. In addition, there are few policies in place to tackle green issues, and the city's transport network is one of the least developed in the Index. Investment on the scale needed to overhaul Dar es Salaam seems unlikely in the short term. Instead, further green initiatives will most likely have to come from innovative approaches, community participation and more involvement from international agencies, such as the UN, which have been active in the city in recent years.

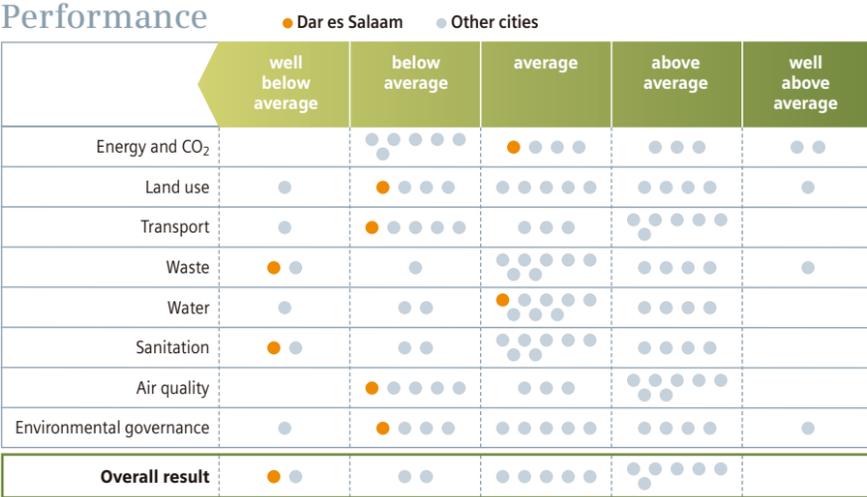
Energy and CO₂: Average
One of Dar es Salaam's stronger categories is energy and CO₂, where it is marked up for its relatively low electricity consumption and emission levels. The city consumes 2.5 gigajoules of electricity per capita, versus the Index average of 6.4 gigajoules. CO₂ emissions from electricity consumption are an estimated 61 kg per capita, a tiny fraction of the Index average of 984 kg. The city's emissions performance is helped by sourcing 60% of its electricity from hydropower. Also, a lack of electricity supply helps explain the low consumption and low CO₂ emissions. Only an estimated 60% of households in Dar es Salaam have access to electricity, compared with the Index average of 84%. This leads to a heavy dependency on gas and diesel generators – leased at high expense from foreign companies – to meet the city's power requirements. Dar seems set to reduce its reliance on hydropower, because the water supply to power the hydro plants has

been compromised by inefficient agricultural activities upstream in the Kilombero and Usungu valleys. Instead it is favouring natural gas, which currently accounts for 36% of electricity production. For example, the city is looking to add substantial supplies by building a natural gas pipeline from a newly discovered source in south Tanzania. The city is marked down for its lack of clean energy policies. For example, it does not have a strategy to reduce the environmental impact of its energy consumption.

Land use: Below average
An estimated 68% of Dar es Salaam's population lives in informal settlements, compared with the Index average of 38%. Despite a fairly low population density of roughly 2,200 people per square kilometre, the city's amount of green spaces is under the Index average, at 64 square

metres per person. The Index average is 74 square metres. Relatively weak land use policies also contribute to Dar's performance. It does not have policies to protect green space or environmentally sensitive areas, for example, nor does it have policies in place to manage urban sprawl. The city gains marks, however, for providing informal settlements with municipal services, which it has carried out in partnership with UN Habitat. The city's master plan dates back to the 1970s, although this is currently being reviewed.

Green initiatives: Tanzania's new minister of Lands, Housing and Human Settlements, Anna Tibaijuka, has returned from heading UN Habitat to declare that one of her first tasks will be to impose "urban order" on Dar es Salaam. In particular, she wants to strengthen the city's policies to improve the quality of the building stock and reduce illegal building. Under her watch, Ms Tibaijuka says, developers will have to take account of sanitation, waste and traffic produced by their proposed construction. The ministry will also seek to limit and manage illegal takeovers of vacant land in the city. In another initiative relating to buildings, the international Aga Khan Foundation, a non-governmental organisation, is trying to introduce traditional Swahili building methods. This includes using shade and breezes to cool buildings, and using local mud and thatch instead of imported steel and glass. Although these will be difficult to realise on a large scale, some of the principles of Swahili architecture can help show the way for superior and greener new developments. Other initiatives include the integration of urban farm-



Transport: Below average
Dar es Salaam's public transport network is underdeveloped and the city lacks any form of superior transport such as light rail, trams or metro. Although 7,000 to 10,000 privately run buses and minivans are in operation, dedicated bus routes have yet to be created. There are plans to roll out a bus rapid transit network (see "green initiatives"), but it is not expected to be up and running until 2013. Meanwhile, Dar es Salaam's roads continue to get more and more congested – average commuting time has doubled during the last decade. Policies, too, are relatively underdeveloped. Dar es Salaam is one of only a few Index cities that have not taken any

steps to reduce emissions from mass urban transport. Nor has the city undertaken any initiatives to reduce traffic congestion, although it does have sequenced traffic lights. However, Dar is marked up for being one of three cities in the Index that promote greener forms of transport. It has, for example, a partnership with a local non-governmental organisation to take into account the needs of cyclists when constructing new roads.

Green initiatives: In 2005 the World Bank funded the development of plans for a bus rapid transit system in order to modernise the public transportation network and limit the further growth of car traffic. The plan envisions that DART (Dar Rapid Transit) will run along dedicated lanes, with links to private minibuses. Although the project has been delayed, there are signs that the start of construction is near-

ties to recycle paper, plastics and glass are said to be in the planning stage, but are not yet present. However, some private operators recycle goods such as plastic on a small scale around the city.

Water: Average

On quantifiable water metrics Dar es Salaam is in line with Index averages: the city consumes an estimated 187 litres of water per day per capita, which is equal to the Index average. An estimated 90% of the city's inhabitants have access to potable water, compared with the average of 91%. Water system leakages, at an estimated 30% of total volume, also mirror the Index average. Yet challenges remain. Poorer districts in the city receive water only on a weekly basis, and Dar's performance is relatively weak in policy areas. The city does not yet have a strategy aimed at encouraging efficient water consumption, nor does it enforce water pollution stan-

ding and rationing water sources in the city. A key element is a campaign of water education for Dar es Salaam residents that seeks to promote a better understanding of the value of water and its limited supply, and implement improved water usage in communities. In another initiative, Tanzania's minister for water recently announced a US\$21 million effort to increase the supply of water to the city by 90% before 2015. The ministry says this will be achieved by rapidly improving sewage treatment, doubling the size of the pumping plants on rivers that supply Dar with water, and drilling large boreholes in and around the city.

Sanitation: Well below average

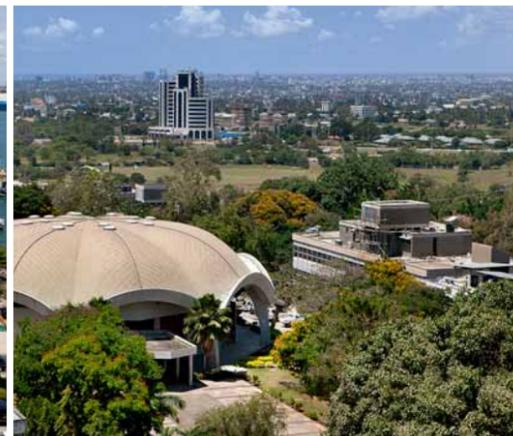
An estimated 56% of the city's population has access to sanitation, with an estimated 7% of Dar's households linked directly to sewers. In addition, it is estimated that only 10% of the

raises carbon monoxide and nitrogen oxide levels. Another air pollution problem is the use of wood and charcoal for cooking, as well as the burning of solid waste. There has been air quality monitoring in the past, with the assistance of the US Environmental Protection Agency and the UN, but these efforts were temporary and only took place in limited locations around the city. Dar does not currently monitor air quality on its own without outside assistance.

Green initiatives: Dar es Salaam hopes to receive part of a US\$777 million loan from the World Bank to the national government of Tanzania to improve the environment, including provisions to deal with air quality. Specifics are unclear at this point, although one suggested scheme could help develop clean energy stoves and community cooking initiatives in poorer communities.

Environmental governance: Below average

Unlike the majority of Index cities, Dar has no authority dedicated to green issues. Responsibility for environmental programmes is generally divided between various departments and in many cases when policies are in place they are ignored or not enforced. Neither have there been any recent published reports on environmental performance and progress. In a city where more than two thirds of the population lives in informal settlements, the lack of green reporting is unlikely to be a top priority in most people's minds. Nevertheless, the absence of baseline environmental reviews and the lack of any concerted green management efforts are cause for concern. Without a plan or strategy to improve the city's environmental affairs, the majority of city inhabitants are unlikely to see a rise in their environmental living standards.



ing. City authorities say the first seven stations will be open by 2013. This initial phase is expected to cost US\$10 million, with most of the funding coming from the World Bank.

Waste: Well below average

Dar es Salaam generates an estimated 462 kg of waste per capita, slightly more than the Index average of 408 kg. Policies, however, are relatively weak and the city lacks an integrated strategy aimed at reducing or recycling waste. It also lacks regulations for waste picking, monitoring of illegal waste dumping and standards for the industry to adequately dispose of hazardous waste. As a result the city is struggling to cope with municipal waste. In the absence of a regular and reliable waste collection service, residents typically burn their rubbish. Toxic fumes from burning plastic are not uncommon. Facili-

ties on local industry. In a recent assessment, UN Habitat outlined water and sanitation needs for Dar es Salaam. Those included developing an overall conservation and water-demand management strategy that addresses in particular the needs of the urban poor; educating policy makers and senior administrators about demand management in order to reduce the number of illegal connections and vandalism; transferring resource management from the city's water and sewer agency to communities; and introducing water conservation education for children. The UN has made investments in the city to address some of these action points (see "green initiatives" below).

Green initiatives: UN Habitat has run several initiatives in the city in the last ten years, including a programme aimed at identifying, protect-

ing and rationing water sources in the city. The city has relatively weak sanitation policies, which need to be strengthened to improve sanitation services. Like the majority of Index cities, Dar could bolster regulations to monitor sanitation facilities and treat wastewater. But unlike the majority of Index cities, Dar does not promote public awareness about healthy sanitation practices.

Air quality: Below average

Dar es Salaam has no code to improve air quality and there is no comprehensive and continuous monitoring of air pollutants. The city lacks campaigns to raise public awareness about the dangers of air pollution, although that might change if it is awarded outside financial assistance (see "green initiatives"). Meanwhile, Dar's roads are becoming more congested, which

Quantitative indicators

Category	Indicator	Average	Dar es Salaam	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	59.8 ^e	2004	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	2.5	2009	National Bureau of Statistics
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	60.8 ^{1e}	2009	2006 IPCC Guidelines for National Greenhouse Gas Inventories
LAND USE	Population density (persons/km ²)	4,578.1	2,182.4	2009	EIU calculation
	Population living in informal settlements (%)	38.0	68.0 ^e	2009	UN Habitat
	Green spaces per person (m ² /person)	73.6	64.1 ^e	2004	Royal Institute of Technology, Division of Urban Studies, Stockholm
TRANSPORT	Length of mass transport network (km/km ²)	2.7	0.0 ²	2011	
	Superior public transport network (km/km ²)	0.07	0.00 ³	2011	
WASTE	Waste generated per person (kg/person/year)	407.8	462.4 ^e	2009	Dar es Salaam City Council
WATER	Population with access to potable water (%)	91.2	90.0 ^e	2009	Energy and Water Utility Regulatory Authority
	Water consumption per person (litres per person per day)	187.2	187.0 ^{4e}	2009	UN Habitat
	Water system leakages (%)	30.5	30.0 ^{5e}	2007	UN Habitat
SANITATION	Population with access to sanitation (%)	84.1	55.6 ^e	2004	UN Habitat

All data applies to Dar es Salaam unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National electricity generation mix used to estimate city level CO₂ data. 2) There are no dedicated bus routes in Dar es Salaam. 3) There are no subway, tram, light-rail or BRT lines. 4) Data refer to Tanzania urban population. As the largest urban centre, this is a good estimate for Dar es Salaam. 5) Unaccounted for water = 60%

Transport: Above average

With an extensive bus system of 1,400 routes and some 200 operators, Durban has the longest public transport system in the Index. In total it measures 9.2 km per square kilometre, more than three times the Index average of 2.7 km. Superior forms of public transport, such as metro, BRT or tram lines, make up an estimated 0.16 km per square kilometre, more than twice the Index average of 0.07 km, and consist mostly of suburban trains. Nevertheless, Durban's public transit network is often hampered by unreliability and those who can afford them commonly use private vehicles. City officials' ability to overcome these obstacles will be a key factor in the future success of mass transit development efforts.

Green initiatives: The city council used the hosting of the 2010 World Cup as an opportunity to invest in public transport, securing US\$236 million of national government money for this purpose. Initiatives included the launching of a

city's growth. Though there is no separate municipal collection service for household hazardous waste, a domestic collection programme ensures the adequate disposal of cardboard, paper, tin and glass, and covers most of the city's formal housing areas. In recent years, the city has introduced public clean-up campaigns to address the problem of illegal dumping and has even conducted raids to stop that. Durban's waste score is further bolstered by a robust set of policies aimed at enforcing environmental standards on landfill sites.

Green initiatives: In a bid to increase recycling and create local income, informal waste-pickers are allowed to rummage through the Bisasar Road landfill site for items they perceive to be of value. They can then sell their items at various buy-back centres run by both private recycling companies and the city. It is estimated that more than 66,000 kg of material are retrieved from the Bisasar Road site each month by some 300 to 400 waste collectors, or around 200 families.

water sustainability in the Index, and leads the Index, along with Cape Town, on water quality policy.

Green initiatives: There are seasonal hose-pipe bans, and some environmentally conscious residents carry out private collection of rainwater and grey-water recycling. The city promotes water conservation in homes by giving out free water-flow limiters and encourages people to use water meters. Furthermore, the water and sanitation department has started supplying treated wastewater to irrigate farmland and community gardens.

Sanitation: Above average

An estimated 90% of the population has access to sanitation, compared with the Index average of 84%, and the city's wastewater is treated before being discharged into nearby rivers and the ocean. However, like many cities in the Index, Durban faces challenges providing sanitary conditions to low-income informal settle-



have had a positive impact, with blockages down significantly, and the scheme has been hailed as a best-practice example. Durban's water department was invited to create a toolkit to be used in urban Kenya and then possibly elsewhere on the continent.

Air quality: Above average

Durban's clean air policies are among the strongest in the Index, and officials have been monitoring air quality at various sites around the city since 2004. Systems measure sulphur dioxide, nitrogen dioxide, particulate matter and carbon monoxide. Air pollution is particularly severe in the south of the city, near the coast, where the mix of heavy industry and densely settled residential sectors has prompted concerns about air quality.

Green initiatives: Through its Imagine Durban project (see "green initiatives" in the environmental governance category) the city has set a target to ensure that within ten years air is "not

harmful to human health". In a bid to achieve this target, a number of key goals have been outlined. The first is to reduce commercial pollution by establishing and implementing by-laws that create penalties for pollution and promoting low-emission industries. There are calls for vehicles to meet low-emissions standards, and suggestions that workers share vehicles and companies promote carpooling or provide more communal transport.

Environmental governance: Above average

Durban has some of the strongest policies on environmental management and monitoring in the Index. In 1994 Durban was the first South African city to adopt the UN's Local Agenda 21, which committed the city to implement sustainability measures, including creating a small environmental management department. Since then, the department has expanded to 20 full-time employees. The city government consistently monitors its environmental performance

and regularly publishes information on progress.

Green initiatives: The Imagine Durban initiative is a city-council-led project on integrated, long-term planning. It is being implemented in conjunction with partners: Sustainable Cities, a Canadian non-governmental organisation, and the PLUS Network, a network of 35 cities sharing experiences in sustainability planning. The concept behind Imagine Durban is to focus on what citizens would like the city to be in the future and then set medium- and long-term targets to meet these goals. In another initiative, in September 2011 Durban hosted its second three-day "Sustainable Living Exhibition", which aimed to showcase innovative ideas for more environmentally friendly lifestyles. More than 130 stands exhibited a range of goods, including devices to save water and energy, solar-power equipment, ozone-friendly appliances, and tools for organic gardening and recycling. The event was seen as a warm up for the COP 17 summit.



new passenger bus called the People Mover, which created new routes in areas not served by existing transport providers, running along the beachfront and connecting Durban to neighbouring communities. The council also created a new online travel information system integrating details of buses, taxis and minibuses on touch screens at various sites around the city, including the Moses Mabhida Stadium. There are longer-term plans to have a fully integrated public transport system, so that bus and taxi routes match up with train stations.

Waste: Above average

Durban generates 519 kg of waste per capita annually, more than the Index average of 408 kg. Landfills are increasingly unable to match expanding waste volumes resulting from the

The city is studying ways to expand these sites and put them in more suitable areas, closer to lower-income residents.

Water: Above average

An estimated 98% of the population has access to potable water, compared with the Index average of 91%. The city's consumption has increased steadily over the past four years and today, at 253 litres per person per day, it is above the Index average of 187 litres. Leakages, at 36%, are also higher than the Index average of 30%. The quality of Durban's drinking water is generally very good, in part due to the city's strict policies on improving and monitoring surface water. Likewise, the city enforces water pollution standards on local industry. As a result, the city has the strongest policies on

ments. Those areas often suffer from a poorly maintained and often vandalised sewerage network susceptible to blockages during periods of high demand. Nevertheless, Durban's efforts to promote public awareness around proper sanitation and its implementation of minimum wastewater treatment standards set it apart from many of the other cities in the Index.

Green initiatives: In 2000 the city's water service launched a sewage education programme in a bid to reduce damage to the city's sewerage network. Educational resources and toolkits were designed for use in schools and at informal education settings, such as clinics. There were road shows and street theatre performances aimed at lower income communities where literacy levels are lower. The campaign appears to

Quantitative indicators

Category	Indicator	Average	Durban	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	88.0 ^{1e}	2010	National Department of Cooperative Governance and Traditional Affairs
	Electricity consumption per capita (GJ/inhabitant)	6.4	11.3 ¹	2010	Durban Electricity Department
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	3,503.4 ^e	2010	World Bank
LAND USE	Population density (persons/km ²)	4,578.1	1,509.8 ^e	2007	EIU calculation
	Population living in informal settlements (%)	38.0	22.4 ^e	2007	Community survey 2007
	Green spaces per person (m ² /person)	73.6	186.6 ¹	2007	State of Energy, Key Indicators Report 2007/08
TRANSPORT	Length of mass transport network (km/km ²)	2.7	9.2 ¹	2011	eThekweni Transport Authority
	Superior public transport network (km/km ²)	0.07	0.16 ^{1, 2e}	2010	Metrorail
WASTE	Waste generated per person (kg/person/year)	407.8	519.0	2007	State of Energy, Key Indicators Report 2007/09
WATER	Population with access to potable water (%)	91.2	98.0 ^{1e}	2007	Community Survey 2007
	Water consumption per person (litres per person per day)	187.2	252.9 ¹	2007	State of Energy, Key Indicators Report 2007/08
	Water system leakages (%)	30.5	36.4 ¹	2007	State of Energy, Key Indicators Report 2007/09
SANITATION	Population with access to sanitation (%)	84.1	90.1 ^e	1998	UN Habitat

All data applies to Durban unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) eThekweni area. 2) There are no subway, tram or BRT lines



Johannesburg

South Africa

African Green City Index

Background indicators

Total population (million)	3.9
Administrative area (km ²)	1,600
Population density (persons/km ²)	2,400

Johannesburg is the economic centre of South Africa and headquarters for the country's manufacturing and mining industries. A magnet for migration, it is South Africa's most populous city, with around 3.9 million people. Johannesburg is located in the Gauteng province, which has a total population of over 10 million. Water, waste and sanitation standards are generally better than in many of the other cities in the African Green City Index, and often consistent with those in more developed parts of the world. However, like many developing cities in Africa and globally, and due in part to the legacy of Apartheid, there are wide income disparities and dramatically different living conditions between rich and poor. The city has introduced several policies and plans, particularly in the

areas of transport, land use and air quality, with the specific aim of improving environmental performance. There was also significant progress in transport and land use in preparation for the 2010 World Cup.

Johannesburg ranks above average overall in the Index, along with five other cities. It is particularly strong in energy and CO₂, land use, transport, air quality and environmental governance, ranking above average in each category. The city's environmental performance is bolstered by having the second highest amount of green space among the 15 Index cities and an extensive bus network, as well as generally robust environmental policies, especially for clean energy and congestion reduction. The city's performance is very consistent – it never falls below

emissions are higher than average, at an estimated 1,484 kg per person, compared with the Index average of 984 kg. On the other hand, Johannesburg's per capita electricity consumption, at 5.6 gigajoules, is lower than the Index average of 6.4 gigajoules per person. And like all other South African cities, Johannesburg has a robust strategy aimed at reducing the environmental impact of energy consumption (see "green initiatives" below), which helps secure its above average ranking in this category.

Green initiatives: The city of Johannesburg is keen to promote solar power as a way to reduce carbon emissions and cut electricity costs. The authorities, thanks to funding from the Danish Development Agency, have spent US\$1.2 million installing solar water heaters in 700 low-cost homes in Cosmo City, a housing development. There are plans to extend the scheme to other parts of the city where electricity supplies are poor. In another solar-related initiative, the Johannesburg Road Agency has been installing solar power signals at key city intersections since 2009. In addition to saving energy, the signals are not susceptible to power failures, which cause congestion and higher fuel consumption from queuing drivers. Plans are also under way to convert landfill gas from several sites into electricity to power city homes. Work has begun on the first plant of its kind at one of the city's landfills, and there are plans to extend the scheme to four further landfill areas, with a view to generating enough electricity for 12,500 households over a 20-year period.

Land use: Above average

Johannesburg is a sprawling city comprised of scattered pockets of residential, industrial and office developments. As a result, population

density is lower than the Index average, at 2,400 people per square kilometre, versus the Index average of 4,600. More recent development has continued to favour sprawl, but the city is introducing policies to revive the city centre (see "green initiatives" below). An estimated 19% of Johannesburg's residents live in informal settlements, which is well below the Index average of 38%. The city boasts more than 10 million trees in parks and along avenues, and has the second highest amount of green space in the Index, at 231 square metres per person, compared with the average of 74 square metres. Although Johannesburg aims to protect sensitive areas such as wetlands, the overwhelming demand for new housing will put pressure on this goal.

Green initiatives: The city is trying to reduce urban sprawl by rehabilitating under-populated city centre neighbourhoods and building new mixed-density and mixed-income housing developments with access to municipal services and public transport links. To this end, the Johannesburg Development Agency, which receives city and private funds, was set up in 2001 with the specific remit to regenerate decayed inner city areas. It has been credited with transforming several city districts, upgrading pavements, lighting, parking and security. The parks department, meanwhile, works to maintain and refurbish green spaces and promote environmental projects, such as tree planting, bird watching, litter collection and river cleaning. A number of parks have been developed from wasteland alongside some townships with a view to create a greener environment for residents.

Transport: Above average

Although the city has an estimated 6.8 km per square kilometre of bus routes, far more than

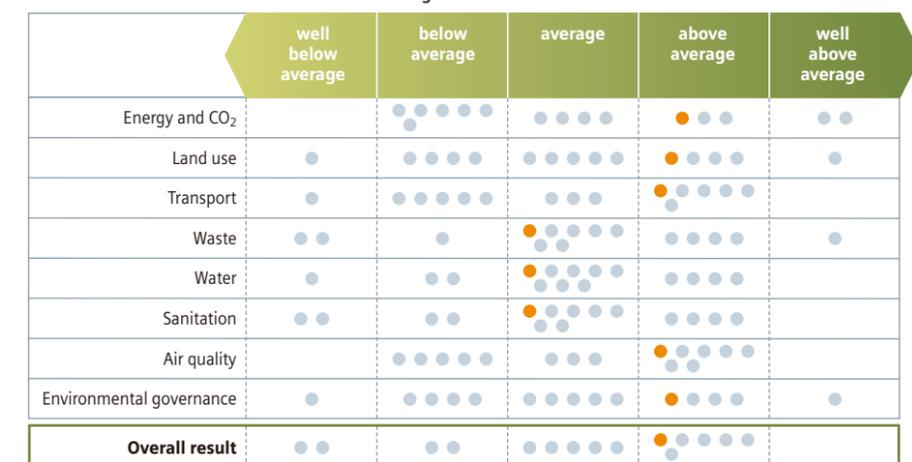
average in any individual category, achieving average rankings in water, waste and sanitation.

Energy and CO₂: Above average

Providing energy to Johannesburg's 3.9 million residents, half of whom live in cramped and poorly served townships, is no easy feat. In the colder months when demand is high, power outages are regular occurrences. Still, an estimated 90% of households in the city have access to electricity, which is better than the Index average of 84%. Although the majority of people are connected to the electricity grid, those in informal settlements rely on coal and wood fires. Grid electricity is also highly dependent on coal, which is responsible for more than 90% of the city's electricity production. As a result, CO₂

Performance

● Johannesburg ● Other cities



The order of the dots within the performance bands has no bearing on the cities' results.

the Index average of 2.7 km, public transport in the city is often unreliable or unsafe. This means personal vehicles, for those who can afford them, and mini-bus taxis for the less well off, clog city streets. However, the city has worked to improve, introducing a bus rapid transit system and a high-speed train line to the airport (see “green initiatives” below). Both of these initiatives have helped extend fast, safe and affordable transport options.

Green initiatives: There are two recently launched major public transport initiatives in Johannesburg, both of which were driven in part by South Africa’s hosting of the 2010 World Cup. The first is the high-speed train line, the Gautrain, which links downtown Johannesburg to Pretoria. It is already operational though works are underway on one final station; the train also connects the Johannesburg’s Sandton

Waste: Average

The city generates 401 kg per person of waste each year, very much in line with the Index average of 408 kg. Almost 95% of this goes to landfill, with recycling and composting accounting for less than 5% of waste treatment. The city has introduced recycling through central collection points rather than curb-side collection. Overall, dealing with waste, including the estimated 244,000 tonnes that are illegally dumped each year, remains a challenge in Johannesburg as the city is rapidly running out of landfill space and the population is growing.

Green initiatives: In a bid to increase recycling, the city is drafting new regulations to make separation of waste into recyclables a legal requirement for residents and businesses. Non-compliance could possibly be punishable by fines or criminal prosecution. Pikitup, the city’s waste

Johannesburg’s water from as far away as Lesotho or Botswana. Johannesburg performs better than the Index average for water leakages, at 25% compared with the Index average of 30%. Plans are underway to introduce meters, and improve billing and water delivery services, which have had a reputation for administrative errors in past years. Regarding policy, the municipality monitors surface water, ground water, potable water and wastewater for multiple pollutants and quality levels by taking water samples from about 150 different points in the city. It has also placed sensors in key areas to detect sewer overflows and pump-station failures. Furthermore, the city promotes public awareness on water conservation.

Green initiatives: Tackling the looming threat of acid mine drainage will be one of the biggest challenges for the city’s water department in the

Sanitation: Average

An estimated 92% of the population has access to clean toilets, according to a 2007 community survey, well above the Index average of 84%. Unlike other parts of South Africa, Johannesburg does not have open toilets, and most people who live in informal settlements are given portable toilets. Johannesburg Water owns and operates six wastewater treatment works, which treat all domestic sewage and industrial effluents.

Green initiatives: In 2008 the water department committed US\$139 million in its capital budget to improving water infrastructure and sewer networks. Work is still ongoing, though exact details are difficult to obtain. In addition, the city promotes proper sanitation at water events such as the annual Water Festival held in April.

Air quality: Above average

Johannesburg’s above average performance in the air quality category is driven by its strong policies to improve air quality, including routine and stringent air quality monitoring efforts. Using a well-developed network of air monitoring stations, the city measures sulphur dioxide, nitrogen dioxide, carbon monoxide and ozone emissions from vehicles, industry and domestic fuel burning. Despite aggressive action in this area, air quality issues still persist, and Johannesburg faces the same challenges as most large cities in reducing air pollution. Vehicle emissions are growing and air pollution is posing a real health risk to residents, particularly for people who live in areas where paraffin and wood are commonly used for heating and cooking. Dependence on fossil fuels for generating electricity also contributes to air quality issues.

Green initiatives: In 2003 the city launched its Air Quality Management Plan, which has been updated several times and forms part of the 2040 Growth Development Strategy launched in 2011. The city is proposing to add five air quality monitoring stations to the existing six. Officials are also in the process of establishing an air pollution control bylaw that will set acceptable industry and commercial emission levels. However, they have not specified when the new rules are expected to come into force.

Environmental governance: Above average

The city government has several departments focusing on different aspects of environmental management, while various regional and neighbourhood entities work in tandem with the municipal authorities to carry out policies and enforce regulations. Although the city government must work under national law, it sets its own environmental objectives and management plans. Johannesburg has one of the best records on environmental monitoring in the Index: the municipal government regularly monitors environmental performance and publishes information on progress. The latest iteration was in 2008, when it published the State of the Environment Report.

Green initiatives: Johannesburg’s Growth Development Strategy, launched early August 2011, aims to set out a clear strategy for the city’s management. It started with a nine-week consultation period, during which nine separate themes were tackled through community events, roundtables and roadshows, as well as high-level meetings and expert conferences.



business district to OR Tambo International Airport. The second major initiative is the Rea Vaya bus rapid transit system. Construction began in 2006, with the first route connecting the densely populated township of Soweto with downtown Johannesburg. The 25 km route has 33 station stops, and a number of other feeder routes join from the east and west. The long-term plan is for the Rea Vaya to cover more than 300 km and become a transport option for 80% of the city’s residents. Officials say it is the single biggest initiative to tackle greenhouse gases in the city. They also claim that if only 15% of Johannesburg’s car users switched to Rea Vaya buses, which run on low-sulphur diesel, instead of using their private vehicles, the city would cut its CO₂ emissions by 1.6 million tonnes by 2020.

management company, has been piloting collection of some recyclable materials from more than 30,000 households, and is encouraging people to use separate bins for paper, metal, plastic, textiles and electronic equipment, although this is voluntary.

Water: Average

Johannesburg residents consume 349 litres of water per person per day, versus the Index average of 187 litres. An estimated 98% of the population has access to potable water, more than the Index average of 91%. Most of Johannesburg’s water supply is delivered from the Vaal River 50 km away. In order to meet growing demand and address concerns about industrial contamination from past mining operations, the city has considered long-term plans to source

next decade, and responsibility for the programme has been scaled up to the central government. In early 2011 the national Department of Water Affairs announced plans to install a US\$25 million pump to divert acid mine water from the city’s water sources. As part of its 2011 revised Growth and Development Strategy the city has said it is keen to invest in urban rainwater harvesting systems and capitalise from increased rainfall due to climate change. The city is currently canvassing for ideas about how the rainwater harvest scheme will operate and details are yet to be announced. In addition, every year, usually in April, the city puts on a Water Festival aimed at promoting water conservation, with educational and family activities hosted by the city and private companies that sponsor the event.

Quantitative indicators

Category	Indicator	Average	Johannesburg	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	90.0 ^e	2010	National Department of Cooperative Governance and Traditional Affairs
	Electricity consumption per capita (GJ/inhabitant)	6.4	5.6	2007	State of Energy Report 2008
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	1,483.8 ^e	2007	State of Energy Report 2008
LAND USE	Population density (persons/km ²)	4,578.1	2,363.5	2007	EIU calculation
	Population living in informal settlements (%)	38.0	18.8 ^e	2007	State of Energy Report 2008
	Green spaces per person (m ² /person)	73.6	230.7	2007	State of Energy Report 2008
TRANSPORT	Length of mass transport network (km/km ²)	2.7	6.8 ^{1e}	2003	Johannesburg Integrated Transport Plan 2003-2008
	Superior public transport network (km/km ²)	0.07	0.08 ²	2010	Metrobus & Gautrain
WASTE	Waste generated per person (kg/person/year)	407.8	401.3	2007	State of Energy Report 2008
WATER	Population with access to potable water (%)	91.2	98.3 ^e	2007	Community survey 2007
	Water consumption per person (litres per person per day)	187.2	348.7	2008	Johannesburg Water – Annual Report 2007/08
	Water system leakages (%)	30.5	25.1 ³	2008	Johannesburg Water – Annual Report 2007/08
SANITATION	Population with access to sanitation (%)	84.1	91.9 ^e	2007	Community survey 2007

All data applies to Johannesburg unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) Number of bus routes (448) multiplied by average length of a bus route (25 km). 2) There are no subway or tram lines. 3) Data refer to “unaccounted for water”



Lagos_Nigeria

African Green City Index

Background indicators

Total population (million) ^{1e}	10.6
Administrative area (km ²) ¹	3,600
Population density (persons/km ²) ^e	3,000

¹) Lagos State, ^e = EIU Estimate

Lagos, located on the southwest coast of Nigeria, is the most populous city in the African Green City Index, with an estimated urban agglomeration of 10.6 million people. It is made up of Lagos Island, the original city, and the Mainland, which is comprised of rapidly growing settlements. Lagos has a large concentration of multinational companies and is home to almost half of Nigeria's skilled workers. It is one of Africa's five biggest consumer markets and boasts a higher standard of living than anywhere else in Nigeria. Nevertheless, rapid urbanisation and population growth have introduced significant challenges for its water, waste management and sanitation infrastructure, and have put pressure on the energy supply and traffic management. However, officials are keen to transform this mega-city into a first-class busi-

ness centre, and in the last decade have established a dedicated environmental authority and invested heavily in a mass transit plan.

Lagos ranks average overall in the Index, with its best performance in the energy and CO₂ category, where it ranks well above average. This is driven by better-than-average levels of electricity access, a very low rate of per capita electricity consumption and low levels of CO₂ emissions from electricity use. Lagos also places above average in the waste category due to a comparatively low rate of waste generation, although challenges still remain in waste management. The city's transport, water, sanitation, air quality and environmental governance results are average. Land use, where Lagos ranks below average, remains a particularly challenging area for the city because of the demands of a rapidly

growing population, which is expected to increase by 33% by 2020, according to the UN.

Energy and CO₂: Well above average

Lagos State as a whole consumes roughly 45% of the country's energy and is responsible for a significant portion of its carbon footprint. In the city, incinerated solid waste, bush burning, domestic cooking, vehicles and electricity generators are the main sources of CO₂ emissions. Still, Lagos performs comparably well on most indicators in the category. For example, UN Habitat estimates that just under 100% of households have access to electricity, more than the Index average of 84%. In addition, Lagos has one of the lowest per capita electricity consumption levels in the Index, at 0.8 gigajoules, compared with the average of 6.4 giga-

joules. Per capita CO₂ emissions from electricity consumption, at an estimated 36 kg, also are well below the Index average of 984 kg. Just over a quarter, 27%, of the city's electricity is generated from hydropower. Nevertheless, Lagos faces electricity shortages and blackouts are common, forcing households and industries to rely on generators as an alternative power supply.

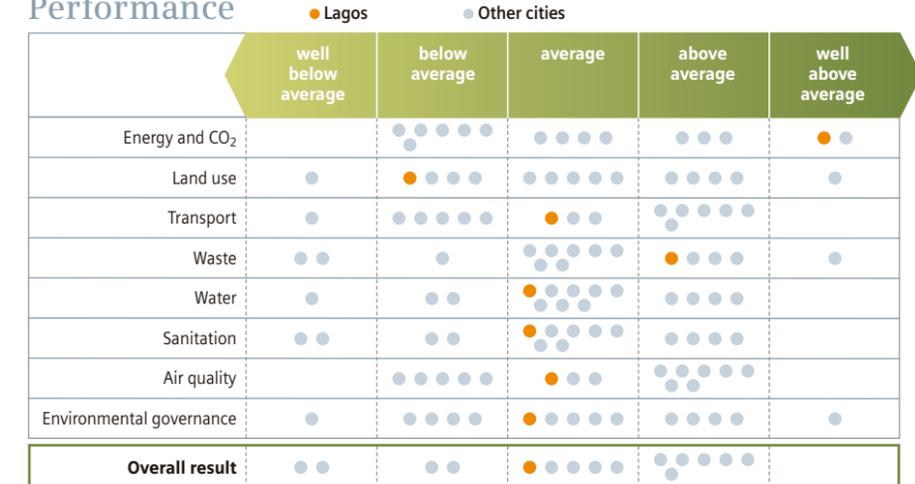
Green initiatives: For the past three years the state government has organised and hosted an annual three-day International Summit on Climate Change, which demonstrates its commitment to improving sustainability and mitigating its environmental impact. Officials have also been looking at ways to capitalise on global carbon credit trading schemes, such as the Kyoto Protocol's Clean Development Mechanism,

Resources to champion the city's electricity challenges and ensure the development of the state's natural mineral resources.

Land use: Below average

The World Bank estimates that two-thirds of Lagos's residents live in informal settlements, compared with the Index average of 38%. Only an estimated 20% to 40% of development in Lagos is carried out with government approval. Demand for land in Lagos has skyrocketed in line with the city's rapid population growth, and as a result there are relatively few green spaces. They measure an estimated 34 square metres per person, compared with the Index average of 74 square metres. Policies to contain urban sprawl are weaker than in many other cities in the Index, and there are no clear policies protecting existing environmentally sensitive areas from

Performance



The order of the dots within the performance bands has no bearing on the cities' results.

under which developed countries can invest in developing nations in exchange for carbon emissions credits. In 2010 the Lagos State government kicked off its National Carbon Credit Awareness Campaign to raise awareness around the potential benefits of carbon trading. It also supported the National Carbon Train, a campaign to encourage low carbon emissions and the potential for earning carbon credits. As part of this the Lagos State Environmental Protection Agency has established a Carbon Credit Centre to deal with carbon credit consultations, transactions, applications and trading, and also to promote clean energy deals. In addition, the city is piloting various renewable energy schemes, including solar street lights and wind turbines. Moreover, in July 2011 the Lagos State government created a Ministry of Energy and Mineral

development, although the state government has initiatives in place to plant trees and improve green spaces (see "green initiatives" below).

Green initiatives: In 2008 the Lagos State government, in collaboration with the Clinton Climate Initiative, embarked on a beautification programme for its major open spaces and highways. A year earlier it had started an aggressive tree planting campaign, with the commitment to plant a million trees within four years, which should have a positive impact on air quality. Within two years over 500,000 trees had been planted. On top of this the state government called on the private sector to partner with it in the greening of public spaces. A parks and garden agency is being established to drive this programme forward.



Transport: Average

With over six million cars on the road every day, thoroughfares are congested and polluted. The public transport system, consisting mainly of tens of thousands of privately owned buses, is not directly controlled by city officials. Rail networks are limited, although the city introduced bus rapid transit in 2008 to tackle the huge mass transit challenges (see “green initiatives” below). As a result, the city’s public transport network is considerably shorter than the Index average, measuring 0.1 km per square kilometre, compared with the Index average of 2.7, though due to data availability private operators were not included. However, the state has a comprehensive urban mass transport policy in place and has awarded contracts for two new rail lines. The Lagos State Waterways Authority is considering using the city’s waterways for transport and has built jetties intended for ferry transport.

Green initiatives: In March 2008 the Lagos State government introduced bus rapid transit in conjunction with the private sector. This was promoted as an affordable, reliable and safe means of travelling while significantly reducing congestion on the city’s roads. The buses, running in dedicated lanes, can reduce journey times by 30%. In 2010 there were 220 buses in operation and 120 million passengers used the system in the two years of operation, reducing carbon emissions by an estimated 13%.

Waste: Above average

Lagos generates an estimated 276 kg of waste per capita annually, less than the Index average of 408 kg. Municipal solid waste is disposed of at the state’s three landfills and two temporary sites. City officials have stated a goal to make Lagos Africa’s cleanest city by 2012, and are working with the World Bank and the Clinton Climate Initiative to establish modern, efficient

waste management infrastructure. Still, only an estimated 10% of the city’s rubbish is currently collected. Waste pickers operate informally, although the city has tried to curb their activities.

Green initiatives: The Lagos Megacity Project is the overarching waste policy of the state government. One of the most notable initiatives of the past decade was the waste-to-wealth programme to convert various types of waste into usable materials. The programme was introduced in 1999 but has gathered momentum in recent years. As part of this programme, Lagos has established one of the biggest compost plants in Africa and converts 800 tonnes of municipal solid waste into fertiliser each day. In addition, the city has established four small-scale plastic-recycling plants, which convert 30 metric tonnes of nylon or plastic waste materials into usable products like shopping bags. In April 2011 the state waste management authority announced that it had installed 20 recycling banks across the state, with 1,000 more to come within two years.

Water: Average

Lagos has one of the lowest water consumption figures in the Index, at 90 litres per person per day, compared with the Index average of 187 litres. An estimated 88% of the population has access to potable water, versus the Index average of 91%. The city’s main water sources are local rivers and it does not suffer from water scarcity relative to the other 14 cities in the Index. Still, the delivery system to provide water to end users is insufficient, with treatment plants suffering from electricity shortages and pipe infrastructure that doesn’t meet the needs of the population. Ten additional mini-waterworks were unveiled in February 2011 and five more are under construction, but no target date for completion has been set. The city has forecasted that these plants,

along with improved electricity supply to the water plants, will dramatically improve Lagos’s water delivery system. Desalination plants are not currently in use, though the city has considered this as a long-term strategy.

Green initiatives: The World Bank is currently conducting a water initiative across the states of Lagos and Cross River called the Second National Urban Water Sector Reform Project. It has several aims: to improve the reliability of water supplies produced by the water treatment works in Lagos; to increase access to piped water networks in four cities in Cross River State; and to improve the commercial viability of urban water utilities in Cross River and Lagos states. The project was approved in 2005 and is expected to end in May 2013. Some of the practical outcomes of the project will be the installation of safe and suitable housing for pumps and generators; hiring better-trained chemists, biologists and water scientists for laboratory work; completely fencing-off the perimeter of water treatment plants; using better and more secure man-hole covers; and conducting more frequent testing of water before it is pumped out for distribution.

Sanitation: Average

An estimated 83% of the population has access to sanitation, compared with the Index average of 84%. While there are no major wastewater treatment facilities in the city, Lagos State operates five smaller wastewater treatment plants serving about 500,000 people, a fraction of the total population. The state government set out a five-year sanitation plan in 2010, which includes a goal to improve water treatment infrastructure. In addition, the government conducts inspections of septic tanks and has ordered the removal of prohibited pit latrines (a dry toilet system that collects waste in large containers).

The exact nature of enforcement is unknown, but noncompliance is subject to prosecution.

Air quality: Average

Lagos has high concentrations of pollutants such as carbon monoxide, sulphur dioxide and nitrogen oxides, which explains why respiratory ailments due to air pollution are not uncommon. Some monitoring of air quality is conducted in non-industrial locations around the city, but this system is far from complete. All pollutants are regularly monitored in industrial areas. Nevertheless, with a rapidly expanding population, a limited public transit network and an economy centred largely on refining petrochemicals, Lagos faces major challenges in improving air quality. The newly established National Environmental Standards and Regulation Enforcement Agency, and the vision of a cleaner and healthier environment they intend to deliver, are positive steps forward.

Green initiatives: The Nigerian government has a long-standing ban on the import of cars

more than five years old. While the government has not put any other specific measures in place, such as monitoring emissions from cars and generators, preventing very old cars from entering the country is expected to have a positive effect on air quality over time.

Environmental governance: Average

The Lagos State Environmental Protection Agency, created in 1996, oversees and implements environmental policy for the city. In addition, citizens, non-governmental organisations and other stakeholders have been involved, to some extent, regarding decisions on projects with major environmental impact. One such organisation, Environmental Rights Action, regularly collaborates with the state government on major environmental issues and sometimes serves as an unofficial watchdog. Most laws that deal with the environment are not passed without a public hearing in the State House of Assembly. In 2008 the state government conducted a baseline review

on water, sanitation and transport, though it is unclear how the results of that study were used.

Green initiatives: In 2006 the World Bank started an initiative, the Lagos Metropolitan Development and Governance Project, which aims to invest in critical infrastructure to increase access to basic urban services. It includes programmes to improve the professional capacity of the Lagos State Urban Renewal Authority to assess, develop, plan and coordinate a city-wide infrastructure programme, and to support public finance and budget reforms. The project is expected to end in September 2013. In another initiative, the National Environment Standards and Regulations Enforcement Agency launched a competition on environmental protection in July 2011 for senior secondary schools, in an effort to improve sanitation awareness. The competition is aimed at encouraging school children to adopt healthful environmental practices.

Quantitative indicators

Category	Indicator	Average	Lagos	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	99.8 ^e	2003	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	0.8 ¹	2010	Lagos Bureau of Statistics
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	35.9 ^{2e}	2009	Lagos Bureau of Statistics
LAND USE	Population density (persons/km ²)	4,578.1	2,957.2	2010	EIU calculation
	Population living in informal settlements (%)	38.0	66.0 ^{1e}	2006	World Bank
	Green spaces per person (m ² /person)	73.6	33.8 ^e	2009	Lagos Commissioner for the Environment
TRANSPORT	Length of mass transport network (km/km ²)	2.7	0.1	2009	Lagos Metropolitan Area Transport Authority
	Superior public transport network (km/km ²)	0.07	0.01 ³	2010	Lagos Metropolitan Area Transport Authority
WASTE	Waste generated per person (kg/person/year)	407.8	276.0 ^e	2009	Lagos Waste Management Authority
WATER	Population with access to potable water (%)	91.2	88.2 ^e	2003	UN Habitat
	Water consumption per person (litres per person per day)	187.2	90.1	2009	GM Water Corporation
	Water system leakages (%)	30.5	30.0 ^{4e}	2009	GM Water Corporation
SANITATION	Population with access to sanitation (%)	84.1	82.9 ^e	2003	UN Habitat

All data applies to Lagos unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) Lagos State. 2) National electricity generation mix used to estimate city level CO₂ data. 3) There are no subway, tram or light-rail lines. 4) Unclear whether data refers to “unaccounted for water” or “system leakage”.



Luanda_Angola

African Green City Index

Background indicators

Total population (million)	5.8
Administrative area (km ²) ¹	2,300
Population density (persons/km ²)	2,600

¹) Luanda province

Luanda is the capital city of Angola, a country in south-central Africa. Located on Angola's west coast, facing the Atlantic Ocean, Luanda is also the country's major seaport. Angola, formerly a colony of Portugal, has undergone enormous socio-economic upheavals that have impacted the capital city. The Portuguese built Luanda to accommodate around 500,000 people but during the Angolan Civil War (1975-2002), which followed independence from Portugal, people flocked to the city in the belief it was safer than other parts of the country. Luanda's population has now swelled to 5.8 million, which has put a strain on the city's few resources. Electricity supplies and potable water are scarce, and the majority of the city's population lives in informal settlements known as musseques. Luanda is also the capital of Luanda

Province, a collection of municipalities surrounding the city. Luanda Province and the national government share the jurisdiction of Luanda. There is no separate city government. Luanda ranks below average overall in the African Green City Index. The city is average in the categories of energy and CO₂, waste and sanitation. Its placement in these areas is a reflection of its low level of CO₂ emissions from electricity, a low rate of waste generation and high access to sanitation. However, in four categories – land use, transport, water and environmental governance – the city is well below average. Given the pressing need for more water and electricity, and the daunting challenge of managing the sprawling musseques that surround the city, it is perhaps not surprising that Luanda has yet to develop a strong environmental agen-

da. The city is trying to increase access to water and electricity. That said, much-needed improvements in waste, land use, sanitation and transport would improve living conditions, and also benefit the environment. Luanda's few green initiatives are mostly led by the national government and are short on detail. The absence of a city government, championing environmental improvements for its citizens, seems to work against Luanda. However, the city's overall performance could improve with the recent adoption of a master plan aimed at improving the city's water, land use, sanitation, transportation and energy infrastructure.

Energy and CO₂: Average

One in every four households in Luanda has no access to electricity. In the city centre and newly

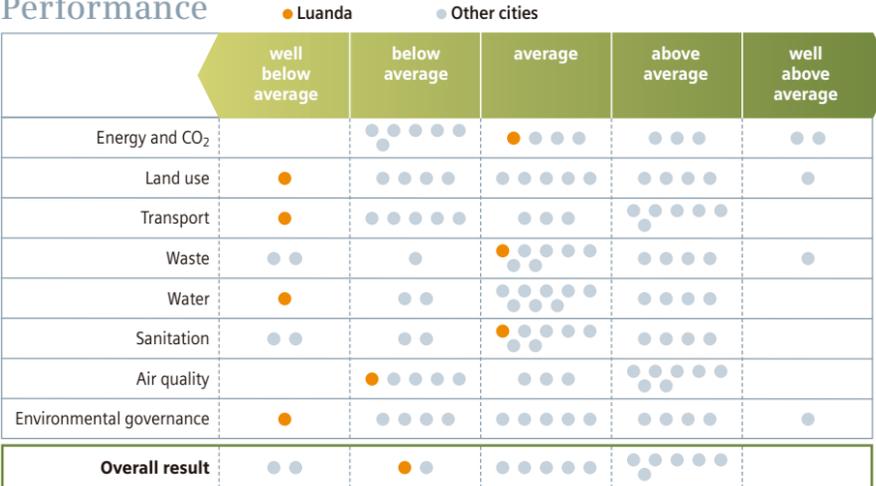
built suburbs, nearly all homes and businesses rely on diesel-powered generators. For reasons of data availability electricity produced and consumed from these generators were not included in the Index, nor were annual CO₂ emissions from diesel generators. Electricity consumption per capita, at just under 1 gigajoule, is well below the Index average of 6.4 gigajoules, though if diesel generators were taken into account consumption would likely be much higher. Annual CO₂ emissions from electricity consumption per person are 3 kg, compared with the Index average of nearly 984 kg. Green energy also plays a part in keeping CO₂ emissions down. The share of renewable energy in Luanda's electricity production, not including electricity generated from diesel generators, is 96%, all of which is hydropower. Only Maputo in the Index has a higher share of renewable energy in electricity production. Other than its

but no details have been published. Angola has signed up to the Kyoto Protocol, and there are national climate change action plans and CO₂ reduction strategies. Although these strategies endorse the concept of uniform standards, they do not contain specific policy suggestions.

Land use: Well below average

An estimated 69% of Luanda's population lives in musseques, the informal settlements that have spread from the city centre in all directions for 20 km. In recent years there have been a number of controversial informal settlement clearances with residents transferred to new accommodations (although sometimes they are just given tents) some 30 km from the city centre in an area known as Zango. The land reclaimed from these clearances is usually sold for expensive office and luxury housing development. A number of large-scale national gov-

Performance



The order of the dots within the performance bands has no bearing on the cities' results.

commitment to hydropower, Luanda scores poorly in policy areas. In some ways that is understandable. Policies aimed at reducing the environmental impact of energy consumption are unlikely to be a priority when the focus is on increasing energy supply and access to the electricity grid.

Green initiatives: The national government has pledged to spend US\$18 billion by 2016 to build new dams, and upgrade the electricity grid and power lines. In 2010 there was a city-run campaign to introduce low-energy light bulbs but no data is available about how many households it served or its success rate. There are some solar-powered traffic lights in the city and officials have discussed the possibility of new housing developments incorporating solar power,

ernment housing projects are under way, but although many of the new apartment blocks are ready, the policy for allocation and their price has yet to be decided, and they remain empty. Built in open spaces away from the urban sprawl, these housing developments are described as "new cities" but appear to have few public transport and road links between them. Also access to the urban centre and employment is limited. Luanda Province is short of green space, with an estimated 0.09 square metres of green space per person. Some work is under way, however, to rehabilitate the green spaces that remain.

Transport: Well below average

Luanda's transport infrastructure is sparse and dilapidated. At an estimated 0.2 km per square

kilometre, the length of Luanda's mass transport network is much shorter than the Index average, at 2.7 km per square kilometre. Luanda is also one of only a handful of cities in the Index that has yet to embark on building a superior public transport network (defined as subways, trams, light rail or bus rapid transit). Luanda's roads are invariably clogged by dense traffic. Office workers living in the new suburbs of Talatona, just 15 km south of Luanda, face a three-hour commute into the city centre each morning. The heat and humidity, coupled with dusty streets where pavements are rare and crime is common, mean walking is not an option for anyone working in an office or similar environment. Cycling is also impossible due to the level of congestion, poor driving, bad road surfaces and high temperatures. There are no policies to reduce traffic congestion, although road tolls and pedestrian areas are reportedly in the planning stage. There are some transport and housing plans at a national level (see "green initiatives" below), which, if carried out, should reduce congestion in Luanda's city centre.

Green initiatives: The national government has nearly finished a new ring road linking the town of Cacucaco to the north of Luanda, to

Viana and the new government housing developments in the east, and to the suburbs of Benfica and Talatona in the south. The national government has longer-term plans for a metro in Luanda but there is no current strategy to move forward. In 2009 the national Ministry of Transport published its 2009-2012 plan for transport development in Angola, which discusses "establishing strategies and plans", and developing better systems and services as well as an "integrated transport network". There are few concrete plans in the document, however. There have also been several public pledges about creating bus lanes, introducing maritime taxis and generally reducing city centre congestion.

Waste: Average

Poorer cities tend to generate less waste than richer ones, and Luanda follows that trend. Waste per capita in Luanda is an estimated 292 kg every year, which is lower than the Index average of 408 kg and much lower than in the richer South African cities. Luanda also scores well for its waste collection and disposal policy. It is one of only three cities in the Index that fully enforces environmental standards for the disposal of waste in landfill and incineration sites. Littering is also banned. For all that, however, significant waste problems remain. Private com-

panies are responsible for weekly rubbish collections in most parts of the inner city, but demand far outweighs collection capacity and large piles of waste on Luanda's streets are a common sight. In informal settlements, waste collection is limited and rubbish is usually dumped in open sewers, often blocking them and causing flooding. And the law against littering is generally ignored. Luanda has no recycling schemes and all waste goes to a single landfill some 20 km outside the city centre.

Green initiatives: The national government began discussing plans for a recycling law in 2008 and since then officials have held several workshops on the topic, but no concrete plans or policies have emerged. In June 2011 Bevcán, a South African canned-beverage manufacturer, launched a programme called Reclatas to recycle used aluminium drinks cans produced by its recently-opened Luanda factory. This is the first initiative of its kind in the city, but the company has not released any more details. The Provincial Government of Luanda (GPL) runs billboard, television and radio campaigns, often involving pop stars, to try to discourage street littering.

Water: Well below average

Potable water is scarcer in Luanda than in any other city in the Index. Barely more than half of the city's population has access to drinking water against an Index average of 91%. Through lack of supply, water consumption in Luanda is by some distance the lowest in the Index. An estimated 20 litres of water are consumed per person in Luanda every day, yet the Index average is more than nine times that amount. The government water company, Empresa de Aguas de Luanda (EPAL), says it only supplies water to around 131,000 households in a city which has a population of 5.8 million. With such limited supply, measures to reduce over consumption are not a concern for the city.

Green initiatives: The national Ministry of Health, UNICEF, and other international and national non-governmental organisations run campaigns to encourage people to use sterilisation products to avoid cholera and other waterborne infections. EPAL and the Environment Ministry run water-conservation awareness campaigns through posters, television ads and radio ads encouraging people, for example, not to wash their cars with buckets in the street, because it wastes water.

Sanitation: Average

Luanda's sprawling musseques bring inevitable sanitation challenges. UN Habitat estimates 92%



of the city's population has access to some type of sanitation system, but they are rarely the flush systems used in developed cities. Drains and septic tanks are widely used in formal areas. Even in offices and homes, it is common for lavatories to be manually flushed with bucket water. Informal settlements generally lack sanitation infrastructure. Although the city promotes public awareness about sanitation (see "green initiatives" below), there is no regular monitoring of on-site sanitation facilities, either in homes or communal areas.

Green initiatives: There are some local government poster campaigns, and television and radio advertisements to discourage people from urinating and defecating in the open air, with some linked to wider health campaigns run by agencies like UNICEF. Construction of latrines in informal settlements has been left largely to non-governmental organisations, such as Development Workshop, and individuals.

Air quality: Below average

There is no formal monitoring of air pollution in Luanda but the level of contamination is likely to be high given the huge volume of vehicles using the roads, the heavy reliance on diesel-powered generators and the number of air conditioning systems in operation. There are no specific initiatives in place to improve air quality in the city, although Luanda makes some effort to inform citizens about the dangers of air pollution.

Environmental governance: Well below average

Luanda is the only city in the Index that falls into the well below average category for environmental governance. There is some citizen involvement in decision-making for projects that might have a major environmental impact, but other than that Luanda fails to pick up any points in this category. Developing a strong environmental agenda is, understandably perhaps, not a top priority for Luanda, particularly

at a time when the need to increase access to water and energy is more important than curtailing consumption. What is a concern is that Luanda has no direct control over its own environmental affairs, which might hamper any future green efforts. The Provincial Government of Luanda (GPL) has a Directorate of Public Works, Urbanism and Environment, but this department has neither a budget nor a clear purpose. Most GPL policy remains highly centralised, while the remit of the national Ministry of Environment does not appear to make any city or region-specific plans. No departments within the GPL hold any city-specific environmental data, although plans are said to be in place to rectify that.

Green initiatives: In July 2010 the Ministry of Environment began working on a national environment database as part of a project being financed by the African Development Bank, but work on this is still ongoing.



Quantitative indicators

Category	Indicator	Average	Luanda	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	75.5 ^e	2006	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	1.0 ^e	2009	EDEL (state electricity company)
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	2.7 ^{1e}	2009	EDEL (state electricity company)
LAND USE	Population density (persons/km ²)	4,578.1	2,554.3	2008	EIU calculation
	Population living in informal settlements (%)	38.0	69.4 ^e	2006	Care International Report
	Green spaces per person (m ² /person)	73.6	0.1 ^{2e}	2007	Dept de Servicios Comunitarios
TRANSPORT	Length of mass transport network (km/km ²)	2.7	0.2 ^e	2010	TCUL (public bus operator)
	Superior public transport network (km/km ²)	0.07	0.00 ³	2009	Caminho de Ferro Luanda
WASTE	Waste generated per person (kg/person/year)	407.8	292.0 ^{2e}	2009	ELISAL (Empresa de Limpeza e Saneamento de Luanda)
WATER	Population with access to potable water (%)	91.2	51.4 ^e	2006	UN Habitat
	Water consumption per person (litres per person per day)	187.2	20.0 ^{2e}	2009	Development Workshop Angola (NGO) 2009 report
	Water system leakages (%)	30.5	29.9 ^e	2009	Development Workshop Angola (NGO) 2009 report
SANITATION	Population with access to sanitation (%)	84.1	92.4 ^e	2006	UN Habitat

All data applies to Luanda unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National electricity generation mix used to estimate city level CO₂ data. Almost all electricity in Angola is generated from hydro (IEA). 2) Luanda province. 3) There are no subway, tram, light-rail or BRT lines.

three-wheeled motorised rickshaws, called *txopelas*, have also become popular. Maputo has a long way to go in terms of transport, but the city appears poised to improve its performance in this area in the coming years as urban transport is a major priority of the World Bank-sponsored PROMAPUTO project.

Green initiatives: In 2011 the government ordered 150 compressed natural gas (CNG) buses, which emit fewer air pollutants. The first batch of 32 CNG buses arrived in June and the rest were scheduled to arrive later in 2011.

Waste: Average

The city produces an estimated 294 kg of waste per person per year, well below the Index average of 408 kg. Households and businesses pay a waste collection fee, which is collected through the electricity company. This fee is prorated based on energy consumed, on the logic that consumers using less energy also produce less

plastic bags. By December 2010 the programme was extended to include the majority of the informal neighbourhoods, according to city officials.

Water: Below average

Until December 2010, the city's water system was operated by a private company under a concession contract that was scheduled to end in 2014. However, because of concerns over performance, the public Water Supply Investments and Assets Fund (FIPAG) assumed control of the city's public water system in January 2011. Currently, UN Habitat estimates that only 83% of Maputo's population has access to potable water, compared with the Index average of 91%. Between 400 to 600 small, private – and frequently unlicensed – water suppliers serve as much as 25% of Maputo's water market, primarily in informal settlements that are not yet connected to the city's water supply system. These operators use several methods, including the provision of untreated groundwater from shallow wells, the

tions, so that they can begin selling treated water to end users. The improvement of the city's water supply and services is also a priority of the World Bank's PROMAPUTO programme.

Sanitation: Well below average

Sanitation is a major challenge for Maputo. Only an estimated 49% of the city's population has access to sanitation, compared with the Index average of 84%. Informal settlements frequently lack access to sanitation services; residents instead use latrines that are not only insufficient in number and sometimes shoddily constructed, but also subject to collapse during periods of heavy rainfall and flooding. Even in the city centre, which is served by both a sewage system and septic tanks linked to the storm-water drainage network, inadequate infrastructure and maintenance remain persistent problems. This often leads to raw sewage emptying into the nearby Maputo Bay. Though overlapping national and local institutional roles have somewhat hin-



dered progress on sanitation policies to date, plans are in place to promote environmentally sustainable sanitation services under the PROMAPUTO umbrella (see "green initiatives" below).

Air quality: Below average

The main sources of air pollution are informal shared taxis, *chapas*, that ply the streets despite their poor emissions standards, as well as nearby aluminium and cement factories. The city has not yet created an air quality monitoring system, nor does it regularly monitor or promote air quality. Independent air pollution studies in Maputo indicate "exceedingly high" concentrations of particulate matter. Developing enforceable regulatory standards is among the challenges city officials will face in the years ahead.

Green initiatives: In March 2010 the city adopted a new initiative to inspect automobiles

older than four years. One category for inspections is carbon emissions, with high-emissions vehicles banned from the roads. It is unclear how much progress has been made so far.

Environmental governance: Below average

The city has experienced a degree of institutional reform from the first phase of the World Bank-supported PROMAPUTO programme. This includes the establishment of the Maputo municipal council, which now oversees environmental decision-making. Though the council has the ability to issue environmental licenses, monitor water and sanitation quality, and manage waste, it is staffed with only ten full-time employees and is limited in its ability to implement environmental policies. In the future, the enlargement of this agency, both in terms of size and authority, will be a key indicator of Maputo's effectiveness in environmental governance.

Green initiatives: In 2011 the Maputo municipal council's environmental department launched an awareness campaign to educate students about the importance of protecting the environment. According to the department's director, representatives have visited most of Maputo's schools, highlighting the importance of planting trees and keeping beaches clean. The department also initiated a tree-planting programme in schools and by mid-2011 an estimated 2,800 trees had been planted. Another new initiative concerns climate change. Because it is a coastal city, Maputo is extremely vulnerable to rising sea levels, flooding and erosion. In April 2010 UN Habitat signed an agreement with city officials to conduct a study on the potential impact of climate change on Maputo and suggest ways to address the risks. The city hopes to develop a formal climate change adaptation plan based on the results of the research.



waste. However, only about 19% of Maputo's generated waste is collected and the city currently lacks environmental standards for waste disposal. Most collected waste is deposited in Hulene, a large open-air dump that extends over 17 hectares on the outskirts of the city and is widely considered a threat to public health. Maputo officials intend to close Hulene by 2014 and open a new sanitary landfill in the nearby city of Matola. This costly project will rely upon central government funding and approval from Matola, which has not yet consented.

Green initiatives: For informal settlements, which lack proper roads, in 2007 the city piloted a project to contract with micro-enterprises to collect household waste on foot, going door-to-door with

resale of water from the water company or the distribution of piped water from bore holes. These methods, though undoubtedly entrepreneurial, have potentially negative implications for public health and groundwater sustainability, and are also more expensive than the public water system. In Maputo an estimated 50% of water is lost to leakages, compared with the Index average of 30%. The city's per capita water consumption is an estimated 99 litres per person per day, almost half the Index average of 187 litres.

Green initiatives: City officials are currently studying and piloting alternative methods for water distribution. Recently FIPAG began collaborating with the small water providers to formalise, legalise and professionalise their opera-

tioned progress on sanitation policies to date, plans are in place to promote environmentally sustainable sanitation services under the PROMAPUTO umbrella (see "green initiatives" below).

Green initiatives: The improvement of sanitation services is a priority of the World Bank-funded PROMAPUTO plan over the next five years. The city is in the process of developing a Citywide Sanitation Strategy through consultation with donors and non-governmental organisations. Since 2004 a raft of national-level sanitation policies have been drafted: a Seven Cities Sanitation Strategy (2004), which included Maputo and Matola; a Strategic Plan of Urban Sanitation (2006); and a National Water Policy (2007), which had implications for Maputo's

Quantitative indicators

Category	Indicator	Average	Maputo	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	28.8 ^e	2003	UN Habitat
	Electricity consumption per capita (GJ/inhabitant)	6.4	0.8	2006	Electricidade de Mocambique - Annual Statistical Report 2007
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	0.04 ^{1e}	2009	Electricidade de Mocambique - Annual Statistical Report 2007
LAND USE	Population density (persons/km ²)	4,578.1	4,147.4	2006	EIU calculation
	Population living in informal settlements (%)	38.0	70.0 ^e	2010	World Bank
	Green spaces per person (m ² /person)	73.6	114.9 ^e	2009	Directorate of Urban Plannification and Environment
TRANSPORT	Length of mass transport network (km/km ²)	2.7	0.0 ²	2011	–
	Superior public transport network (km/km ²)	0.07	0.00 ³	2011	–
WASTE	Waste generated per person (kg/person/year)	407.8	293.9 ^e	2010	Maputo Waste Management Department
WATER	Population with access to potable water (%)	91.2	82.8 ^e	2003	UN Habitat
	Water consumption per person (litres per person per day)	187.2	99.1 ^e	2010	Mozambique Country Water Resources, Assistance Strategy
	Water system leakages (%)	30.5	50.0 ^{4e}	2009	Fundo de Investimento e Patrimonio de Abastecimento de Agua
SANITATION	Population with access to sanitation (%)	84.1	48.8 ^e	2003	UN Habitat

All data applies to Maputo unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National electricity generation mix used to estimate city level CO₂ data. Almost all electricity in Mozambique is generated from hydro (IEA). 2) There are no dedicated bus routes in Maputo. 3) There are no subway, tram, light-rail or BRT lines. 4) Unclear whether data refer to "unaccounted for water" or "system leakage"



Nairobi_Kenya

African Green City Index

Background indicators

Total population (million)	3.1
Administrative area (km ²)	700
Population density (persons/km ²)	4,500

Initially a railway outpost for the Mombasa-Kampala Railway, Nairobi is now home to 3.1 million people. It is one of Africa's most important cities and a major hub for finance, media, technology and air travel. Its altitude of well over 1,000 metres above sea level results in a moderate climate, which means there is little need for air conditioning or heating. The city receives much of its energy from renewable hydro power, but insufficient generation and transmission infrastructure leads to the frequent use of diesel-fuelled generators. Like other large African cities, growth remains haphazard; the management of waste, sewage and water are urgent challenges. With Nairobi's population expected to more than double to 7 million by 2020, the city government and the Kenyan

national government are under increased pressure to create a capital city that is more liveable, safe and environmentally friendly. Nairobi is below average overall in the African Green City Index. It achieves an average rank in four categories – land use, waste, water and sanitation. Particular strengths in these areas include good policies to protect existing green spaces and other environmentally sensitive areas, as well as a relatively robust code covering surface water quality. The city receives below average rankings in energy and CO₂, transport, air quality and environmental governance. A wide range of challenges still confront Nairobi, including a low level of access to electricity, and relatively weak policies covering public transport and air pollution.

Green initiatives: Kenya's first wind power plant, completed in 2010 with six turbines producing up to 5 megawatts of power, is located in the Ngong Hills 22 km outside Nairobi. Financing has been announced for a second phase of the project, which could bring the total capacity to 11 megawatts, enough to power 2,000 households. The national government is also exploring more wind power projects in other parts of the country. Although hydro-power is still a very small part of the energy mix in Kenya, national officials are looking at ways to diversify away from it because of unreliable rainfall.

Land use: Average
The city has relatively strong regulations protecting green spaces and environmentally sensitive areas, but the total amount of green space per person, at 37 square metres, is below the Index average of 74 square metres. Nairobi also has a

for water, energy, waste and sewage treatment. It remains to be seen whether the development, the first phase of which is due for completion by 2020, will have a demonstrable impact on land use in the rest of the city, or exist mainly as a luxury suburb.

Green initiatives: The Kenya Wildlife service in partnership with private companies is managing the Green Line Project, an initiative to plant forest along 30 km of the perimeter of Nairobi National Park in the south of the city. The programme began in 2010 with the planting of several thousand trees, and organisers continue to raise money from the private sector to plant more trees and pay for patrolling the area. The hope is to create a visible boundary between the park and surrounding new developments, and to discourage lobbying by developers to cut slices off the park. The tree planting is also part

Performance



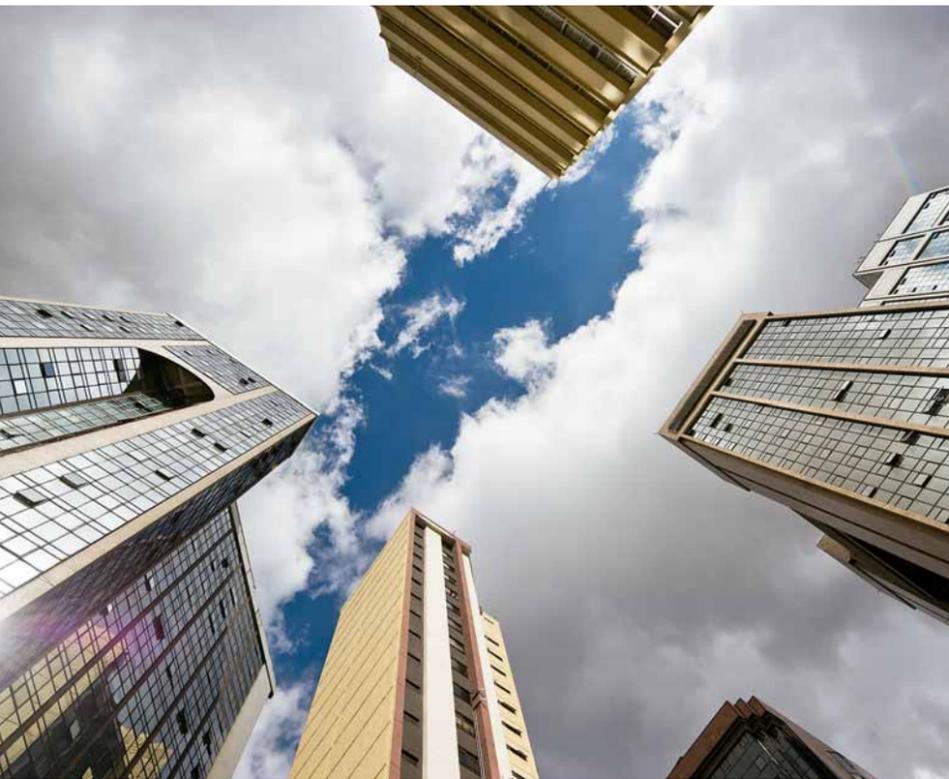
The order of the dots within the performance bands has no bearing on the cities' results.

Energy and CO₂: Below average
Although Nairobi generates 62% of its electricity from renewables, mostly hydro and some geothermal power, poor generation and transmission infrastructure often forces utilities to rely on diesel-powered generators. An estimated 75% of households have access to electricity, below the Index average of 84%, and blackouts are common. The reliance on renewables drives down Nairobi's per capita CO₂ emissions to an estimated 182 kg, much less than the Index average of 984 kg. Per capita electricity consumption is almost on par with the Index average, at an estimated 6.5 gigajoules per person versus the Index average of 6.4 gigajoules. Nairobi is also marked down for lacking many of the energy policies evaluated in the Index.

relatively high percentage of people living in informal settlements, at an estimated 50%, compared with the Index average of 38%. In 2008 the national government unveiled Nairobi Metro 2030, a blueprint for the capital city's urban development. The plan envisions rapid yet environmentally sustainable development in the metropolitan region, and already several new initiatives are underway. The most ambitious of these is a Russian-financed project called Tatu City. Designed around the concept of efficient urban development, plans call for Tatu City to accommodate 62,000 residents while preserving wetlands, forest areas and coffee plantations on the property. City officials call it "the prototype of the African city of the future" and say it will be predominantly self-sufficient

of a wider initiative led by Nobel Prize winner Wangari Mathai to plant new trees throughout Nairobi to improve water catchment and biodiversity.

Transport: Below average
More than 90% of city commuters depend on privately run, frequently over-crowded minibuses called matatus. City efforts to replace matatus with public buses have had disappointing results, and the density of the public transport network in the city is below the Index average, at an estimated 1.9 km per square kilometre, compared with the average of 2.7 km per square kilometre. The superior network serving the city, consisting of suburban railways built in the 1980s, measures 0.09 km per



square kilometre, just over the Index average of 0.07 km per square kilometre, although only an estimated 19,000 commuters use the system daily. Although officials have discussed a rapid rail system, no concrete plans have been implemented. Nairobi's efforts to implement an advanced traffic-management system through the application of traffic light sequencing and to introduce some limited-vehicle zones are positive steps.

Green initiatives: Nairobi is seeing major investment in its road network. A ring road planned since the 1970s will finally be built by 2012. Even more significant is an eight-lane superhighway linking Nairobi to the neighbouring town of Thika. This US\$310 million project looks likely to be finished by 2012. The project will set new standards for Kenyan roads, and includes underpasses and footpaths.

Waste: Average

Nairobi residents generate an estimated 318 kg of waste annually, compared with the Index average of 408 kg, although collection remains limited to about 40% of the total waste generated. Collection consists mainly of private contractors picking up, sorting and transporting the trash to landfills outside the city. Because of this, waste collection in the city is not a widely

available public service, but remains limited to wealthier residents and businesses that can afford to pay for it. There is some recycling of electrical waste, glass, paper and plastics, but this is also conducted by private waste-management companies. The city government has made several positive strides – it monitors a portion of the industrial sector's disposal of hazardous waste, discourages the public from littering or dumping through the installation of additional waste bins, and has established a policy to reduce, recycle and re-use waste. These public initiatives give reason for optimism, even though it is not entirely clear how strictly these standards and rules are enforced. The city government also organises the separate collection and disposal of medical and chemical waste. Overall, however, waste management remains a significant environmental challenge.

Water: Average

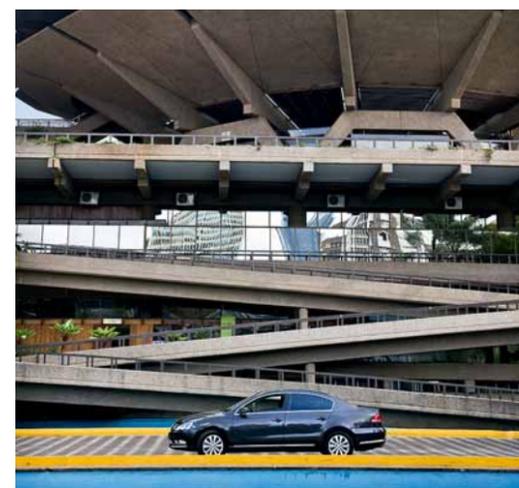
An estimated 93% of residents have access to potable water, narrowly more than the Index average of 91%. The city consumes an estimated 112 litres of water per person per day, less than the Index average of 187 litres. Nairobi draws its water supply from local rivers and reservoirs. It is also in the middle of a major project to rehabilitate and conserve the city's main surface water

source, the Nairobi River, using support from the United Nations Environment Programme, which is headquartered in Nairobi. In addition, the Nairobi City Water and Sewerage Company has increased the supply and quality of water in recent years. Nevertheless, the city is likely to face water shortages unless major capital investments are made into new reservoirs. At the same time, piped water is currently somewhat unreliable and expensive. An estimated 50% of the system's water is lost to leakages, well above the Index average of 30%. Addressing these issues effectively, and tackling a dropping water table believed to be the result of unregulated bore hole drilling, will be critical tasks for local government officials in years to come.

Green initiatives: The Ngong, Mathare and Nairobi rivers meet in Nairobi and flow from there to the Indian Ocean. The three rivers are clogged with waste and during rains the rivers are thick with human excrement washed out of informal settlements. The Nairobi River Basin initiative, run by the Kenya Ministry of Environment, aims to recover the rivers, providing clear flow through the city, and increasing land and recreational value along the river bank. Initial surveys have been completed. There is no deadline year to finish the entire project, but initiative planners hope to have reclaimed city centre sections of the river before 2020. Some progress has been made clearing the Nairobi River around the municipal dump at Dandora in the east of the city.

Sanitation: Average

An estimated 83% of the population has access to sanitation, about equal to the Index average of 84%. The city's wastewater treatment plants are unable to accommodate the total waste-



water generated each day in Nairobi. In informal settlements access to toilets is limited, resulting in the pollution of local streams. To combat these issues, the Kenyan government adopted the National Environmental Sanitation and Hygiene Promotion Policy in 2007 to expand access to and the quality of sanitation services around the country. How much has been implemented is still unclear.

Air quality: Below average

The main causes of air pollution in Nairobi are idling cars in traffic jams and faecal dust from informal settlements during dry months. It is hoped that new limits on importing old cars that do not meet emission standards will improve conditions, though in the long term regulation of vehicles running on leaded petrol, such as lorries and buses, would likely yield more dramatic results. The city lacks an air quality code and air monitoring in Nairobi is conducted only on a limited, ad hoc basis, which negatively affects its placement in this category.



Environmental governance: Below average

Nairobi has a dedicated environmental authority that oversees and implements environmental policy, as well as some ability to implement its own environmental legislation. In addition, the city involves external stakeholders, such as citizen groups and non-governmental organisations, to some extent in decision-making for projects with major environmental impact. For the fiscal year ending June 30th, 2010 Nairobi's annual environmental budget was about US\$5.9 million, or roughly 5% of the total annual city authority budget of US\$107 million. Challenges remain, of course. New development in Nairobi is supposed to be overseen by the National Environmental Management Agency (NEMA). Some have been critical of the agency's effectiveness, but the agency says it is moving forward with plans to better enforce environmental laws. The city's placement in this category is hindered because it does not appear to regularly monitor its envi-

ronmental performance and publish information on its progress.

Green initiatives: Numerous new technology initiatives are tracking Nairobi's environmental conditions. A new government online data portal announced in July by President Mwai Kibaki will allow Kenyans to identify spending on water and energy, and to keep track of the state of the hydropower dams that provide the city most of its energy. A Climate Change Innovation Centre funded by the World Bank and the Danish government aims to make Nairobi a centre of green technology, creating 4,600 jobs within five years. As the third capital of the United Nations, after New York and Geneva, Nairobi is the world headquarters of the organisation's environmental and urban planning programmes. The UN campus in Gigiri was overhauled in 2011 with energy neutral offices. The new building for 1,200 employees includes 6,000 square metres of solar panels. The UN says the energy savings should pay for the investment within seven years.



Quantitative indicators

Category	Indicator	Average	Nairobi	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	75.0 ^e	2010	University of Nairobi, Department of Urban and Regional Planning
	Electricity consumption per capita (GJ/inhabitant)	6.4	6.5 ^{1e}	2008	International Energy Association
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	181.5 ^{2e}	2008	International Energy Association
LAND USE	Population density (persons/km ²)	4,578.1	4,509.0	2007	EIU calculation
	Population living in informal settlements (%)	38.0	50.0 ^e	2010	University of Nairobi, Department of Urban and Regional Planning
	Green spaces per person (m ² /person)	73.6	37.3 ^e	2009	UN Environmental Programme
TRANSPORT	Length of mass transport network (km/km ²)	2.7	1.9 ^{3e}	2009	Kenya Bus Service Management Ltd
	Superior public transport network (km/km ²)	0.07	0.09 ⁴	2009	Kenya Railways Corporation
WASTE	Waste generated per person (kg/person/year)	407.8	317.5 ^e	2008	City of Nairobi Environmental Outlook 2007
WATER	Population with access to potable water (%)	91.2	93.3 ^e	2003	UN Habitat
	Water consumption per person (litres per person per day)	187.2	111.5 ^e	2005	City of Nairobi Environmental Outlook 2007
	Water system leakages (%)	30.5	50.0 ^e	2007	City of Nairobi Environmental Outlook 2007
SANITATION	Population with access to sanitation (%)	84.1	82.9 ^e	2003	UN Habitat

All data applies to Nairobi unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National data used as proxy for city level data. 2) National electricity generation mix used to estimate city level CO₂ data. 3) Number of bus routes (51) multiplied by average length of bus routes for other cities in the Index (26 km). 4) There are no subway, tram or BRT lines



Pretoria_South Africa

African Green City Index

Background indicators

Total population (million)	2.3
Administrative area (km ²)	2,200
Population density (persons/km ²)	1,100

Pretoria is South Africa's administrative capital, housing the government ministries, foreign embassies, and various academic and research centres. The city centre is highly developed, with a mix of historical and modern buildings. Compared with other cities in the African Green City Index, Pretoria has a relatively small population of 2.3 million residents. It is overseen by an entity called the City of Tshwane, which includes many different municipalities in the Gauteng Province, and was expanded in 2011. Following the absorption of several additional municipalities, the City of Tshwane's population rose to 2.5 million and its area grew from 2,200 square kilometres to just under 6,400 square kilometres (much of this additional area is rural and undeveloped), but these newer fig-

ures were not included in the Index. Pretoria is closely connected to Johannesburg, both geographically and economically. Situated approximately 50 km from Johannesburg, Pretoria's urban area is growing ever closer to its neighbour, and housing developments are being constructed along the corridor that links the two. Pretoria and Johannesburg are also connected by a new commuter railway. The city places average overall in the Index, with some mixed results in the individual eight categories: it achieves above average results in the transport, air quality and environmental governance categories. Pretoria boasts a transport network more than double the Index average. It also has a relatively strong environmental department and a comparatively high level of

Energy and CO₂: Below average

An estimated 78% of households have access to electricity, less than the Index average of 84%. However, the city has set a target to increase this to 100% of households by April 2016. Despite low access levels, the city consumes 12.0 gigajoules of electricity per person – nearly twice the Index average of 6.4 gigajoules. As is the case for the other South African cities in the Index, over 90% of Pretoria's electricity is generated using coal, while nuclear power generates about 5% and renewable energy in the form of hydropower less than 2%. As a result, the city emits an estimated 3,048 kg of CO₂ per person from electricity consumption, more than three times the Index average of 984 kg. Pretoria introduced an integrated environmental policy in January 2005, which aims to diversify the energy supply, encourage energy efficiency and promote cooperation between government, business, labour, communities and other stakeholders, among other goals. The document says the city should discourage the use of inefficient and high-polluting fuels, although there are no specific action points. The plan also calls for reducing energy consumption in all municipal operations and implementing "green procurement" policies based on energy efficiency, but again no specific plans are included in the document.

Green initiatives: During the past two years the city has installed more than 12,000 solar water heaters in a number of communities in the metropolitan area through an investment by the national Department of Energy. As well as reducing energy consumption and associated emissions, the water heaters have no cost apart from their initial installation and are popular among lower-income households. In a bid

to create jobs and tackle high levels of unemployment, people in the target communities have been trained to install the heaters themselves.

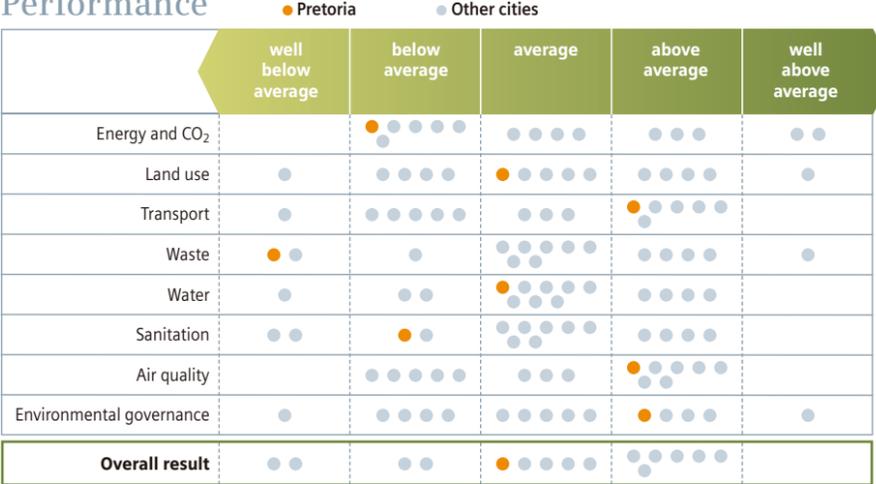
Land use: Average

The centre of Pretoria is not densely populated and most of the people who work there commute from nearby Johannesburg. Indeed, Pretoria is the least densely populated city in the Index, with only 1,100 people per square kilometre compared with the Index average of 4,600 people. An estimated 27% of the population lives in informal settlements, below the Index average of 38%. Like in many cities in South Africa, Pretoria's population is growing rapidly, which has resulted in the appearance of informal settlements. In recent years, though, Pretoria has taken steps to redevelop these areas and provide more access to municipal services, including sanitation and electricity. Regarding green space, the city's development strategy calls for investments in new parks as well as proposing a number of sprawl-prevention policies. Already, Pretoria has 13 nature reserves and ten bird sanctuaries, along with other recreational nature areas. However, on a per capita basis there are only an estimated 39 square metres of green space per person compared with the Index average of 74 square metres.

Green initiatives: The city is prioritising so-called integrated land use, in which housing for affluent residents is in close proximity to less wealthy developments. This is an attempt to address the legacy of Apartheid planning that deliberately created black townships without access to basic services on the peripheries of cities. There are plans to formalise all informal settlements (providing electricity and water

public participation in projects with environmental impact. Pretoria is average for land use and water. Although the city has introduced water quality standards, some residents are still without access to potable water. Officials are also working to improve overall environmental conditions in informal settlements. Pretoria's performances in the categories of energy and CO₂ and sanitation are below average, driven by high levels of CO₂ emissions from electricity consumption – electricity for the city is mainly produced from coal – and relatively low levels of access to sanitation. The city is well below average in the waste category, due mainly to generating the most waste per capita in the Index. There is nevertheless a variety of notable green initiatives underway in the city.

Performance





supplies, tarring roads and replacing shacks with brick houses) by the end of 2016, and deliver more services to less developed townships.

Transport: Above average

Pretoria's public transport network, consisting mainly of buses and commuter trains linking it to Johannesburg, measures 6.4 km per square kilometre, more than double the Index average of 2.7 km. However, despite the network's wide coverage, as in the rest of South Africa, private automobiles remain the primary form of transportation for those who can afford them. The arteries around the city centre are regularly clogged by high volumes of commuter traffic travelling to the various government offices in Pretoria. According to a 2008 city household survey, most respondents expressed concern about their personal safety while using buses, due to a high number of traffic accidents on the roads between Pretoria and Johannesburg.

Green initiatives: The city has plans to completely revamp its public transport system and is currently developing an integrated rapid public transport network (IRPTN). At the heart of this will be a bus rapid transit (BRT) system, which will run along dedicated lanes through the city to avoid congestion and have sealed stations to create safety. However, as of December 2010 the BRT had been put on hold due to concerns about the feasibility of the design. Through the IRPTN the city also plans to assess ways to reduce traffic congestion and connect different forms of public transport. In another initiative, the Gautrain, a high-speed line linking Pretoria to downtown Johannesburg, is already operational, although construction continues on one final station. The new service offers a long-awaited

alternative to driving between the cities and will greatly reduce the amount of traffic in central Pretoria. The system also includes buses linking Gautrain stations to locations in the city centre.

Waste: Well below average

The city's result in this category is due to a high level of waste generation, at 1,070 kg per person per year. This is the highest rate in the Index and well above the average of 408 kg. However, all of the South African cities in the Index generate relatively high levels of waste. The city has a waste management division responsible for collection, transportation, treatment and disposal. In light of the high level of waste generated, the city could improve its waste management and recycling policies. There is an informal sector of an estimated 6,000 waste collectors who sift through bins and collect items they can sell to recycling firms but the city lacks regulations for this group. Pretoria also lacks standards governing disposal of industrial hazardous waste, but the city does provide for recycling of glass, paper and cardboard.

Water: Average

An estimated 97% of Pretoria residents have access to potable water, compared with the Index average of 91%. Additionally, Pretoria has implemented a water quality policy and standards for the level of pollutants in surface and drinking water. It also boasts the second lowest leakage rate in the Index, at 18%, compared with the Index average of 30%. The city is working to improve further, however. To meet its stated goal of providing potable water for all residents by April 2016, the city is investing US\$35 million to upgrade the water system, although few details are available about what

this programme entails. Pretoria consumes 320 litres of water per person per day, above the Index average of 187 litres. The city's environmental policy includes a goal to reduce water consumption.

Green initiatives: Aside from the investments in its water system, the city is raising public awareness around water efficiency. The Water-Wise section on its website offers tips on how to save water in the home, including encouraging homeowners to turn taps off whenever possible and take quick showers, and asking residents to use indigenous plants in their gardens, since they tend to use less water than non-indigenous breeds.

Sanitation: Below average

Just over three-quarters of the population has access to sanitation, below the Index average of 84%. The city originally had a target to provide free basic sanitation for all residents by December 2010. Because that target was not met due to a lack of funding, the city set a new deadline of December 2016. The city has allocated US\$55 million to tackle this issue and invest in overall refurbishment of the infrastructure, but details are vague. Pretoria has minimum standards for treatment of wastewater and regularly monitors treatment facilities (such as those found in homes or communal areas), nor does it publicly promote cleanliness when using sanitation facilities.

Air quality: Above average

The city's strong performance in this category is a reflection of a robust set of policies to ensure local ambient air quality. The national Department of Environmental Affairs' weather service regularly monitors air quality and publishes results

online. Several monitoring stations around the municipality test for sulphur dioxide, nitrogen dioxide, suspended particulate matter, suspended fine particulate matter and carbon monoxide.

Green initiatives: The city has an Air Quality Management Plan (AQMP) that aims to minimise the negative impact of air pollution on people's health and wellbeing, and on the environment. Reducing domestic fuel burning, such as the burning of charcoal in informal settlements, is also a key priority stated in the AQMP.

Environmental governance: Above average

The city has a dedicated agriculture and environ-

mental management department under which fall two environmentally related divisions: environmental management and waste management. The environmental management department is responsible for all environmental policy and information, management systems, audit and promotion, as well as the day-to-day running of parks, cemeteries, urban forestry, strategic open place planning, air quality, climate change and sustainable energy policies. The waste department manages waste collection and recycling. In 2001 the city published a State of the Environment Report, which was followed in 2005 by the integrated environment policy mentioned above. Additional environmental indicators and planning were covered in the April

2011 Integrated Development Plan. There is also a provincial-level Gauteng State of the Environment Report, which was published in 2004. The city has a public participation process in place for projects with an environmental impact.

Green initiatives: Since 2003 the city has been running its Sustainable Energy and Climate Change programme, which aims to "encourage the integration of sustainable energy and environment concerns into urban development in South Africa". All departments are required to make sustainable energy objectives part of their activities and functions, although few specific details are available about how this policy has been implemented.

Quantitative indicators

Category	Indicator	Average	Pretoria	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	78.0 ^e	2010	National Department of Cooperative Governance and Traditional Affairs
	Electricity consumption per capita (GJ/inhabitant)	6.4	12.0 ¹	2005	State of Energy Report 2006
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	3,047.6 ^{1e}	2005	State of Energy Report 2006
LAND USE	Population density (persons/km ²)	4,578.1	1,066.3	2007	EIU calculation
	Population living in informal settlements (%)	38.0	26.8 ^{1e}	2007	Community Survey 2007
	Green spaces per person (m ² /person)	73.6	39.2 ^{1e}	2005	2005 Report – Proposed Tshwane open space framework
TRANSPORT	Length of mass transport network (km/km ²)	2.7	6.4 ²	2010	Tshwane Bus Service
	Superior public transport network (km/km ²)	0.07	0.04 ³	2010	Sapromo Magazine, Pretoria
WASTE	Waste generated per person (kg/person/year)	407.8	1,070.0 ¹	2005	Tshwane environment education and awareness strategy – appendix to report 2005
WATER	Population with access to potable water (%)	91.2	97.2 ^{1e}	2007	Community Survey 2007
	Water consumption per person (litres per person per day)	187.2	319.7 ¹	2008	Miyawater
	Water system leakages (%)	30.5	18.0 ^{1e}	2009	Department of Water Affairs – 2009 Water Services Development Plan
SANITATION	Population with access to sanitation (%)	84.1	76.3 ^{1e}	2007	Community Survey 2007

All data applies to Pretoria unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) City of Tshwane Metropolitan Municipality. 2) Number of bus routes (545) multiplied by average length of bus routes in Cape Town, Durban and Johannesburg (26 km). 3) There are no subway, tram or light rail lines



Tunis Tunisia

African Green City Index

Background indicators

Total population (million)	1.0
Administrative area (km ²) ^e	200
Population density (persons/km ²)	4,700

^e = EIU Estimate

Tunis is the capital of Tunisia. It is the smallest city in the African Green City Index in terms of population, with only 1 million residents, though the greater metropolitan area is home to roughly 2.4 million. With an administrative area estimated at just 200 square kilometres, Tunis is also the second smallest city by area in the Index, just marginally larger than Accra. Compared with other major cities in North Africa, the city is relatively well managed and prosperous, and benefits from a tourist industry that brings visitors to Tunisia's beaches and historic sites. The overturning of the previous national government in January 2011 and the installation of an interim regime means that environmental governance, like much else in Tunisia, is currently in a state of flux. However, the new govern-

ment will have an opportunity to build on several existing environmental strengths in its capital city.

Tunis ranks above average overall in the Index, and is above average in the individual categories of transport, waste, sanitation and air quality. The city has the longest superior mass transit network in the Index, with a well-developed system of light rail and suburban trains. Tunis ranks average for land use, water and environmental governance. Sprawl is an ongoing issue, but the city is emphasising pedestrian-friendly development and increasing green spaces. Likewise, Tunis currently faces water supply and wastewater discharge issues, but improving water infrastructure has been a top priority in recent years. The city falls below aver-

age for energy and CO₂ due to relatively high CO₂ emissions and electricity consumption. However, recent investments in solar power could bolster its performance in this category.

Energy and CO₂: Below average

Tunis has the highest electricity consumption per capita in the Index, at 18.1 gigajoules per capita, almost three times the Index average of 6.4 gigajoules. A major driver of this high consumption has been the government's push in recent years to continually expand access to the grid. An estimated 99% of households have access to electricity, exceeding the Index average of 84%. Air conditioning in the summer also drives up Tunis's electricity demand. Tunis emits an estimated 1,044 kg of CO₂ per capita from

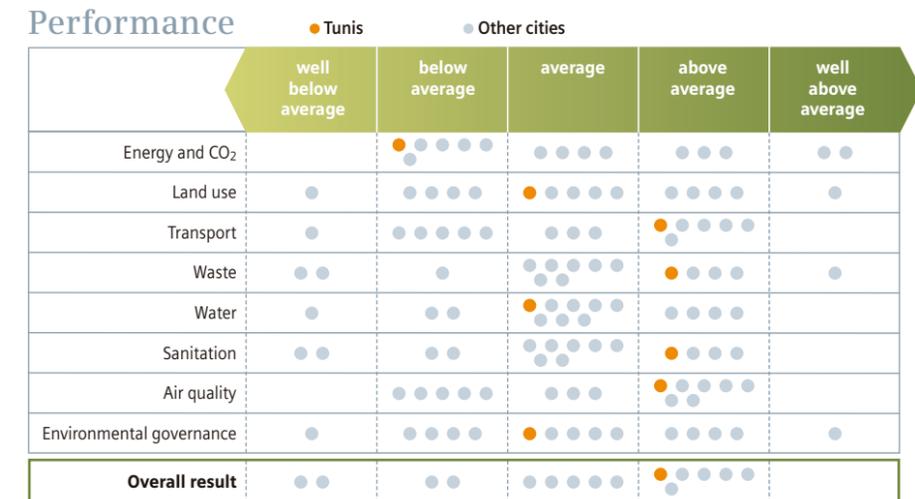
electricity consumption, compared with the Index average of 984 kg. Most of the city's electricity is generated using natural gas, with little renewable power in the mix, but solar production has been increasing in recent years (see "green initiatives" below).

Green initiatives: In 2005 the government adopted a programme to promote solar energy, PROSOL. The programme is a joint initiative of the government-run National Agency for Energy Conservation, the state power company Société Tunisienne de l'Electricité et de Gas (STEG), the UN Environment Programme and the Italian environment ministry. The scheme includes loans and subsidies to offset the cost of solar water heaters. More than 50,000 families benefited in the first two years of the programme, saving an estimated 240,000 tonnes of CO₂ emissions. Ultimately, through a series of related

metres. The exception is the 100-hectare Belvedere Park, known as the "lungs" of the city. Many of the city's poorer residents live in crumbling buildings in the city centre, but one particularly active non-governmental organisation has been leading a revitalisation of these neighbourhoods (see "green initiatives" below).

Green initiatives: Over several decades the Association de Sauvegarde de la Médina de Tunis (ASM), a non-governmental organisation, has been responsible for a series of rehabilitation projects in the historic city centre. The ASM programme, supported by organisations such as the World Bank, has reversed the creeping disrepair of the old city by upgrading electricity connections and street lights, restoring monuments, clearing waste from the streets and creating pedestrian areas. Under one of ASM's initiatives, Project Oukalas, three new neigh-

Performance



The order of the dots within the performance bands has no bearing on the cities' results.

initiatives, the national government wants to increase its renewables from 0.5% of production to 10% by 2020. In addition, the World Bank has financed a programme to examine how Tunis and the rest of the region can adapt infrastructure for the potential effects of climate change, such as increased coastal erosion or natural disasters such as extreme storms and flooding.

Land use: Average

Tunis performs well for its relatively high population density, at an estimated 4,700 people per square kilometre, versus the Index average of 4,600. However, this also leads to a relative lack of green space. The city only offers an estimated 15 square metres of green space per person, well below the Index average of 74 square

metres. The exception is the 100-hectare Belvedere Park, known as the "lungs" of the city. Many of the city's poorer residents live in crumbling buildings in the city centre, but one particularly active non-governmental organisation has been leading a revitalisation of these neighbourhoods (see "green initiatives" below). The residents were provided with 25-year rent-purchase plans with low monthly repayments. The demolished buildings were then replaced with newer accommodations. In another US\$19.5 million project, carried out between 1994 and 2007, the ASM led the restructuring of public spaces on two avenues, making them chiefly pedestrian. The organisation also listed and restored landmarks, including the Tunis municipal theatre and the central market.

Transport: Above average

Tunis residents have the choice of bus, light rail and suburban rail services. The city's light rail



Green initiatives: The city is investing US\$2 billion in public transport network improvements. In November 2008 Tunis completed a 6.8 km extension to the light rail network in the south of the city and in December 2009 a 5.3 km western extension. Two further extensions are under way. An additional suburban network is planned by 2016. The city also plans to introduce 14 new bus corridors totalling 90 km.

Waste: Above average

On a per capita basis, Tunis generates an estimated 173 kg of waste annually, compared with the Index average of 408 kg. This is one of the lowest rates in the Index and the main driver of the city's performance in this category. The government adopted a ten-year strategic framework for waste management in 1995 known as PRONAGDES. It was designed to promote reuse and recycling, as well as reduce waste generation and improve cost management. The PRONAGDES waste management framework was followed by a second programme covering the 2007-16 period and

unauthorised dumps and increasing treatment rates of industrial and special waste to 70%.

Water: Average

Water resources in Tunis are limited because of the arid climate. Despite this, residents consume an average of 299 litres of water per person per day, which is well above the Index average of 187 litres. It is estimated that nearly 100% of the population has access to potable water, above the Index average of 91% and the second highest rate in the Index. Tunis's water system leakages, at 28%, are slightly lower than the Index average of 30%. Several international agencies, including the World Bank, the French Development Bank and the African Development Bank, have invested and loaned large sums in recent years to upgrade infrastructure and management practices (see "green initiatives"). In large part these investments have paid off in terms of greater water access for residents and a more efficient water system. The city has relatively strong policies, including regular monitoring of surface water quality, a water quality strategy

by a high rate of access and strong policies relative to the other cities in the Index. An estimated 95% of the population has access to sanitation, well above the Index average of 84%. Regarding policies, the city is covered by a sanitation code, has wastewater treatment standards, and monitors on-site treatment facilities in homes and communal areas. As in the water category, many international agencies have extended loans and financial assistance to upgrade wastewater treatment and sewage networks in Greater Tunis and the rest of the country in recent years (see "green initiatives" below).

Green initiatives: In 2006 the European Investment Bank invested US\$121 million to upgrade sewerage networks in Greater Tunis and several other towns in the country, and to construct new wastewater treatment plants. Also, the French Development Agency is financing a programme to expand and rehabilitate 19 water treatment stations and 130 pumping stations throughout Tunisia. Additionally, the government is prioritising the local eco-system. With

assistance from the World Bank and other international organisations, it has introduced a plan to increase the use of treated wastewater for agriculture rather than discharging it into the gulf of Tunis.

Air quality: Above average

Tunis city officials conduct regular air quality monitoring in locations around the city and inform citizens about air pollution. The air quality in Tunis is better overall than in other major urban centres in North Africa. Compared with cities in Egypt and Morocco, Tunis's roadways have less congestion, though pollution from traffic and industry is still a significant problem. On a national level, energy generation contributes 31% of the country's air pollution and transport contributes 30%.

Green initiatives: The government has implemented a national plan to survey air quality. The plan foresees the installation of a network of fixed stations and the use of mobile laboratories to monitor and control the sources of pollution.

By 2002 five fixed stations had been established, including three in Greater Tunis at Bab Alioua, Manouba and Ghazela. A total of 15 stations have now been completed nationally, nine of which are located in Greater Tunis in Bab Saâdoun, El Mourouj, Ariana, El Nahli, Ben Arous and Radès. The government plans to extend the network to a total of 25 stations by the end of 2011.

Environmental governance: Average

The city's environmental policy is managed by the national ministry of environment, with different state-owned agencies carrying out specific policies in different areas. The overturning of the regime of Zine El Abidine Ben Ali in January 2011 and the replacement of the government by an interim regime means that environmental governance is currently in a state of flux.

Green initiatives: The Tunis International Center for Environmental Technologies (CITET), a national agency, was created in 1996 to develop qualifications for better mastery of environmental technologies to ensure sustainable development in Tunisia as well as the Arab and Mediterranean region. The organisation promotes environmental issues in the private sector, offers training and distance learning programmes to raise awareness about the environment, and helps companies comply with international environmental standards. The National Agency for Energy Conservation (ANME), established in 1985, aims at improving the level of energy efficiency and diversifying energy sources around Tunisia. In addition, the Association de Sauvegarde de la Médina de Tunis (ASM) serves as a meeting point and research centre on urban, architectural and socio-economic aspects of the old centre of Tunis.



system, known as the Métro Léger de Tunis, opened in 1985 and carries more than 460,000 passengers per day. Tunis has the longest superior transport network (defined as light rail, suburban trains, bus rapid transit or metro) in the Index, at 0.27 km per square kilometre, versus the Index average of 0.07 km. The light rail system is integrated with other forms of public transport, linking to suburban lines at the Tunis Marine station and to the Tunisian state rail service at Place Barcelone. As part of a comprehensive urban mass transport policy, the city has been working on plans to extend both the light rail and suburban railway systems. Tunis receives full marks for encouraging citizens to take greener forms of transport, and many residents walk to and from work in the pedestrian-friendly historic centre.

known as the Programme National de Gestion Intégrée et Durable des Déchets (PRONGIDD, see "green initiatives" below).

Green initiatives: PRONGIDD focuses on optimising the financing, collection, transport and recycling of waste, and on promoting private sector involvement and cooperation between communities. The nationwide programme contains a series of key targets, including reducing waste generation by 20% by changing consumption patterns, increasing composting levels by 15% and household-waste recycling by 20% and ensuring 100% of municipalities have access to waste transfer stations and landfill facilities. Additionally the framework calls for: raising private-sector participation in waste collection and infrastructure development to 30%, closing 70% of

and a policy aimed at conservation. These policies have also received input from Tunisia's international partners.

Green initiatives: In 2005 the World Bank approved a loan of US\$38 million to the state-owned water company to upgrade water infrastructure in Greater Tunis and other urban centres. The project, which is set to finish in 2012, has two components: The first entails upgrading water infrastructure to improve delivery capacity, and the second focuses on upgrading management systems, including information systems, planning, cost control and customer-service procedures.

Sanitation: Above average

The city's performance in this category is driven

Quantitative indicators

Category	Indicator	Average	Tunis	Year*	Source
ENERGY and CO ₂	Proportion of households with access to electricity (%)	84.2	99.0 ^{1e}	2010	Goliath Business Knowledge
	Electricity consumption per capita (GJ/inhabitant)	6.4	18.1 ²	2008	Annuaire Statistique de la Tunisie 2008
	CO ₂ emissions from electricity consumption per person (kg/person)	983.9	1,044.1 ^{3e}	2008	2006 IPCC Guidelines for National Greenhouse Gas Inventories
LAND USE	Population density (persons/km ²)	4,578.1	4,698.1	2009	EIU calculation
	Population living in informal settlements (%)	38.0	25.0 ^e	2001	Tunis City Development Strategy Report 2001
	Green spaces per person (m ² /person)	73.6	14.5 ^e	2004	l'Institut National de la Statistique
TRANSPORT	Length of mass transport network (km/km ²)	2.7	2.3 ⁴	2008	Société du Métro léger de Tunis
	Superior public transport network (km/km ²)	0.07	0.27 ^{2,5}	2008	Société du Métro léger de Tunis
WASTE	Waste generated per person (kg/person/year)	407.8	172.5 ^{1e}	2002	Mediterranean Environmental Technical Assistance Program Report 2002
WATER	Population with access to potable water (%)	91.2	99.7 ^e	2009	Société Nationale d'Exploitation et de Distribution des Eaux
	Water consumption per person (litres per person per day)	187.2	299.3	2008	Ministry of Environment
	Water system leakages (%)	30.5	28.4	2008	Ministry of Environment
SANITATION	Population with access to sanitation (%)	84.1	95.0 ^e	2009	Office National de l'Assainissement

All data applies to Tunis unless stated otherwise below. * Where data from different years were used only the year of the main indicator is listed. e = EIU Estimate. 1) National data used as proxy for city data. 2) Tunis district. 3) National electricity generation mix used to estimate city level CO₂ data. 4) Greater Tunis. 5) There are no subway, tram or BRT lines

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Picture editing: Stephanie Rahn, Publicis Publishing, München
Layout: Rigobert Ratschke, Seufferle Mediendesign GmbH, Stuttgart
Graphics: Jochen Haller, Seufferle Mediendesign GmbH, Stuttgart
Printing: BechtleDruck&Service, Zeppelinstraße 116, 73730 Esslingen

Photography: Plus Utomi Ekpei (Lagos), Zacharias Garcia (Alexandria, Cairo, Casablanca,
Tunis), Sala Lewis (Dar es Salaam), Kostadin Luchansky (Luanda), Martin Steffen (Accra),
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Munich, Germany, 2011

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Order no.: A19100-F-P185-X-7600