



# SUSTAINABLE CITIES

*Leveraging the transition  
to sustainability*



@leboditibane



# Key Messages

1

The typical South African city is growing in a resource-intensive way and suffers from inefficiencies across all sectors (energy, food, water, waste and transport).

2

The current silo approach to planning and delivery is inefficient and increases risks of exclusion.

3

Cities should pursue spatial transformation, which encourages compact cities and sustainable neighbourhoods that value natural and open spaces.

4

Sustainability and growth are interdependent, and so sustainability must be fundamentally embedded in a city's development paradigm, and not just in its long-term visions and strategies.

5

Cities need to tackle resource efficiency aggressively.



@drae\_savvides

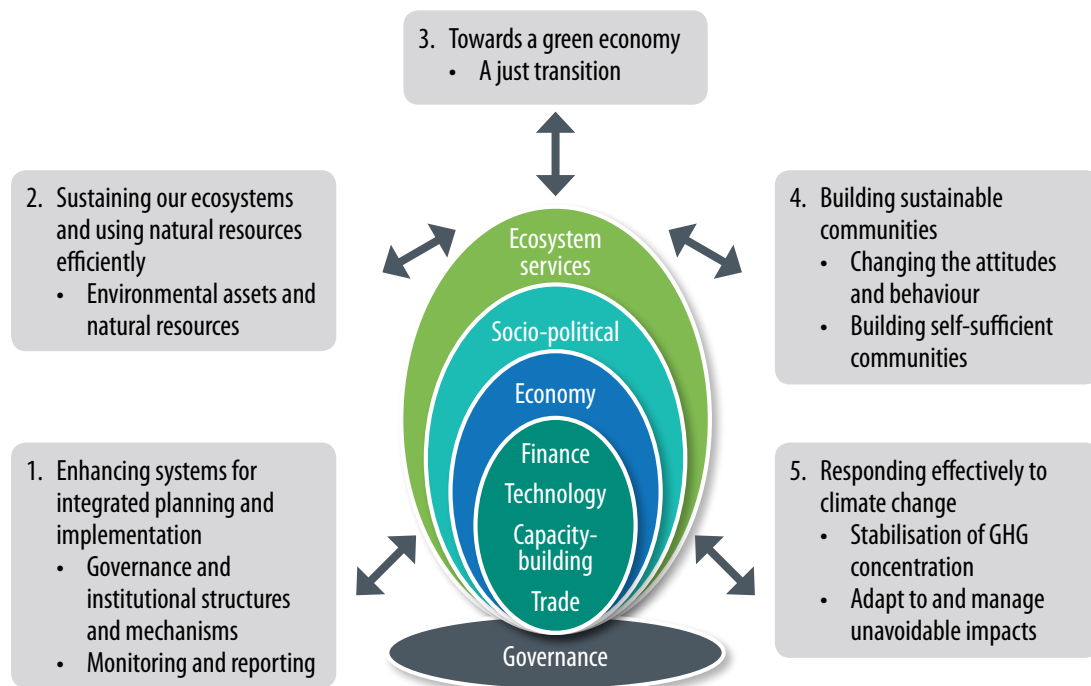


# INTRODUCTION

Since 1994, the government has clearly positioned South Africa as a country on a sustainable path. The South African Constitution requires local government to “secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”. In support of this constitutional objective, the National Environmental Management Act (NEMA) (No. 107 of 1998) established cooperative governance principles, institutional mechanisms and sustainable development tools needed to promote environmental sustainability. These include environmental impact assessments, environmental management frameworks, environmental management cooperation agreements, environmental management plans, environmental implementation plans and regular State of the Environment reports.

In 2008, the National Framework for Sustainable Development was adopted. It became the National Strategy for Sustainable Development (NSSD) in 2011. To achieve the nation's vision for sustainable development, the NSSD proposes five strategic interventions and means of implementation required (DEA, 2011a), as shown in Figure 5.1.

**Figure 5.1:** Sustainable development priorities and means of implementation



Source: DEA (2011a)

Although environmental sustainability is mainstreamed across government spheres, with champions beginning to lobby for broader sustainability, faster implementation is required.

A sustainable city is defined here as a city that meets its developmental responsibility (social justice and urban safety) in a sustainable, spatially transformed and resource-efficient way (natural and economic resources, and human capacity) that takes into account the limited biophysical planetary boundaries

(environmental thresholds). Living sustainably means grappling with the “perfect storm” associated with the inseparability of water, food, energy and climate change (Oxford Martin University, 2013: 18).

Cities have control over resources (water, electricity, waste and land, etc.), and the condition of these resources affects both the local and national economy. Furthermore, revenue generated from managing these resources is used to subsidise services provided by cities to residents. Efficient consumption and maintenance of these resources is important because the economy will be negatively affected if they are depleted or degraded.

In 2011, the State of Cities Report (SoCR) assessed South Africa’s nine major cities under the theme of resilience (SACN, 2011). Resilience was referred to as the ability of urban systems and institutions to accommodate different sources of change and adapt to a state of flux. As urban spaces are dynamic and constantly evolving, an integrated systems thinking approach is required to assess and manage them. Cities must view sustainability as part of their everyday business (i.e. service delivery), not as a fringe environmental concept. The SoCR 2011 concluded that resilient cities need to be accountable for resource usage, which requires high-quality, city-level data on resource stocks and flows.

The country has made good progress in development, but sustainability is not yet seen as central to service delivery. The percentage of households with “access to a basic level of water (one stand pipe within 200 metres)” increased by about 35%, from just over 60% in 1994/95 to over 95% in 2011/12 (The Presidency, 2014: 71), and South Africa is considered “one of the few countries in which tap water is safe for drinking and use” (ibid: 127). Waste management has improved tremendously, with waste collection in all nine cities above the national average of 65%. However, progress has come at a cost. For instance, the coastal areas in Cape Town and eThekweni have been the most transformed from their natural state, which means they are rapidly losing the ability to provide ecosystem services and to buffer coastal communities from sea level rise.

This chapter aims to provide a perspective on accelerating transition towards sustainable and inclusive cities. It uses a resource-efficiency lens on energy, waste, water and food security to reflect on environmental sustainability, and examines how cities understand and manage cross-cutting issues such as land, air quality, climate change, disaster management, coastal management as well as rural-urban linkages. Foresight principles are proposed as a tool to operationalise existing growth and development strategies.

## CITY TRANSITIONS TO SUSTAINABILITY

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In 2015, the Paris climate agreement on cities at COP21<sup>1</sup> emphasised that, unlike cities in the developed world, African cities, as key drivers of growth, will not have the luxury of riding an environmental Kuznets curve (i.e. to pollute now and implement sustainability practices later). Cities

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1 COP stands for the Conference of Parties, which is held annually to review the implementation of the Rio Convention that includes the UN Framework on Climate Change (UNFCCC).

will need to have low-emissions growth and development trajectories that work smartly within an increasingly resource-constrained world. Yet, despite a relatively high level of expressed political commitment, South African cities are not transitioning to sustainability quickly enough.

Cities have in place planning tools, such as integrated development plans (IDPs), spatial development frameworks (SDFs) and service delivery and budget implementation plans (SDBIPs). They have developed and improved service delivery in key sectors: energy, waste management, water and sanitation, human settlements and public transport, and have begun tackling climate change, food security, and disaster and risk reduction. However, the apartheid spatial development legacy combined with rapid urbanisation mean that cities are continuously playing catch-up, as access to infrastructure and services falls behind population growth. This pressure feeds urban sprawl, which, in turn, encourages car use, exacerbates social segregation, increases greenhouse gas (GHG) emissions and leads to the loss of natural resources.

As a result, the typical South African city is resource intensive and suffers from inefficiencies across sectors (energy, food, water, waste and transport). Some decoupling<sup>2</sup> has been observed in the energy sector, but generally the development trajectory is unsustainable. Volumes of waste are disposed annually at landfill sites, which are fast running out of airspace; freshwater reserves are constrained; and GHGs and other air pollutants continue to be emitted from electricity generation and vehicles that run on fossil fuel. Cities continue to depend on food that is produced elsewhere, making them vulnerable to shocks in the food value chain (e.g. rising costs because of drought, flood, or increased electricity and petrol prices).

Income and wealth inequalities aggravate the situation. Equitable access to services and infrastructure eludes many communities within the cities. Although middle- and high-income households are investing in rainwater storage, renewable energy, solar water heating and grey water systems across the country, the majority of the population remains in poorly connected settlements, with poor access to public transport and subject to increasing water, electricity and transport costs, which stretch household budgets even further. The consequence is a deepening energy poverty that is perpetuated through generations.

Cities need to appreciate that environmental sustainability is the foundation for the economic and social well-being of their citizenry, as underscored by the cross-subsidisation that happens between the different levels of households. They have powers, planning tools and instruments that can be used to ensure the efficient management and consumption of resources. Where their mandate and ability is constrained by national legislative ambiguity, cities can use existing intergovernmental cooperation platforms to negotiate such ambiguities. Cities have made significant progress towards sustainability, and this is analysed through energy, waste, water and food security.

<sup>2</sup> Decoupling refers to the ability of an economy to grow without corresponding increases in environmental pressure. In many economies, increasing production (GDP) raises pressure on the environment. An economy is said to be decoupled when it is able to sustain GDP growth without having a negative impact on environmental conditions. The OECD definition: the term “decoupling” refers to breaking the link between “environmental bads” and “economic goods”. In other words, the rates of increasing wealth are greater than the rates of increasing impacts. [https://en.wikipedia.org/wiki/Eco-economic\\_decoupling](https://en.wikipedia.org/wiki/Eco-economic_decoupling)



## SUSTAINABLE ENERGY

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Sustainable energy refers to the production and consumption of energy in ways that support social and economic development in an environmentally benign manner (SACN, 2015a). The current electricity crisis facing the country is an invitation for cities to invest more in renewable energy and energy efficiency, but this will require rethinking the way cities charge for electricity.

Supply shortages led to load-shedding in 2008 and again in 2014–2015, negatively affecting businesses and households. Eskom is under severe financial strain to maintain its operations and bring new capacity online. Many municipalities are struggling to pay for electricity used, which compounds Eskom's financial pressures. Emissions from coal-based electricity and high consumption of fossil diesel and petrol are also under scrutiny because of the country's commitment to reducing GHG emissions.

For municipalities, reducing Eskom-supplied electricity sales will affect city finances, as cities use proceeds from electricity sales to cross-subsidise other functions and services. Furthermore, the price of renewable energy technologies is becoming attractive for businesses and households. While this move is good for industry development, cities are likely to lose income from electricity sales, as businesses and middle- and high-income households adopt renewable energy and everyone reduces their consumption because of rising electricity tariffs. Therefore, cities need to find innovative ways of growing their revenue.

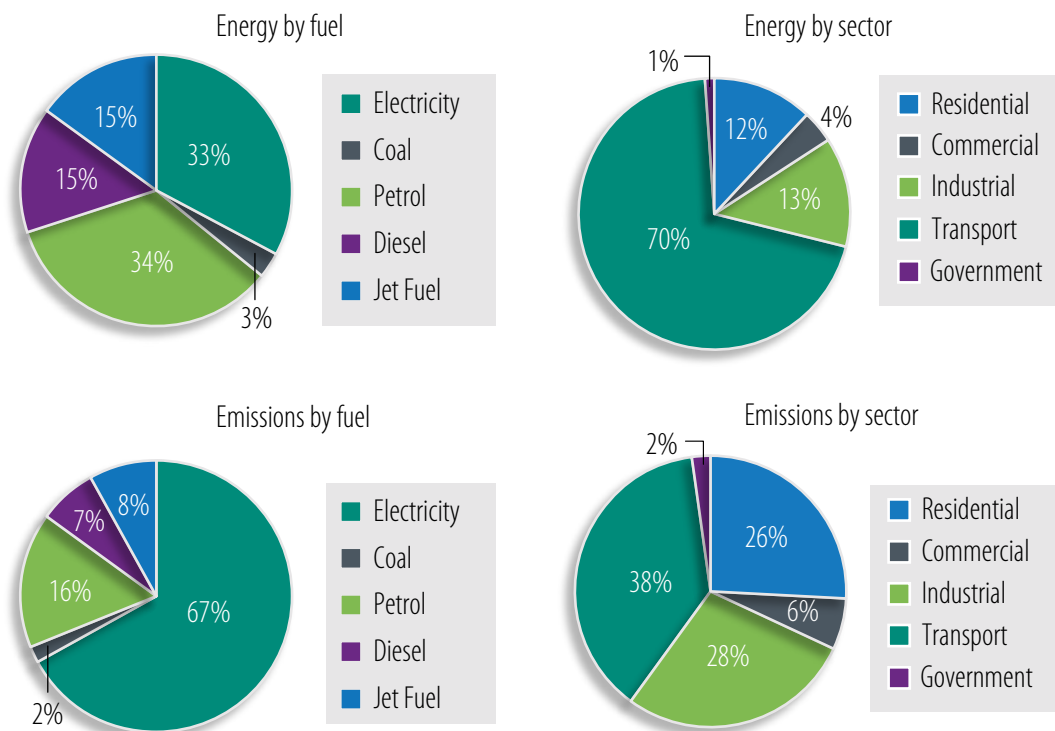
### **ENERGY: legislation, policies and plans**

The National Energy Act (No. 34 of 2008) aims to ensure that diverse energy resources are available for all South Africans, and its objectives include effective energy management and conservation. The Act paves the way for increased renewable energy supplies and energy efficiency initiatives. It obliges the Minister of Energy to develop an Integrated Energy Plan that includes the supply, transformation, transport, storage and demand of energy. Sustainable energy is further promoted through the Renewable Energy White Paper (DME, 2003) and the Energy Efficiency Strategy (DME, 2005; SACN, 2015a). Cities can support these national ambitions through developing policies and bylaws.

The Integrated Energy Plan is meant to guide future energy investments, while the Integrated Resource Plan guarantees security of electricity supply and reduction of carbon emissions through diversification and introduction of cleaner technologies. The Integrated Resource Plan identifies the need to accelerate tapping into the country's solar, wind and hydropower resources, while exploiting fossil fuels and mineral resources more responsibly. As of May 2015, 4116 MW of renewable energy had been procured (DoE, 2015) as well as plans pronounced for nuclear expansion, but the slow diversification of national energy supply means that energy production will remain largely dependent on coal for some time.

Most of South Africa's energy consumption occurs in cities: just eight cities (metros) consume more than one-third of national energy consumption, and more than half of all petrol and diesel (SEA, 2015). Figure 5.2 shows the energy use and emissions for a typical metro.

**Figure 5.2: Energy use and emissions for a typical metro**



Source: SEA (2015)

Figure 5.2 shows that:

- Energy use is split evenly between petrol (34%), electricity (33%) and diesel and jet fuel (30%), with a negligible contribution (3%) from coal. The transport sector accounts for 70% of energy consumed within a typical metro.
- Electricity generation is the largest contributor to emissions, accounting for two-thirds (67%) of all emissions. This is in part because South Africa uses coal to generate the bulk of its electricity, and coal has a very high emissions factor. The transport sector is the largest emitter (38%), followed by the industrial and commercial sectors (34% combined).

As the largest consumers of energy, cities are at considerable risk from rising electricity tariffs, crude oil import tariffs and climate change pressures. Yet, at the same time, they have a huge potential to enhance energy security, reduce emissions and lead the transition to cleaner energy sources. In this regard, cities have made some progress, as the following sections illustrate, but implementation and scaling-up of initiatives have been limited.





## Renewable energy

Small-scale, local renewable energy generation is becoming increasingly financially and technically viable (SEA, 2015). The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has accelerated the shift to photovoltaic (PV), wind, as well as landfill, wastewater and biogas-to-electricity projects. In 2014, municipal-led or supported local renewable energy development was at 67,647MWh/year from zero installations in 2005 (SEA, 2015). This is a significant effort that needs increased support from national government.

**PV projects:** In 2012, Ekurhuleni installed 200 kWp of solar PV plant from 860 solar panels, with plans to scale up to 600kWp, while in 2014, Cape Town installed 167 kWp of rooftop PV panels, with 90 kWp planned for installation by June 2016. eThekweni has developed a Solar City Framework to promote the local manufacturing of PV technology and its uptake in residential and commercial properties. The output of this framework is an online solar map that can be used to quantify solar potential before further investment. There are also plans to install 150 kWp on municipal buildings.

**Wind power:** The wind farm in Darling, Cape Town, offers 5.2 MW of installed capacity, while in Nelson Mandela Bay, the 1.8 MW Coega wind farm is being developed and privately supported by a municipal Power Purchase Agreement (PPA) and wheeling agreement.

**Landfill gas to electricity:** The largest plant is in eThekweni, where the Bisasar Road produces 7 MW per year from landfill gas. Johannesburg is planning to generate 18.6 MW from its five landfill sites, while Ekurhuleni and Buffalo City continue to flare as feasibility studies are undertaken.

**Wastewater gas to electricity:** Johannesburg's Northern Water Works Treatment Plant has plans to ramp up production to 4.5 MW.

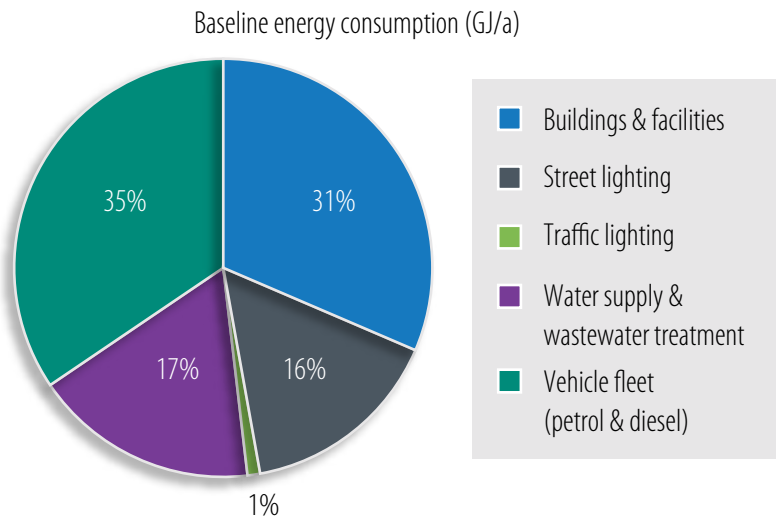
**Waste to electricity:** Tshwane's Bronkhorstspuit facility currently produces 3 MW with expected full capacity of 4.5 MW.

**Micro-hydro:** Cape Town has 2 775 kW installed capacity at the Wemmershoek, Blackheath, Faure and Steenbras water treatment plant facilities (SEA, 2015).

## Energy efficiency

At the national level, energy efficiency and fuel switching remain under-exploited despite their benefits for job creation, financial savings and enhanced energy security. Cities can lead the way and, in so doing, will not only save money, but also encourage the residential, commercial and industrial sectors to follow suit. Payback times are often reasonable and large savings can be achieved by retrofitting streetlights, traffic lights, water pumps and buildings with technologies that are more efficient.

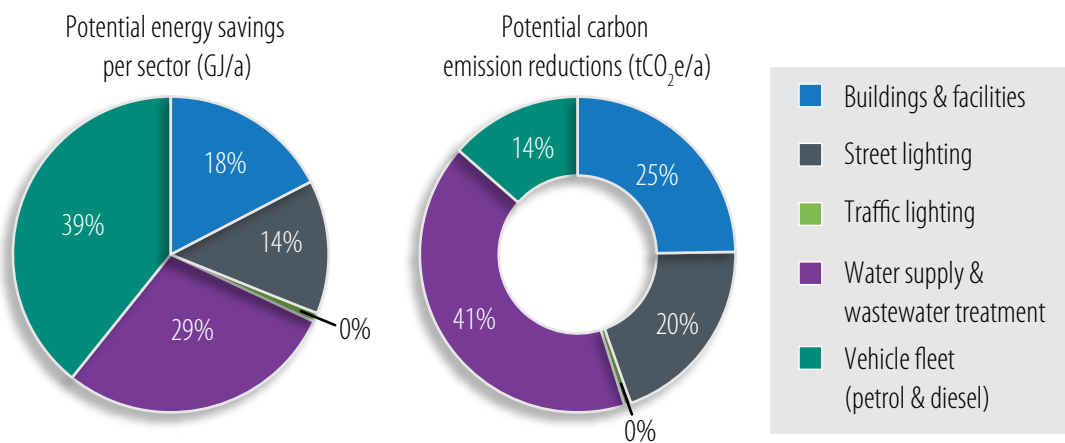
**Figure 5.3: Average baseline energy consumption per sector (GJ/a) in a city**



Source: SACN (2014a)

As can be seen in Figure 5.3 there is significant energy consumption in cities and so the potential end-use savings are considerable: 39% from the municipal fleet, 29% from the water supply and wastewater sector, 18% from buildings and facilities and 14% from street lighting (SACN, 2014a). If the full potential of energy savings were captured, the result would be a significant reduction in carbon emissions across the sectors (Figure 5.4). It should be noted that in the case of the municipal fleet, the potential is higher for energy saving (39%) than for emission reduction (14%). This is because liquid fuels have a lower carbon content than electricity.

**Figure 5.4: Potential energy savings and carbon emissions reductions per sector/annum**



Source: SACN (2014a)



Cities have introduced energy efficiency policies, strategies and campaigns, and have established implementation forums. Implementation is often financed through the Eskom Rebate Programme (for low- and high-pressure solar water heating systems), and the Energy Efficiency Demand Side Management (EEDSM) programme for street and traffic lighting, building lighting, heating, ventilation and air conditioning systems, and more recently for water pumps in water and wastewater plants. Through the EEDSM fund, eThekweni has managed to implement a number of energy efficiency projects focusing on traffic lighting, street lighting and its municipal buildings. Between 2009/10 and 2010/11, eThekweni Transport Authority replaced all 75W incandescent traffic lights with 15–20W LED lights, and spent a total of R25.4-million on traffic lighting retrofits.

### **SUSTAINABLE TRANSPORT: impact on energy consumption and emissions**

While not a direct resource, such as energy or water, transport has an important impact on energy consumption and emissions. The transport sector is responsible for 38% of emissions (as shown in Figure 5.2), which is not surprising as the private car and minibus taxis were the only modes of transport to show an increase in use between 2003 and 2013 (see Table 2.1 in Chapter 2). A strong business case has been made for cities to encourage the use of cleaner fuels, such as compressed natural gas (CNG) and biogas, in public transport vehicles, including minibus taxis (SACN, 2015a). Switching to cleaner fuels will reduce emissions considerably, especially as the minibus taxi industry will remain a highly relevant mode of transport for the foreseeable future.

Municipalities can promote sustainable transport through greening their municipal fleet and improving mobility within cities, which will lead to more efficient use of resources (time, productivity, affordability and air quality). Cities own and operate thousands of vehicles, which account for 35% of municipal energy consumption (Figure 5.3). Therefore, greening municipal fleets makes sense: reduced emissions would lead to reduced air pollution and less respiratory illnesses, while municipalities would save on fuel costs. The lifecycle costs for procuring and operating green bus fleets using either biofuels, CNG/biogas, or electric batteries, have largely converged with those of EuroV diesel buses. All options comply with EuroV tailpipe emission standards and can reduce GHG emissions by over 70%. Biogas and bioethanol have good potential as a sustainable fuel, if care is taken in sourcing them, while electric vehicles can be charged with solar PV to achieve a 100% reduction in emissions. This move would also reduce dependency on imported crude fossil fuels (SACN, 2015c).

Improving mobility through an integrated public transport system that includes mass transit and non-motorised transport (NMT) will also result in lower emissions, more efficient use of resources and increased productivity. The larger cities have introduced bus rapid transit (BRT) systems as part of their plans for integrating public transport.

- **Johannesburg** is rolling out its Rea Vaya BRT system in multiple phases, which is complemented by 190 Metrobus buses that run on dual-fuel (diesel and CNG). Of this Metrobus fleet, 70 (40 new dual fuel and 30 rehabilitated and converted buses) began operating in July 2015. Furthermore, NMT infrastructure, especially in the student-oriented suburb of Braamfontein and parts of Soweto, has been developed.

- **Tshwane** initiated its A Re Yeng BRT system in 2014, and the first buses became operational towards the end of 2015. Approximately 30% of this fleet will operate on CNG, but this percentage is likely to increase for both BRT and metro buses. The city has also procured 10 Nissan Leaf electric vehicles for use by various departments within the city. Money has been spent on infrastructure design and upgrading parts of WF Nkomo Street in the central business district to be a pedestrian zone.
- **Cape Town** has a MyCiTi BRT system that connects the airport, previously disadvantaged townships and other suburbs with the central business district. The city also maintains good infrastructure for NMT and sends its bus drivers on good driving behaviour courses.

## Accelerating the transition to sustainable energy

The scope is huge for the roll-out of a robust municipal renewable energy programme that would have positive spin-offs for job creation and skills development. The SALGA Energy Efficiency and Renewable Energy Strategy for Local Government (SALGA, 2014) provides an overall policy framework, while individual cities have strategies in place (e.g. energy and climate change, green economy framework, etc.). The capacity to manage these projects is gradually developing, especially in Tshwane, Cape Town, Ekurhuleni, Johannesburg and eThekweni. Cities need to explore on a much bigger scale the three ways they can be involved in the electricity supply, i.e. being a generator as demonstrated above, an off-taker from IPPs and the middle-man through wheeling agreements of green electricity.

The national REIPPP is providing valuable lessons and experience for introducing renewable energy into the supply mix. The complementary capacity from cities, through waste-to-energy and PV projects, adds stability into the grid and, if better coordinated and managed, could alleviate the current electricity supply constraints.

Cities should actively participate in the national forums aimed at finding sustainable energy solutions in order to clarify the regulatory ambiguity, for example, the mandate and contribution of municipalities in electricity generation and energy efficiency. The urban energy network jointly convened by the SACN, SALGA and SEA is a valuable platform and was strengthened in 2014 by the development of a national website [www.cityenergy.org.za](http://www.cityenergy.org.za) which acts as a repository of information on policy, research and guidelines relating to urban energy matters

The growth in sustainable energy governance and capacity is laudable and has resulted in the building of new capacity in other service delivery departments. In Ekurhuleni, eThekweni and Johannesburg, waste department officials are involved in methane gas harvesting and gas-to-electricity generation initiatives. In Tshwane, the cross-departmental sustainability task team, facilitated by the City Sustainability Unit, provides an alternative model for mainstreaming sustainability in city operations. In Cape Town, public lighting retrofit has drawn in officials from the roads department and led to managers of city-owned buildings being trained in energy management.





A fundamental lesson from the cities' many energy efficiency and renewable energy projects is that some of these projects are replicable and scalable, and that low-hanging fruits should be targeted. This could be enhanced by strengthened horizontal learning on both success stories and where results were not as envisaged. Data management, monitoring and evaluation of interventions could facilitate large-scale roll-out.

Another lesson is that a market-driven approach to energy transition is having unintended consequences, creating a form of exclusive urbanism. The technology is expensive, which means that middle- to high-income households and businesses can afford it, whereas the benefits are most needed among lower-income groups. Cities therefore need to adopt a holistic approach to the management of sustainable energy in order to lessen future economic and social burden.

## WASTE

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Waste management services are under pressure from rapid urbanisation, population growth, unsustainable consumption patterns and rigid traditional waste-management practices. Cities have little choice but to adopt better waste-management practices because of increasing environmental pollution and diminishing landfill airspace, as well as the high cost of developing new landfill sites.

Global best practices and green waste-management studies show that cost recovery mechanisms and financial incentives for waste producers can change waste generation behaviour. In the case of pay-as-you-throw (PAYT) schemes, whereby the polluter pays, cost recovery and financial incentives go hand in hand. For example, the Belgian province of Flanders increased selective collection and recycling from 34% in 1995 to around 70% in 2002 through the use of PAYT schemes in conjunction with other initiatives; since 2002, the percentage has stabilised (SACN, 2014d).

The high volumes of unsorted waste disposed at landfill sites show that South Africans have not yet realised that household and commercial waste is a cost-effective source of raw materials. This battle can only be won if tackled jointly by government (regulation) and the private sector (producers of products and packaging). In addition, the concept of a circular economy<sup>3</sup> is in its infancy in South Africa. Cities need to take the lead in forging stronger partnerships with the private sector in order to reap the economic and environmental benefits of turning waste into worth.

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3 "A circular economy is an economy which balances economic development with environmental and resources protection. It puts emphasis on the most efficient use and recycling of resources, and environmental protection. A circular economy features low consumption of energy, low emission of pollutants, and high efficiency. It involves applying cleaner production in companies, eco-industrial park development and integrated resource-based planning for development in industry, agriculture and urban areas." (UNEP, 2006)

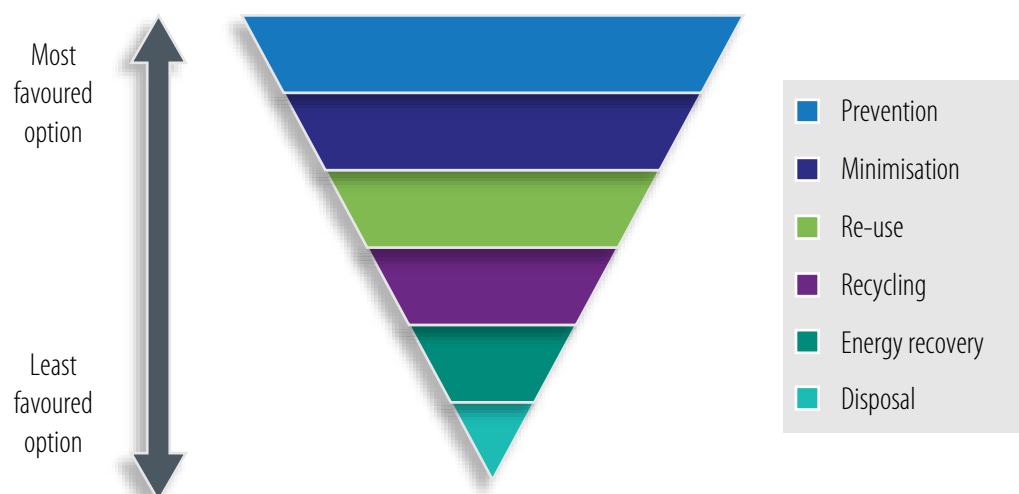
## WASTE: legislation, policies and plans

Constitutionally, proper waste management is a core municipal function. Integrated sustainable waste management in cities is guided by national policy, including the National Environmental Management Waste Act (No. 59 of 2008, amended by Act No. 14 of 2014) and the National Waste Management Strategy (NWMS).

The Act mandates municipalities to develop integrated waste-management plans (IWMPs). These, in turn, must form part of municipal IDPs and SDBIPs. Municipalities may, at their discretion, set service standards for waste separation, compacting and management, and disposal of solid waste. Local standards must be aligned with provincial and national standards, where these exist (DEA, 2011c). IWMPs are key to strengthening waste governance in local municipalities. Cities with IWMPs perform much better than cities without them, as illustrated in Table 5.1 – Johannesburg and Cape Town have functional IWMPs and waste policy frameworks hence their good collection rates. Developing up-to-date waste strategies and plans, and gathering better waste-related data, are important first steps in developing waste-management practices that are more effective and sustainable.

The waste hierarchy is a common approach to waste management and “consists of options for waste management during the lifecycle of waste, arranged in descending order of priority: waste avoidance and reduction, re-use and recycling, recovery, and treatment and disposal as the last resort” (DEA, 2011c: 6), as shown in Figure 5.5.

**Figure 5.5:** The waste hierarchy



Source: SACN (2014c)



Over the past two decades, waste collection in the SACN member cities has improved significantly (Table 5.1).

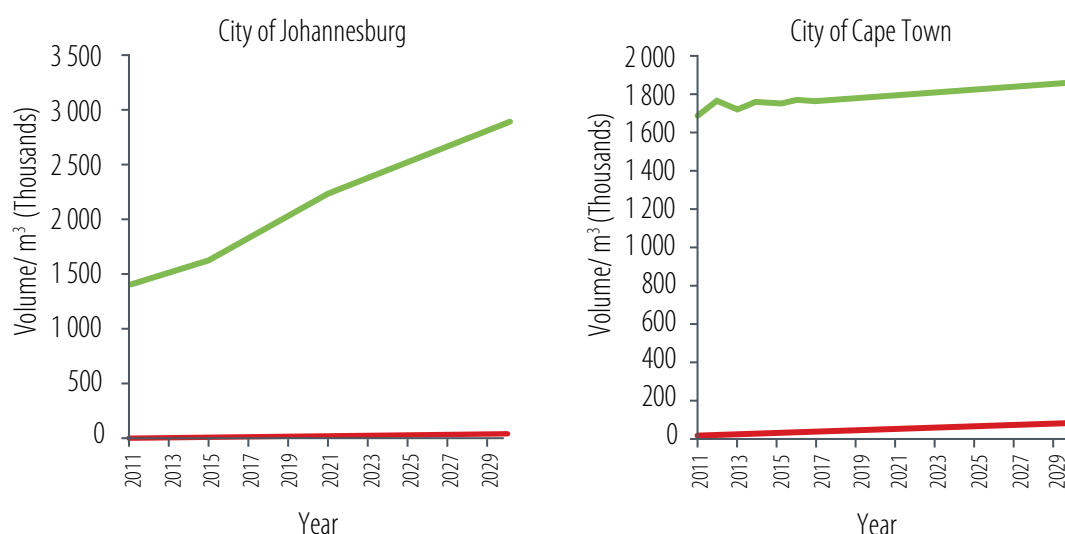
**Table 5.1:** Waste collection models in the cities

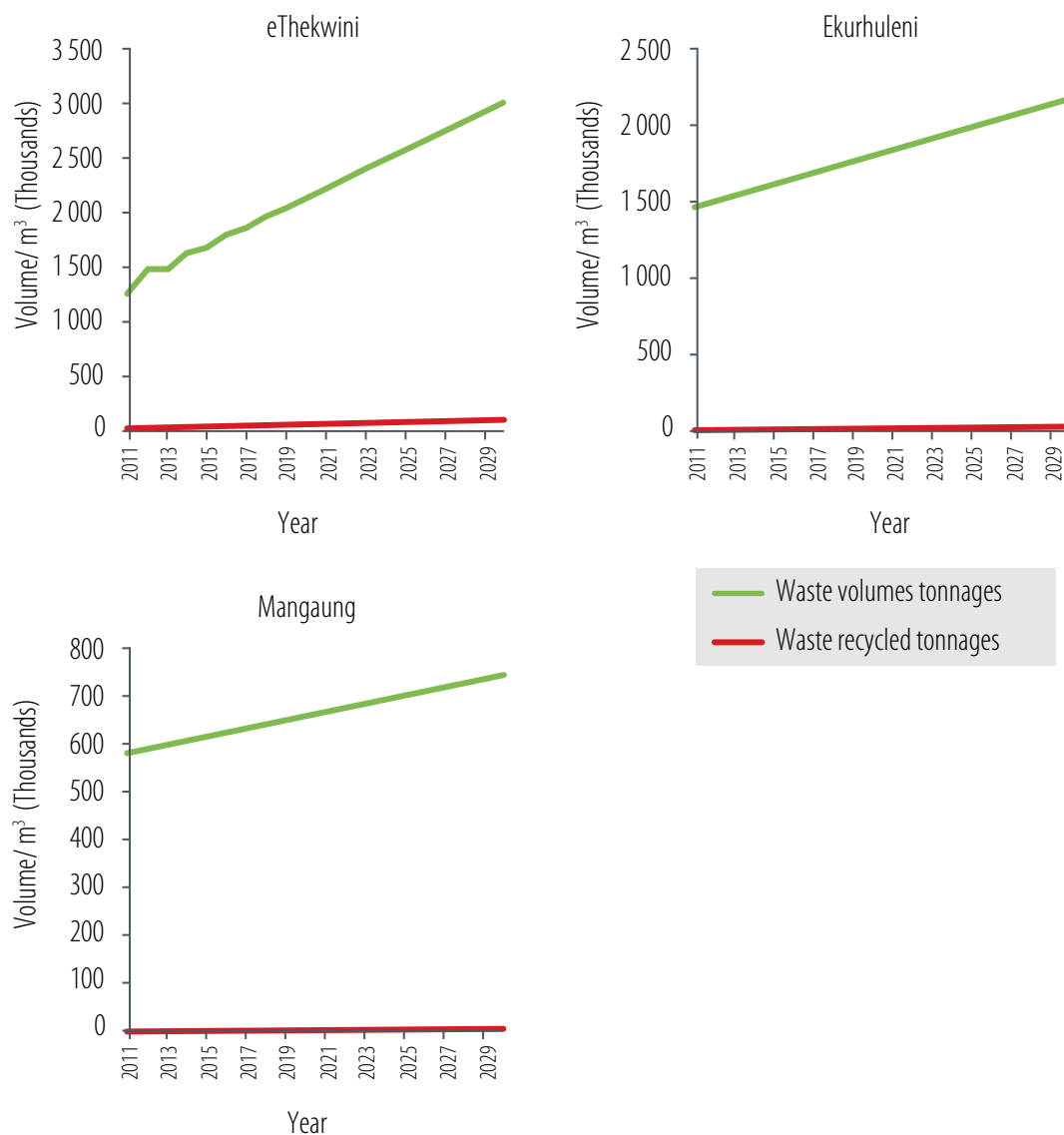
Municipality	Weekly refuse removal municipality (% of households)		Weekly refuse removal municipality/ private sector (% of households)	
	2001	2011	2001	2011
Johannesburg	90.9	95.3	94.1	97.0
Cape Town	94.3	94.3	93.0	95.0
eThekweni	85.7	89.9	70.0	87.9
Ekurhuleni	87.9	88.4	88.8	89.4
Nelson Mandela Bay	86.1	82.9	93.5	91.5
Tshwane	75.2	80.2	76.1	82.0
Mangaung	60.0	78.9	66.7	83.1
Buffalo City	71.2	70.4	65.3	71.3
Msunduzi	59.5	53.2	No data	No data

Mangaung's waste collection service increased by more than 10% between 2001 and 2011, while most cities have waste collection levels that are above the national average of 65%. In 2011, over 95% (97.3%) of households in Johannesburg had access to weekly refuse removal, compared to 59.5% in Msunduzi (SACN, 2014c).

Despite this improvement, unless more progress is made, cities will be grappling with high volumes of waste in 2030 (see Figure 5.6). The Department of Environmental Affairs (DEA) needs to allocate resources to and work closely with cities and the private sector to establish programmes and awareness-raising campaigns to address high volumes of waste. The NWMS expects cities to employ staff who can plan and establish waste separation and recycling facilities, and effectively communicate with communities about proper waste-management practices.

**Figure 5.6:** Waste volumes disposed of at landfill sites per city





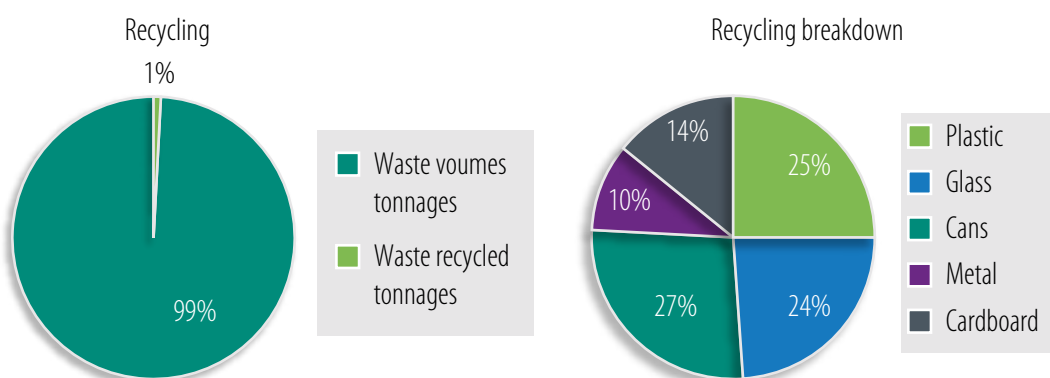
Of particular concern is the alarmingly low level of recycling in cities. Figures 5.7, 5.8 and 5.9 provide a snapshot of recycling levels in 2013/14 in three cities: Cape Town, eThekweni and Ekurhuleni.

While the progress in improving waste collection and exploration of various alternatives including waste to energy and integration of waste pickers are laudable, creative ways are needed in order to support a “reduce, re-use and recycle” (3Rs) mentality.

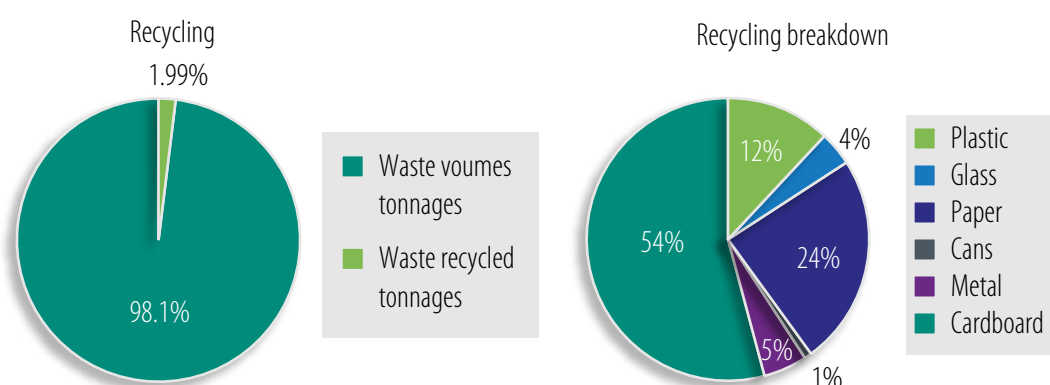




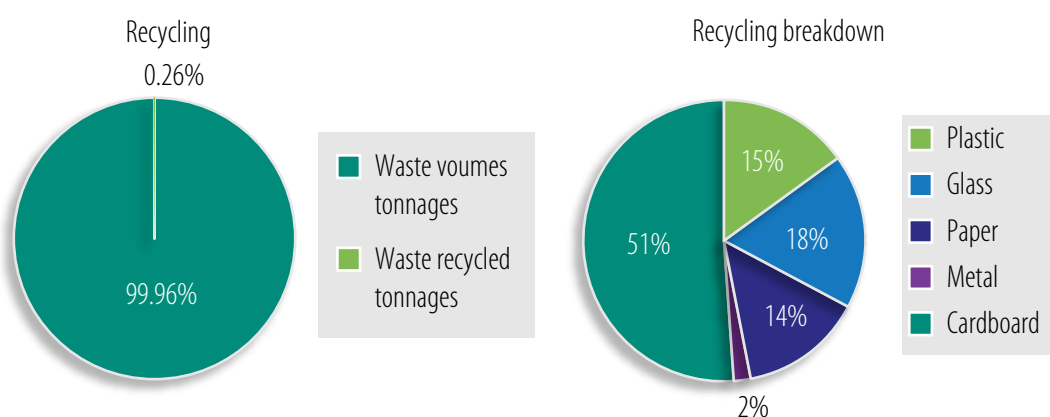
**Figure 5.7: Recycling figures for the City of Cape Town**



**Figure 5.8: Recycling figures for eThekwin**



**Figure 5.9: Recycling figures for Ekurhuleni**



Cities are exploring various alternatives and these are being demonstrated by three cities as described below.

**Cape Town** owns and operates (via private contract) two materials recovery facilities: Athlone Refuse Transfer Station (ARTS) and the Kraaifontein Waste Management Facility (KWMF); a third facility to service the South Peninsula area is planned. At these facilities, the waste is compacted into 20-ton containers and then transferred to a landfill site. KWMF is a clean facility, receiving waste that is recycled at source by 42 000 households provided with 130 litres bins, whereas the Athlone is a dirty

facility (i.e. waste is sorted manually at the site). The Athlone facility employs 100 people from the Langa community, while the KWMF employs 240 people (COCT, 2015).

In August 2007, **eThekweni** Cleansing and Solid Waste Unit initiated a recycling project known as the Domestic Orange Bag Recycling Project. Each household is provided with a three-month supply of orange bags. The orange bags are only used for recycling paper, cardboard, plastic, polystyrene and tetra-pak, and are collected with the normal domestic refuse bags. In 2015 nearly one million (953 510) households are participating in the project, which is planned to extend into the township areas in phases, starting with Umlazi (EMM, 2015).

**Johannesburg** is exploring a combination of waste-management interventions, including the separation of waste at source. In 2009, a waste separation project was piloted at the Waterval Depot, whereby households separate their waste, placing packaging papers in orange reusable bags, and other recyclables (e.g. bottles, cans) in a colourless plastic bag (Pikitup provides the bags). As only residual waste goes into the household's 240 litre refuse bin, the result has been less waste collection rounds by the refuse collection trucks. The plan is to implement the project throughout the city. To date, 264 889 households are participating in the project, which has been extended to Zondi, Avalon, Midrand, Diepsloot and Orange Farm areas. Since the project started, approximately 187 000 tonnes of waste has been diverted away from the landfill sites (City of Joburg, 2015).

## Accelerating the transition to sustainable waste management

Waste management is an essential city service that, if poorly planned, can lead to costly environmental and public health issues. Traditional landfills are still the most common method of waste disposal, despite the fact that cities are rapidly running out of airspace. The current landfills are not coping with the volumes of waste generated by a nation that is not environmentally conscious. Furthermore, this type of waste disposal is not sustainable. For instance, in a space of six months (June–December 2013), Tshwane had to close three of its full landfill sites, and the remaining five sites have rapidly diminishing airspace (City of Tshwane, 2015b). Another reason for encouraging waste diversion away from landfills is that approving and developing a new landfill takes approximately five years.

Cities can accelerate this transition in two ways: (1) reconfigure the current system in order to relieve pressure on existing landfill sites; (2) investigate cost recovery mechanisms and a regulatory framework that would facilitate the nation's mind shift away from being heavy waste generators. Cities can reconfigure the current system through partnerships and investing in full-blown separation at source, infrastructure (differentiated bags and vehicles to pick them up), integrating waste pickers and strategically placing transfer stations, buy-back centres and large-scale multi-purpose recycling facilities. Cities need to investigate the feasibility of PAYT tariffs and promote waste as wealth. Tracking material inflow in the waste sector will also assist in closing the loop towards resource efficiency.



The waste sector is undergoing a global revolution that presents an opportunity for job creation and entrepreneurial initiatives, including waste-to-energy power generation. Cities can learn from each other. For instance, Cape Town has experience in operating both a dirty and a clean materials recovery facility, and Tshwane launched its materials recovery facility in 2015. Citizens who are interested in waste management can be involved in city projects, instead of the current isolated separation-at-source projects and continued non-acknowledgement of waste pickers that have been documented to divert substantial volumes away from landfilling.

## WATER

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Cities must provide access to reliable, safe water and sanitation services, as well as protect ecosystems against pollution and degradation. As part of their obligation to deliver basic services, cities must maximise the availability of water resources, which requires careful management; capital expenditure on infrastructure for extracting, treating and conveying water to the ultimate user; and technical capacity (and operating expenditure) to ensure the infrastructure remains in good working condition.

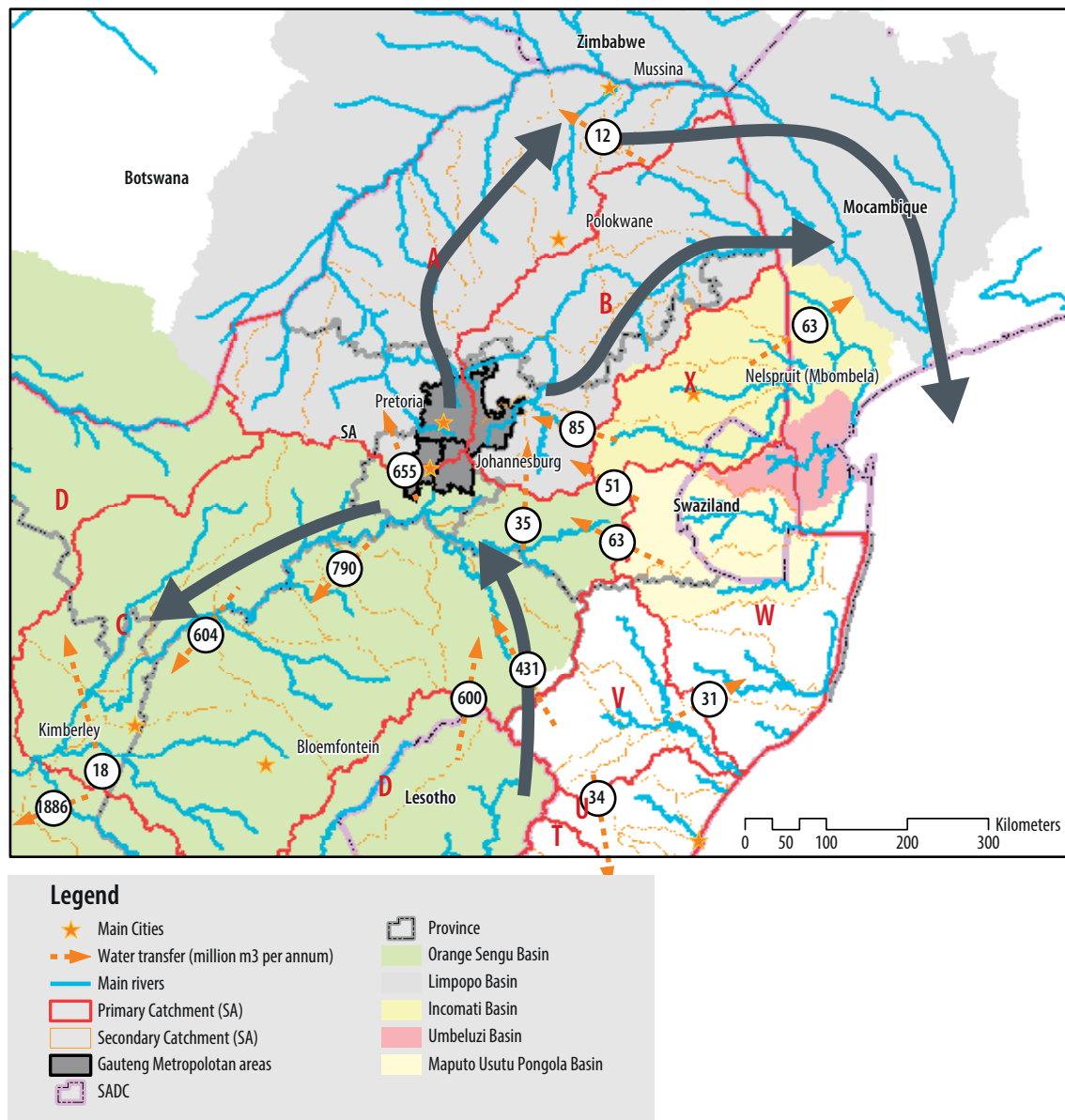
### **WATER: legislation, policies and plans**

In 2013, national government developed a National Water Resources Strategy (NWRS) with the aim of ensuring that water resources are protected and conserved for the long term. The Department of Water and Sanitation (DWS) has divided the country into Water Management Areas (WMA) to reflect the large spatial variations in climate, water availability and requirements, the nature of economic development and population characteristics, as well as potential for growth and development.

Currently, national government (through the DWS) is responsible for water resources planning, development and management, including the bulk water infrastructural systems, and provides water to water service authorities (WSAs). As WSAs, municipalities are tasked with ensuring access to water services as prescribed in the National Water Act (No.36 of 1998). Some municipalities have water service providers (WSPs) that provide water services in accordance with the Constitution, the Water Act, bylaws and any specific conditions set by the respective WSA.

As Figure 5.10 illustrates, cities are often located in areas with inadequate access to water or where growth and development has outgrown local supply.

**Figure 5.10:** Depiction of in- and out-flows of water catchments into Gauteng cities



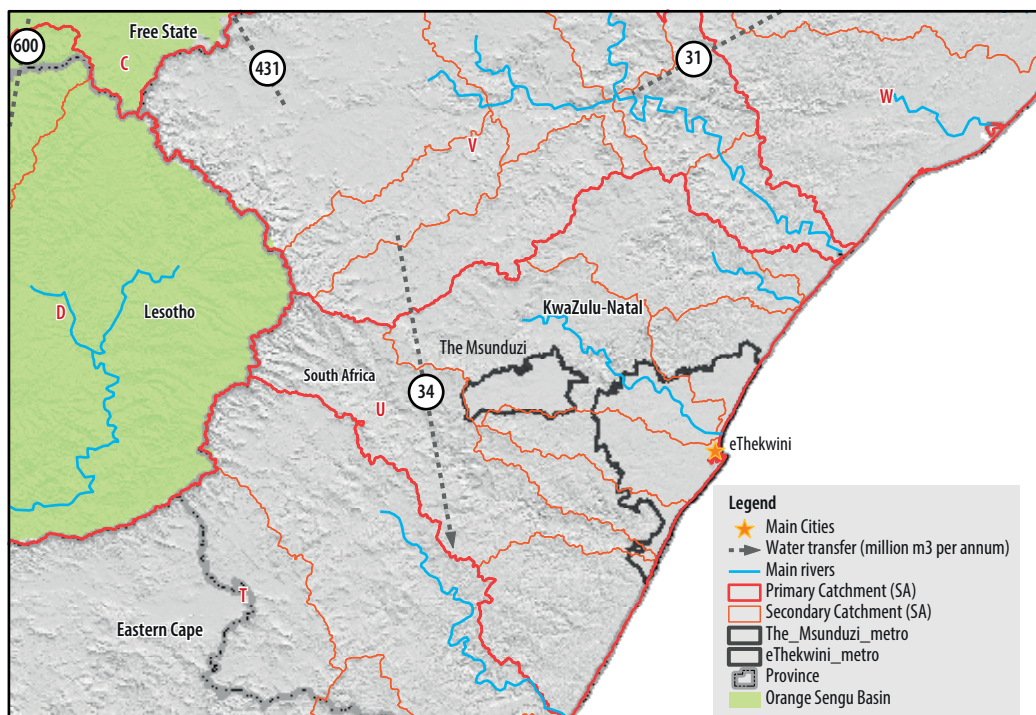
Source: CSIR

Tshwane, Ekurhuleni and Johannesburg are located on the headwater where (i) available water from local sources cannot meet the demand, and (ii) the rivers are polluted from poorly treated effluent and solid waste. Water flows in from a number of catchments, including Lesotho, to satisfy urban demands. Equally important is that Johannesburg is at the top of the catchment, and so the runoff from the city goes into the Atlantic Ocean (for the southern area) or to the Indian Ocean via Zimbabwe and Mozambique. The highly polluted water has a substantial impact for downstream areas.

Figure 5.11 shows water in-flow for eThekweni and Msunduzi, as well as out-flow into the ocean, with subsequent negative impacts on coastal life.

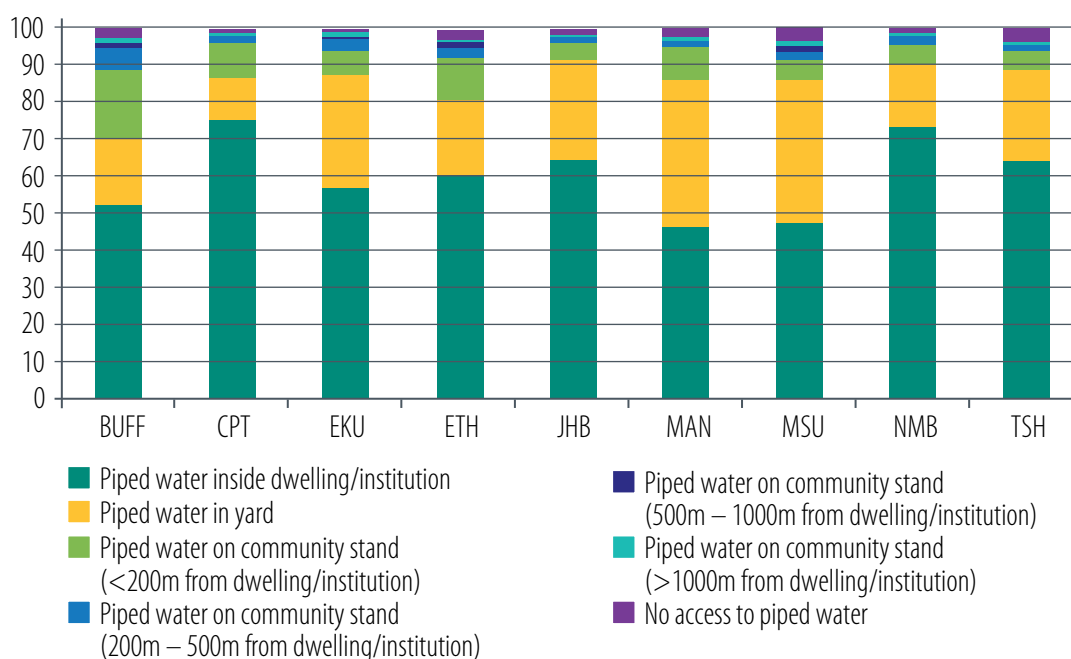


**Figure 5.11:** Depiction of in- and out-flows of water catchments into KZN cities



In general, the cities have good water management. Cape Town's water and wastewater infrastructure is considered the most adequate, based on the proportion of households and persons with access to water and sanitation, and the relatively low new infrastructural needs. However, this does not account for the quality of the service provided (SACN, 2015a).

**Figure 5.12:** Percentage of households with access to water (2010)

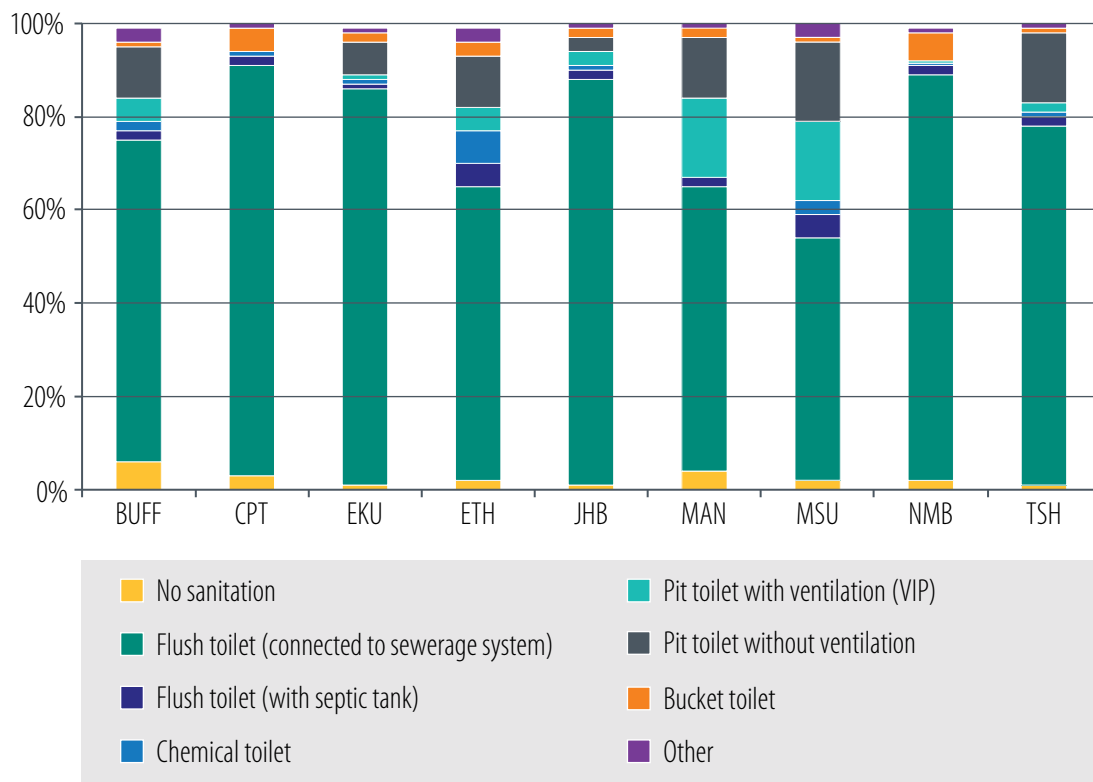


Source: SALGA/WRC (2014)

As Figure 5.12 shows, Cape Town and Nelson Mandela Bay have the highest proportion of households with piped water inside dwellings. Cities such as Buffalo City and eThekweni, with large rural areas, have more difficulty supplying piped water to households. Cape Town, eThekweni, Mangaung and Msunduzi have the highest proportion of households with metered connections. In addition, Cape Town, Ekurhuleni, eThekweni and Nelson Mandela Bay have the best budgeting performance for spending on asset management. eThekweni (whose Water and Sanitation Department won the 2014 Stockholm Industry Water Award), Buffalo City and Cape Town have the best technical capacity, measured by the number and qualifications of people occupying technical positions in their water infrastructure departments (SACN, 2015a).

Over the last 20 years, access to potable water services has increased dramatically in urban areas. However, cities still face challenges in providing adequate sanitation services to households. Inadequately collected and/or treated waste can compromise water quality through pollution, affect human health and reduce the water's fitness for use.

**Figure 5.13: Access to sanitation (2010)**



Source: SALGA/WRC (2014)

As Figure 5.13 shows, over 80% of households have flush toilets connected to the sewerage system in Johannesburg, Cape Town, Ekurhuleni Municipality and Nelson Mandela Bay Metro. In Msunduzi and Mangaung, ventilated improved pit (VIP) latrines are used by nearly 20% of households.



The type of sanitation system and how well it is maintained has implications for the control of outbreaks and spread of water-borne epidemics. The risk of pollution is lower in cities where a high proportion of households have access to flush toilets connected to the sewage system, with the infrastructure to collect and convey sewage to the point of treatment. However, this type of sanitation is expensive for both the consumer and the city, which may explain why the higher proportions are found in economic hubs whose consumers are better able to demand and pay for high service levels.

As a scarce and valuable resource, water needs to be treated carefully. This means taking care of both the water infrastructure within cities and freshwater resources (rivers and wetlands). The overall condition of freshwater resources and wetlands in the country needs to be monitored to prevent further deterioration. Larger metros are better able to attract and keep the essential technical skills to deliver adequately treated water to the final consumer, and so the risks to human health are relatively lower than in less-resourced municipalities. However, treatment of wastewater to an adequate level for discharge into the environment remains a challenge across all cities and has a negative impact on freshwater resources.

The level of water losses is indicative of the state of South Africa's ageing water infrastructure and inadequate maintenance. Between 2009 and 2013, Cape Town, Tshwane and Nelson Mandela Bay consistently kept the percentage of water losses below 30% (SACN, 2015a).

### **ETHEKWINI: Stockholm Industry Water Award winner**

In 2014, the eThekweni Department of Water and Sanitation received the Stockholm Industry Water Award, in acknowledgement of its transformative and inclusive approach to providing water and sanitation services. In a water-scarce country, persistent challenges are increasing access to services with diverse geographic conditions, while maintaining existing infrastructure and growing the rates base. eThekweni achieves this through:

- *Business with a heart:* the municipality provides basic free water and sanitation services, while ensuring that municipal bills are paid. For example, the municipality will gradually write off the debts of customers who make regular payments to their current accounts.
- *Community engagement:* the municipality's participatory approach makes use of customer service agents, community engagement and street theatre to educate and raise awareness among communities of the challenges associated with service delivery.
- *Technology driven:* the municipality uses evidence-based research to support the roll-out of the water and sanitation programme, and stakeholder participation to pioneer and test new technologies.
- *Learning from and sharing experiences:* the municipality recognised the need to connect and learn from other city departments that have an impact on water management, and to provide opportunities for staff members to access learning and development opportunities.
- *Collaborating and partnering:* collaborating and partnering with a wide range of organisations created the space for a number of research projects and initiatives to support municipalities in other African countries.

## Accelerating the transition to sustainable water management

Water and sanitation services are one of the fruits enjoyed from development over the last 20 years. However, cities still need to improve their knowledge of the relationship between water and water users, the importance of ecosystems, and the different water resource types that are available. They also need to better understand existing and emerging threats to reliability of delivery of water to consumers and build the necessary capacity (technical and financial) to address the challenges.

Going forward, water-related challenges are going to become increasingly important for city management, and, if not adequately tackled, the risks to people and infrastructure will increase. Cities have made good progress in providing access to water services, but the maintenance and renewal of existing infrastructure is lagging, and the networks are ageing. The DWS (2014) has highlighted the inadequate levels of investment in water infrastructure. Operational and maintenance issues need to be prioritised in order to avoid risks to the economy (from escalating costs and the impact on the economy) and to the health of humans and the ecosystem. As cities grow and change, the infrastructure designed and built decades ago may not be able to meet and adapt to future conditions. For example, stormwater systems need to cope with increased flooding resulting from the spread of impermeable surfaces and the loss of natural areas, as well as possible climate-change impact. Sewers may be unable to cope with peak rain periods, leading to overflows and untreated wastewater being released into the environment. Cities also face the challenge of increasing water costs and rising water tariffs, within the context of a limited revenue base.

## FOOD SECURITY

Urban household food security depends on the availability, accessibility and use of food, and is affected by a household's disposable income. This is because urban residents have to purchase most of their food, whereas people in rural areas can produce their own food (SACN, 2015a). Food security should be viewed and contextualised within the entire food system, which consists of (i) the activities, actors and institutions who grow, process, distribute, acquire, consume and dispose of food, and (ii) the outcomes of these activities contributing to food security. Therefore, if food security depends on the food and broader systems, approaches to address food insecurity must extend beyond the individual and household, and consider food systems at the neighbourhood, city and national scales, as well as the interface of these various systems (SACN, 2015a).

South Africa is one of only three food-secure countries in Africa (FAO, IFAD and WFP, 2013), although the food system has become increasingly consolidated in the last two decades. South African agriculture has become more export-oriented and is highly reliant on imports, leading to concerns about the presence of highly processed foods and price fluctuations. The deregulation of the food system has also made tracking food within the system harder, and the subsequent critical data gaps make governance more difficult.





Although the country is considered food secure, both the rural and urban poor experience food insecurity. The South African National Health and Nutrition Examination Survey found that over half of households nationally are at risk: 28% of hunger and 26% who experience hunger. The equivalent figures in urban informal areas were 32% and 36% respectively. Supporting this finding are case studies that consistently show high levels of food insecurity in urban areas. With regard to trends, nationally food insecurity was in decline but appears to have plateaued. However, with ever-increasing food and other prices, the levels of urban food insecurity are likely to get worse (SACN 2015a).

Research has found that the informal food retail sector is more responsive to the food security needs of the poor than the supermarket sector. The informal food retail is often more expensive per unit, but, by design, is more attuned to the retail needs of the poor. Poor households make small, frequent purchases because of limited disposable income, storage and refrigeration. Poor households also tend to get home after supermarkets have closed because of the current urban form and inadequate public transport. Informal sector food retailers have longer opening hours than supermarkets, while street vendors sell ready-to-eat foods that satisfy the needs of these communities.

### **FOOD SECURITY: legislation, policies and plans**

The South African Constitution enshrines the right to food and nutrition in Sections 27(1)(b) and 28(1)(c). Therefore, the state (including local government) needs to work towards realising this right. An overview of national policies and strategies found little emphasis on urban food security. Food security is overwhelmingly identified as a rural problem, and so no funding is allocated to urban food insecurity. However, the National Development Plan (NDP) and the Integrated Urban Development Framework (IUDF) do elevate the role of local government in this regard (NPC, 2011; COGTA, 2016).

The NDP argues that malnutrition is the direct outcome of food insecurity. Urban food insecurity is characterised by low dietary diversity, high malnutrition and obesity, and distinct hunger seasons. This is caused by factors that include household income, income stability, household structure and household asset base, as well as geographic access to a range of food sources, access to transport and stability of food prices (SACN, 2015a).

Cities have a number of programmes aimed at food and nutrition security, but these programmes are often spread across departments, directorates and sub-directorates. With the exception of the City of Tshwane's Agriculture and Environmental Management Department, municipalities do not have departments of agriculture, forestry and fisheries, health or education. While all cities recognise the challenge of urban food insecurity, and include food security in some form or another in their IDPs, these city plans have not been reviewed to test implementation or success.

**Buffalo City** has food insecurity levels of 52% (SACN, 2015b). The approach in its IDP is centred on promoting food security through agricultural production, in partnership with the provincial Department of Rural Development and Agrarian Reform. The East London Fresh Produce Market is identified as a project with the potential to transform the market and encourage participation of historically

disadvantaged groups, through facilitating access to the market system (for informal traders, and small, medium and micro-sized enterprises) and improving the functioning of the market. Interventions include upgrading the sales system, the informal traders (hawkers) storage facilities, and the cold room facilities, as well as extending the trading hall.

**Ekurhuleni** recognises food scarcity as a strategic tension and the connection between urban poverty and food insecurity: the “lack of food for many households [...] has to do with the fact that food is mostly a cash commodity”. The focus is on investing in food networks that can support cash-strapped individuals, and creating “urban spaces that are not only meant for houses but also food production networks”. Food security is also included in the city’s Macro Strategic Framework, which identifies sustainable agriculture as a programme within the re-industrialise strategic goal.

**eThekweni** has identified hunger and food security as a major challenge facing residents, which is compounded by the shortage of land available for food production. The IDP calls for a multi-pronged approach to improve livelihoods, with the intention of initiating programmes to assist in alleviating food insecurity, such as community support farms, community gardens, hydroponic projects and the provision of seedlings and compost, as well as professional support programmes. In 2009, the municipality established an Agricultural Management Section, with the immediate aims of food security, economic empowerment and environmental sustainability, and the long-term vision of food sovereignty for eThekweni residents.

In **Johannesburg**, as many as 42% of poor households are estimated to be food insecure. The city’s Food Resilience: Urban Agriculture Support Programme aims to (i) develop “a spatial food security index” to collect and map information about the city; (ii) coordinate and support urban agriculture projects in the city; and (iii) lay the groundwork for the Food Empowerment Zone. This complex and ambitious programme appears to have integrated aspects of the Brazilian Zero Hunger Strategy and is supported by a range of stakeholders, including provincial government, research institutions, non-governmental organisations (NGOs) and the private sector. In addition to urban agriculture, focus areas include child nutrition, food safety compliance linked to a healthy eating campaign, agri-resource centres and processing hubs providing value-chain support to emerging farmers, apprenticeship programmes, a land release programme for agricultural land, people’s restaurant systems, food for waste exchanges, food empowerment zones and food garden development in every house, school and community centre.

**Cape Town** includes food security when discussing the city’s role in environmental health through food control, and when referring to rainwater harvesting for food gardens as part of a water conservation initiative. The Economic Development and Facilitation Programme within the Economic Department houses an Urban Agriculture Unit, which develops policy around urban agriculture, food security and poverty alleviation. Policies cover urban agriculture (COCT, 2007), which seeks to establish a place for urban agriculture in the city, and food gardens (COCT, 2013), which addresses food insecurity and the creation of local economic opportunities through establishing sustainable food gardens. This falls within the city’s strategic focus area “the Caring City”. The recent Strategic



Development Plan for the Development of Urban Agriculture has seven key focus areas for translating the urban agriculture policy into action: awareness and advocacy, policy and legal frameworks, research and knowledge development, multi-stakeholder participation, production, marketing and youth engagement.

**Mangaung's** intention is to ensure food and nutrition security, while reducing the cost of living for low-income and working-class households. It encourages investing in new infrastructure (value chain and public transport) in areas affecting the poor. These imperatives suggest a link between food and spatial urban dimensions. The establishment of both rural and urban food gardens is put forward as a poverty reduction and household food security strategy. The 2014/15 target set was to develop 2800 urban and rural households' food gardens. The IDP also mentions food in relation to environmental health and food control.

In **Tshwane**, food security falls under Sustainable Communities, and a number of programmes have been identified. The Department of Agriculture and Environmental Management oversees two programmes: the Agricultural Starter Pack Programme, which focuses on the distribution of garden tools and seedlings to support homestead and community food gardens; and the Food Bank project that provides food parcels to non-profit organisations. The Health and Social Development Department, in partnership with NGOs, oversees projects for vulnerable groups, such as soup kitchens, food gardens and training, information sharing, exercise programmes and income-generating activities. The IDP also includes expanding the school-feeding scheme and a child nutrition project focused on vaccinations, HIV/Aids complications and malnutrition. Strategic Objective 5 in the IDP connects to food security through the promotion of sound governance, which calls for agricultural land to be protected for agricultural development and job creation. This is in line with the New Metropolitan Spatial Development Framework overseen by the Department of Spatial Planning.

In **Msunduzi**, households (particularly female-headed households) spend, on average, 52% of their income on food. Msunduzi emphasises working towards greater food security through home garden programmes. Home gardens are positioned as a response and solution to food insecurity, but details are not provided in the municipality's IDP. Food safety is discussed in Environmental Health and (briefly) under emergency relief in the Disaster Risk section.

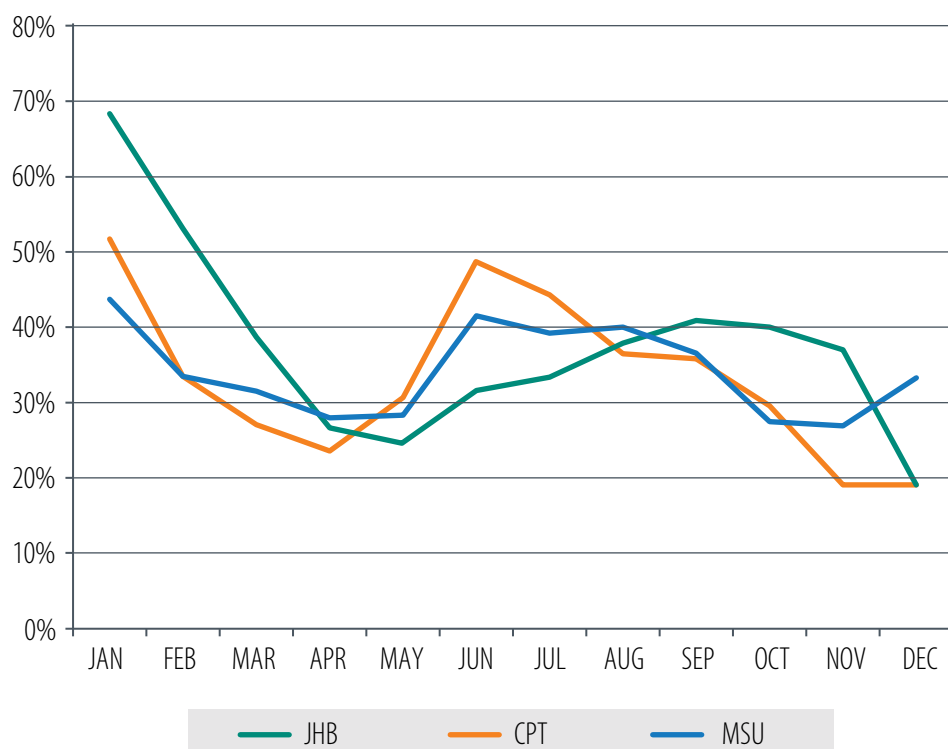
In **Nelson Mandela Bay**, food security is part of the Agrarian Transformation and Food Security objective, which falls under Goal 6 (enhanced livelihoods). The municipality proposes integrating food security into spatial planning, through identifying land parcels for food gardens in all suburbs, and developing food gardens and orchards on vacant or underutilised private and public land. Like in Buffalo City, the municipality partners with the provincial departments of rural development and agrarian reform and social development, which are involved in a number of food gardening projects. Overall, boosting emerging agricultural development, urban agriculture and food garden development is seen as critical for poverty alleviation and food security. Food security is also mentioned within the framework of the Integrated HIV and Aids Plan for Nelson Mandela Bay.

## Accelerating the transition to food security

All of the cities' IDPs include programmes related to food security, but monitoring and evaluation (M&E) are needed, to assess whether or not the programmes have been successfully implemented. For instance, effective M&E in the case of Johannesburg's Food Resilience Urban Agriculture Support Programme indicates that it will require more funding in order to achieve its objectives.

Figure 5.14 highlights two distinct hunger seasons when vulnerable households struggle to access sufficient food: (i) in January, as a result of households overspending on food during the festive season and having to cover other expenses, such as school fees; in addition, most businesses close down over December and January, reducing income and casual labour opportunities. (ii) In June, as a result of adverse weather conditions in winter that prevent industries from operating at full capacity, thus employing less manual labour, which means that poor households have lower incomes. This pattern has significant health implications, particularly for individuals on chronic medication who require consistent nutrition. Therefore, social safety nets are needed to respond to these predictable times of food insecurity.

**Figure 5.14: Months of inadequate household food provisioning: Cape Town, Msunduzi, and Johannesburg**



Source: SACN (2015b)



Cities should go beyond providing access to urban agriculture and play a wider role in shaping the characteristics and trends of the food systems as a whole. Cities can make greater use of existing policies and plans (e.g. IDPs, SDFs, open space master plans, land-use planning, housing and transport plans) to leverage food security interventions. Strategies must be developed that recognise the informal food retail sector and ensure the sustainable management of fresh produce markets, in order to create a thriving business environment that could appeal to unemployed youth. The partnerships identified in the current city interventions need to be strengthened.

## CROSS-CUTTING ISSUES

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While commitments to move towards low-carbon cities are being made, cities need to acknowledge cross-cutting issues that affect sustainability. They include land, air quality, climate change, disaster management and rural-urban linkages.

### Land

Land is an important and limited asset for cities. With increased urbanisation and sprawl, cities are expanding their footprint and using additional land on the periphery, which is not sustainable. A century of development in natural areas and poor land-use practices has reinforced inequalities within cities. Chapter 2 looks at land in relation to the built environment and spatial transformation, whereas this chapter examines land as an environmental and biophysical asset. Nevertheless, it should be noted that the ability to transform a city spatially depends on making sustainable land-use planning choices and valuing inclusive natural and open spaces within cities.

The quality and quantity of available land is under pressure from demands for housing and supporting services to cater for the growing urban population, the need for space in which to dispose of waste products, and the requirements of expanding manufacturing, technological, agricultural and general industries. To ensure that land, as a physical resource, is used optimally requires understanding how spatial development patterns are changing over time, and how the transformation of land leads to the loss or enhancement of urban functionality and efficiency. A further consideration is that the limited land available needs to be used more efficiently than it currently is, which give rise to debates around urban densities, new cities and the implementation of the Spatial Planning and Land Use Management Act (No. 16 of 2013). For example, good quality agricultural land is often under demand from human settlements and mining, or other land-hungry activities such as infrastructure (and servitudes) and dams. And where agricultural land is available, it needs to be more efficient and productive to cater for a growing population.

Outside of the demands within the water and energy sectors, land is likely to be the resource most under pressure and demand in the future.

## Biodiversity

South Africa is the third most biodiverse country in the world and the only country to contain an entire floral kingdom within its borders. The loss of this biodiversity makes ecosystems more vulnerable to shocks and disturbances, less resilient, and less able to supply humans with needed services. Healthy ecosystems are critical for human well-being, as (for example) inland wetlands are the principal source of renewable fresh water for human use, storing and purifying water through the removal of excess nutrients and other pollutants. Disruption of wetland purification processes can have devastating impacts at the source and for downstream end users. Therefore, extracting value from natural systems for lifestyle gains without paying attention to sustainability can do irreparable harm to the very systems that are required for human well-being. The utilisation of resources must not exceed their natural rate of regeneration or the minimum level required for ecological functioning.

Cities are exploring ways of using planning and land use to enable the natural and built environment to co-exist. Conserving key biodiversity areas and maintaining ecological infrastructure not only protects the biodiversity, but also provides a better quality environment for communities. Responses at city level have been in the following areas:

- Integrating biodiversity into land-use planning (mainstreaming);
- Requiring environmental authorisations that are sensitive to local biodiversity and ecological infrastructure;
- Protecting areas and environments; and
- Rehabilitating core biodiversity features.

Nelson Mandela Bay was the first municipality to gazette a Bio-regional Plan in South Africa, while Cape Town, Johannesburg, Tshwane and Ekurhuleni all have draft bio-regional plans. The plans contain key spatial biodiversity information to integrate into spatial plans. A map of biodiversity priorities with accompanying guidelines informs land-use planning, environmental authorisations and natural resource management.

Cities can help preserve critical biodiversity by connecting existing and future protected areas through a network of interconnected open spaces. Conserving and restoring priority biodiversity areas enhances ecosystem resilience and contributes to climate change mitigation and adaptation. Continued dialogue and improved policies are needed to tackle how cities manage and integrate biodiversity within their landscape and economic growth, in a context that is continuously evolving.



Table 5.2 shows how urban land uses changed between 2000 and 2013. Overall urban land uses are expanding, agricultural land is being lost and less land remains in a natural condition. These changes may have a significant impact on the sustainability and future resilience of the cities.

**Table 5.2: Land transformation and natural areas within cities (2000–2014)**

	Year	Buffalo City	Cape Town	Ekurhuleni	eThekweni	Johannesburg	Tshwane	Msunduzi	Mangaung	Nelson Mandela Bay
Cultivated	2000	6 465.87	64 058.94	30 328.83	27 081.72	9 137.88	73 491.93	4 512.42	122 007.42	1 818.27
	2014	30 755.52	40 183.56	36 548.19	23 520.60	6 839.91	108 805.95	5 382.54	170 604.00	8 492.22
	Change	-17%	-59%	17%	-89%	-34%	23%	-10%	24%	36%
Degraded	2000	29 369.34	0.00	0.00	17 405.28	0.00	10 605.69	1 388.16	7 816.86	3 651.84
Mines	2000	484.47	589.32	9 692.73	430.38	5 104.44	5 524.47	113.04	138.87	642.96
	2014	181.62	1 015.56	5 046.39	247.23	2 697.30	4 209.75	49.23	1 490.04	1 397.61
	Change	-167%	42%	-92%	-74%	-89%	-31%	-130%	91%	54%
Natural	2000	179 063.37	98 506.53	70 897.68	121 541.22	63 369.99	422 132.85	35 006.76	447 747.12	147 770.73
	2014	186 218.55	131 026.50	69 678.81	101 151.54	58 381.74	379 836.81	28 637.55	406 471.14	150 077.43
	Change	4%	25%	-2%	-20%	-9%	-11%	-22%	-10%	2%
Plantations	2000	1 580.67	6 278.85	1 838.88	1 147.23	1 544.40	9 198.99	2 988.90	1 037.43	543.87
	2014	5 922.27	3 224.52	4 852.17	1 421.10	5 976.54	7 599.69	4 049.73	2 124.27	998.10
	Change	73%	-95%	62%	19%	74%	-21%	26%	51%	46%
Urban Built-up	2000	32 642.64	74 844.72	70 151.13	57 694.95	80 412.39	100 261.08	19 269.45	36 903.51	37 600.29
	2014	27 746.73	63 872.64	68 740.56	99 981.00	83 334.87	114 115.95	24 314.49	40 437.27	31 425.66
	Change	-18%	-17%	-2%	42%	4%	12%	21%	9%	-20%
Waterbodies	2000	3 817.98	3 704.22	14 544.54	4 437.72	4 831.20	8 403.93	232.38	12 329.10	3 804.57
	2014	2 599.65	8 659.89	12 587.76	3 417.30	7 169.94	15 050.79	1 077.57	6 853.68	3 441.60
	Change	-47%	57%	-16%	-30%	33%	44%	78%	-80%	-11%
Grand Total		253 424.34	247 982.58	197 453.79	229 738.50	164 400.30	629 618.94	63 511.11	627 980.31	195 832.53



## Open spaces

Ecological and social open spaces are important aspects of a sustainable city. Traditionally, open spaces are seen as the green spaces and parks within a city, yet open spaces can range from sports fields, highly landscaped and altered spaces, and public parks. Within a city's land-use planning, streets (walkways), urban squares and institutional areas are not always defined as urban open space, but are a critical part of the open space network (along with social and ecological spaces). The open space network is often poorly planned and not adequately maintained. Informal settlement areas, in particular, often do not have any shared public spaces. Yet, the link between open space planning, urban densities and land-use planning is important in creating a sustainable city. Public spaces and land create a sense of community, and facilitate social and economic development and community revitalisation.

While large public green spaces are often highly valued, and most cities have a Metropolitan Open Space System (MOSS) that includes a spatial plan for prioritising and planning for public spaces. For example, eThekweni uses its MOSS (the Durban MOSS or D'MOSS) to connect the public, private and tribal open spaces (including natural and transformed spaces) within the metropolitan area. The D'MOSS is integrated into the local planning schemes, and environmental areas covered by the D'MOSS may not be developed unless approval is given by the Environmental Management Department. In cases where development is approved, significant controls are imposed, such as the use of environmental or conservation servitudes. The aim is to ensure that the site's ecosystem is protected and not adversely affected by development activities.

## Coasts

The National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008) was a major paradigm shift for coastal management in South Africa, particularly for local government (Celliers et al., 2009). The Act recognises that cities are responsible for various spatial aspects of coasts and must develop coastal management plans, which are integrated into land-use planning schemes. All coastal cities have an Integrated Coastal Management Plan in place, and eThekweni and Cape Town have coastal setback lines (on average 10 metre contour above mean sea level), which also support the city responses to climate change adaptation.

Urban growth and expansion have a significant impact on coastal zones and their resources, which are valuable for many different sectors, including mining, fisheries, forestry and tourism. The demand is increasing for non-consumptive tourism, such as use of beaches (sun-bathing, swimming and picnicking), recreational fishing, boat-based whale watching, shark-cage diving and filming.

Climate change is likely to affect coasts, particularly in ecological sensitive areas and where the built environment has encroached into coastal surge areas. The coastal zone itself will be subject to sea level rise (Breetzke et al., 2011), and the consequent flooding and coastal erosion can result in loss or damage to coastal infrastructure (including breakwaters, roads and buildings) and ecosystem services.



The coastal land can be broadly classified as natural, degraded, urban and agricultural. As coastal land is transformed from its natural state, it loses its ability to provide ecosystem services, and, in particular, to buffer coastal communities from sea level rise and coastal surge. Along South Africa's coastal belt, most urban land occurs in the three largest cities: Cape Town (25%), eThekweni (27%) and Nelson Mandela (12%).<sup>4</sup> Cape Town and eThekweni have been the most transformed from their natural state (Table 5.3).

**Table 5.3: Land transformation and coastal areas**

City	Natural Land cover (ha)	Natural Land cover (%)	Total Area (ha)
Buffalo City	30 755.52	74%	253 424.34
City of Cape Town	40 183.56	55%	247 982.67
eThekweni	23 520.60	45%	229 738.77
Nelson Mandela Bay	8 492.22	78%	195 832.62

Source: DEA National Land Cover 2013/2014 dataset provides at a 1:75 000–1:100 000 data application scale, available from <http://egis.environment.gov.za/frontpage.aspx?m=27>

During peak storms, eThekweni's coastline experiences unprecedented levels of erosion and associated damage to built-up areas within the coastal zone (Breetzke et al., 2008). As coastlines are not static but continually change and either erode (retreat) or build seawards (accrete), it is important to adapt management practices to respond better to changing sea levels and land changes.

A further pressure on coasts is pollution discharged from domestic sewage, industrial wastewater and stormwater flows. Poorly managed stormwater runoff is collected and channelled, and ends up in rivers and on beaches. Runoff water may be polluted with heavy metals, oil residues, nutrients and pathogenic microorganisms. Furthermore, coastal systems are often subjected to littering and dumping, which affects human health, reduces tourism and damages the ecosystem.

Future challenges for coastal areas relate to energy generation, such as off-shore and wave energy. Within the context of climate change, consideration is being given to technologies where the ocean seabed can be used for carbon storage. Small desalination plants have been implemented (e.g. Knysna) as means to alleviate water scarcity in South Africa, but the relative costs and scalability of desalination need to be fully explored.

## Air quality

Pollutants from urban activities and growth are released into the atmosphere, which is the single largest resource shared across cities. Sectors that contribute the most to atmospheric degradation are transport, power generation, incineration, waste and biomass burning (Khumalo et al., 2002). People

<sup>4</sup> <http://soer.deat.gov.za/51.html>

in the city and in their homes then breathe in the airborne pollutants, which can result in respiratory illnesses (South Africa has some of the world's highest asthma rates). Air pollution affects tourism, property values, plant growth and agricultural outputs.

**Indoor air quality:** Air pollution is found both outdoors and indoors. Indoors, poor air quality is caused by bad ventilation, burning of fuels (coal, paraffin, wood, dung, etc.), tobacco smoke, asbestos and pesticides, etc. The poorest households and vulnerable people (elderly, sick and children) are the most at risk from indoor air quality pollution, as burning fuels for cooking and heating can produce high levels of particulate and carbon monoxide, which, in turn, can cause or increase susceptibility to respiratory illnesses (Khumalo et al., 2012). The increasing cost of electricity means that more and more urban households are turning to other, more affordable and polluting fuels (SEA, 2014).

**Outdoor air quality:** Outdoor air pollution comes from both natural (veld fires) sources and those caused by people. Most air pollution is concentrated in urban areas and results from industrial processes, such as fossil fuel burning (coal, oil and natural gas) for electricity and liquid fuel production, biomass burning and waste incineration, as well as domestic fuel burning and vehicle emissions. During winter, a brown haze may be seen over many informal settlements, caused by burning wood and coal, and the levels of particulate matter in the air often far exceed the air quality standards. PM10 levels come from burning of wood and coal and PM2.5 from vehicle emissions. Between 2004 and 2011, PM10 levels increased in the City of Johannesburg, with the highest levels found in Alexandra (Gauteng DARD, 2011). Vehicle emissions are a major contributor to poor outdoor air quality in cities, responsible for 90–95% of carbon monoxide and 70% of nitrogen oxide emissions (Schwela, 2004), and contribute to smog, especially in areas of high traffic congestion. Air quality monitoring stations near busy traffic intersections often show elevated PM2.5 levels, which is an indicator of pollution from vehicles idling in traffic.

**Industrial air pollution:** The bulk of industrial air pollution emanates from mining (including coal). The worst affected areas are the Vaal Triangle, the South Durban Industrial Basin and the Highveld. Poor land-use planning has resulted in heavy industrial developments being located much too close to residential areas (Leaner et al., 2009), affecting mostly the poor and more vulnerable households living in settlements established during apartheid. Air pollution in these areas can cause residents long-term negative health effects, not only when the industries are active, but even long after industrial operations have ceased. For example, in Johannesburg human settlements close to mine residue areas are affected by wind-blown dust from the mine tailings storage facilities.

**Monitoring air quality:** The National Environmental Management: Air Quality Act (No. 39 of 2004) is the main legislation for managing air pollution and also regulates air quality standards and responses. As cities generate so much air pollution, it is important to maintain a network of air quality monitoring points. However, in part because of a lack of capacity and training, the air quality monitoring stations are not always operational or do not adequately monitor all the necessary variables (DEA, 2011b).



## Climate change

Climate change is not purely an environmental issue and cannot be addressed in isolation. South Africa is signatory to a number of global environmental treaties, but these commitments are realised at local government level. Therefore, stronger intergovernmental relations are required when developing and implementing climate change mitigation and adaptation policies. The National Climate Change Response Policy provides the framework for mainstreaming climate change in development, while cities have developed climate change strategies and recognise the need to mitigate the impacts of climate change in their growth and development strategies and IDPs. However, the policy intent is not sufficiently present in the day-to-day service delivery operations. This is an area that can be strengthened, using peer-to-peer learning presented by platforms such as C40,<sup>5</sup> Metropolis<sup>6</sup> and ICLEI- Local Governments for Sustainability<sup>7</sup>. In light of Paris Agreement cities have to lead the local government sector's understanding and implementation of the Agreement.

**Climate change adaptation and resilience:** No matter how robust the mitigation measures are, a certain degree of climate change is inevitable because of historical emissions and the inertia of the climate system. In 2011, at COP17, local governments across the globe signed the Durban Adaptation Charter, which advocates forward-looking adaptation. While the effects of mitigation may take several decades to manifest, most adaptation activities take effect almost immediately and can be applied on a regional or local scale. Adaptation addresses the risks associated with both future climate changes and current climate variability.

- In 2004, eThekweni launched its Municipal Climate Protection Programme, which focuses more on adaptation than on mitigation (unlike many other cities). Initially funded from the municipal biodiversity budget, in 2010/11 the city received its first dedicated climate change funding and has subsequently used various sources of international funding to supplement municipal resources. eThekweni supports a radical shift to a new mode of urban planning, management and governance (Roberts & O'Donoghue, 2013).
- The City of Tshwane's Vision 2055 is to be a low-carbon, resource-efficient sustainable city and is supported by the 2013 Green Economy Strategic Framework (City of Tshwane, 2013a). The Executive Mayor champions climate change in Tshwane, and a Sustainability Unit was established in 2013 to coordinate the climate change response within the broader context of sustainability across the city. A vulnerability assessment of the city has been completed that identifies regions to be prioritised for adaptation measures, and a joint action plan for adaptation and mitigation is under development.
- Johannesburg is developing a Strategic Framework that will inform a Comprehensive Climate Change Strategy. The City has been at the forefront of climate change response and builds its capacity through peer learning and exposure. It was the first South African city to host the ICLEI-Local Government for Sustainability in 2001 and joined the C40 Cities Climate Leadership Group in 2005.

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5 The C40 Cities Climate Leadership Group is a network of the world's megacities taking action to reduce greenhouse gas emissions.

6 Metropolis, or the World Association of the Major Metropolises, is the leading international organisation that represents cities and metropolitan regions with more than a million inhabitants.

7 Founded in 1990 as the International Council for Local Environmental Initiatives, now called Local Governments for Sustainability, ICLEI is the leading global network of local governments dedicated to sustainability, resilience, and climate action..

**Emissions reduction to mitigate climate change:** The current urban growth is accompanied by increased emissions within cities, and so the focus needs to be on reducing emissions. While efforts have been made to reduce emissions associated with coal-based electricity, a similar effort is needed to reduce emissions from the transport sector.

- Johannesburg has a fairly established and operational emissions reduction programme that dates back to the establishment of the Climate Change Action Programme in 2006. Flagship projects to date include the Rea Vaya BRT system, biogas to electricity at Northern Water Works Treatment Plant, the Cosmo City climate-proofing project and the Robinson Deep landfill gas to electricity.
- Tshwane has an ambitious sustainable energy programme that includes solar PV, waste to energy, cleaner fuels for transportation and sustainable neighbourhoods that integrate livestock farming, energy generation and urban agriculture. This programme is complemented by energy efficiency interventions and a green buildings programme that includes the construction of the 5-star rated City Headquarters green building.
- Cape Town's commitment to climate change response is articulated through its Energy and Climate Change Strategy (COCT, 2006a) and the Framework for Adaptation to Climate Change in the City of Cape Town (COCT, 2006b). The city was one of the cities whose efforts were supported by the Danish Development Agency (DANIDA) Urban Environmental Management Programme. The city continues to implement the emissions reduction programme and to build capacity within the city. The city also allocates internal resources towards the programme.
- Johannesburg, eThekweni, Cape Town and Tshwane are active members of the Carbon Registry for voluntary reporting on reducing GHG emissions, and, together with Nelson Mandela Bay, Ekurhuleni and Buffalo City, are active participants in the ICLEI/WWF Earth Hour challenge, which aims to encourage large uptake of mitigation action by cities.

## Disaster management and risk reduction

Reducing risk is critical to achieving broader developmental objectives in urban areas. The IUDF (COGTA, 2016) argues that proactive action to address risk is integral to creating sustainable urban growth. Cities are where most of the population lives and consumes resources. This consumption usually surpasses urban planning and service delivery, thereby making the system vulnerable to disasters. Common problems during the rainy season are blockages in the stormwater drainage system and low-lying bridges that get swept away by heavy rains.

Disasters can result in the loss of human life and the destruction of livelihoods, and are extremely costly. The Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) analysed the direct damage losses incurred over the course of eight severe weather events in the Western Cape between 2003 and 2008. It found that the provincial government, followed by municipalities, incurred the most costs. Provincial departments reported direct damage costs of R1.8-billion that were mainly carried by the departments of agriculture, provincial roads and housing. The costs for local and district municipalities totalled R513-million, mostly from flood-damaged roads and stormwater infrastructure (DiMP, 2014).



An analysis of three cities – Johannesburg, Ekurhuleni and Mangaung – examined their resilience to climate change in the food, water and transportation sectors. It found that existing policies lack appropriate consideration of (and reference to) climate change variables, while strategic planning documents do not adequately cover the interlinkages of planning and managing climate change impacts across all three sectors. Therefore, planning for solutions to improve city resilience will most likely be reactive and isolated rather than proactive and integrated (SACN, 2015a).

With disaster and risk reduction, prevention is better than cure. Events such as heavy storms and rains happen anyway, but they are exacerbated by climate change to an unbearable level for humans and ecosystems. On 28 November 2013, this increasing vulnerability was clearly seen in reality when fist-sized hailstones affected over 44 800 households in regions 1 and 6 of Tshwane. The city's reactive response and lack of a systematic approach to dealing with natural disasters created some tension, delays and inefficient follow-up processes. A report, which was commissioned by the city to quantify the extent of the damage, recommended the development of both a 10-point checklist of actions for making the city resilient and of building blocks for disaster risk reduction in line with the five priorities of the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters (City of Tshwane, 2013). Cities need to strengthen planning around disasters and risk reduction, including implementing coordinated proactive strategies with early warning signals and having dedicated infrastructure maintenance budgets.

## Rural-urban linkages

The UN projects that 71% of South Africa's population will live in urban areas by 2030, reaching almost 80% by 2050. This rapid urbanisation intensifies the rural-urban linkages: people living in cities still maintain some form of connection with the rural area of origin, which can take the form of remittances, social capital, cultural practices, tourism and livelihoods, while resources consumed in urban areas (e.g. food production, electricity generation and water flow) originate in rural areas and the urban hinterland.

People leave rural areas for various reasons, including drought, the lack of income-generating opportunities and a desire to leave farm manual labour, although the expected job opportunities in urban areas do not always materialise. The place where these rural migrants settle in the city often depends on family and social relationships that can facilitate access to shelter, job/income opportunities and access to social and health facilities. Informal settlements are the access point for many rural migrants, from where they are able to strategise and plan how to access the broader urban space for work and services, etc. (SACN, 2015a).

Migration puts pressure on cities' sustainability because of increased demands for services, such as water, land, energy, food etc., and for housing and human settlements, access to public transport, educational, health and community facilities. A combination of strategies needs to be explored to better understand the linkages that exist between urban and rural spaces. The IUDF (COGTA, 2014) states that strengthening rural-urban linkages is a mechanism to achieve sustainable and inclusive development. Cities are vulnerable to shocks in the rural areas that lead to increased migration or reduced resource inflow. Therefore, cities have a role to play in facilitating a dialogue on rural-urban linkages.

# PRINCIPLES OF A SUSTAINABLE CITY

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Urban growth is normally followed by resource consumption and access to quality services – roads, health, schools, connectivity, etc. Since 1996, South African cities have performed fairly well in providing access to basic services – water, electricity, waste management, human settlements and public transport. However, stubborn and rooted challenges remain in the form of urban sprawl, unsustainable mobility options, inefficient consumption of natural resources, inadequate exploitation of renewable options and persistent, inequitable economic opportunities. Silo planning perpetuates this inefficient system, resulting in less impactful development.

The transition towards achieving cities that are more sustainable is not slow because of a lack of commitment, policy directive or know-how. The bigger obstacle is the lack of an integrated and holistic approach to sustainability. Some key shifts are needed in order to see significant progress towards sustainable cities by 2030.

- A *systemic approach* is critical for engaging the issues and improving the city's response to becoming sustainable.
- *Collaboration* is imperative, both within city structures and externally. Strengthened stakeholder engagement is a critical part of co-creating a sustainable future, to ensure buy-in, the leveraging of sustainable partnerships and efficient resource use.
- Cities need a *robust framework* of key sustainable city principles. Such a framework should describe practical key performance indicators (KPIs) with an M&E component.

As a framework for transition towards 2030, the following ten principles are proposed, aligned with the overall vision of cities in the future, i.e. inclusive, productive, sustainable and well-governed cities that benefit all who inhabit them:

- Principle 1: Collaborate for a resilient future (transitioning from silos to systems)
- Principle 2: Establish and maintain internal and external strategic alignment
- Principle 3: Resource efficiency and closing the loops
- Principle 4: Renewable energy (a significant role for cities in cleaner, decentralised renewable energy generation)
- Principle 5: Embrace and leverage diversity
- Principle 6: Capacity building as a critical enabler for change
- Principle 7: Integrate and redefine resilient and effective service delivery
- Principle 8: Localisation within the city construct
- Principle 9: Thriving livelihoods
- Principle 10: Data intelligence

This framework could be used as a tool to implement and test the efficacy of city development strategies. Its integrated and holistic approach will result in effective outcomes with the proper planning, resources and M&E. The idea is that cities should develop robust individual plans that define their programmes, projects and activities in all of the principles.





## CONCLUSION

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Sustainability needs to be understood broadly and holistically, and environmental sustainability should become the foundation to anchor the other pillars concerned with the productivity, inclusivity and well-being of citizens. South Africa's developmental challenges can still be fulfilled with certain levels of economic growth, but pursuing development in a non-integrated way that ignores the environmental thresholds could threaten the local and national economies. This situation could be costly for cities to reverse.

Cities are embracing the sustainable development path, despite limitations resulting from ambiguous national policies, in particular: (i) Section 34 of the Electricity Regulation Act, which specifies that additional new generation capacity can only be added to the national grid through a ministerial determination, and yet this ministerial determination has not been made for municipalities. (ii) The Integrated Energy Plan and Integrated Resource Plan do not specify which generation capacity share has been allocated to municipalities. (iii) Gas is not classified as a vehicular fuel in the regulations thus making use of gas (e.g. compressed natural gas) to propel engines illegal.

In light of the current electricity crisis, cities have a role to play in stabilising the grid by promoting renewable energy and improving energy efficiency. For example, the solar city map developed by eThekweni provides guidance for fully exploiting solar energy for residential and commercial purposes. Generating energy from solid waste needs up-scale exploitation, while energy efficiency is critical because of required leading times for new generation capacity including renewables. To counter the potential negative impact of renewables on city finances such as solar power, cities need to investigate alternative revenue streams and financing models (see Chapter 7). Furthermore, national and local government must also work closely to review regulatory constraints, set realistic targets for diversifying energy supply and allocate adequate resources.

Current city transitions towards sustainable development are inadequate, as shown by intensive consumption of resources, infrastructure backlog, youth unemployment and urban safety challenges. This presents an opportunity to do things differently to effect pro-poor spatial transformation of the current urban form where low-to-middle income households live in outer suburbs and townships. Efficient and inclusive public transport networks will reduce transport-related emissions and help achieve socioeconomic inclusion. However, to function optimally, such public transport networks require high-density developments, as public transport use is greater in areas of higher density (Weakley & Bickford, 2014). The sanitation, water, electricity and housing infrastructure backlogs present an opportunity for innovation that could catalyse small enterprise development.

Cities need to forge trusted partnerships and collaborations in order to achieve the long-term goal of sustainable, spatially transformed resource-efficient cities. Between now and 2030, cities will have to make difficult decisions, guided by long-term vision that is co-created with stakeholders. They can choose to support the haphazard path of development dictated to them by investors, property developers, national government and state-owned enterprises. Or, cities can (and must) look for better, resilient and efficient systems that serve the needs of the local people.

## RECOMMENDATIONS

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**Develop and embed a sustainable cities framework** where capacity exists (2016–2021). This robust, holistic and integrated framework must be based on the sustainable city principles. Its main objectives are to operationalise and test the efficacy of the city's growth and development strategies. Although not all the principles should be turned into programmes, they must be fundamental to service delivery across departments. The modular form of the principles allows cities to continue with areas where progress has been started while programming other components.

**Ensure concrete measurement of progress in the transition**, including baseline studies, KPIs and M&E systems. Sustainability issues and environmental conditions are not adequately represented because of a lack of data and monitoring systems. Urgent investment in environmental data collection and monitoring is needed, as monitoring provides a scientific basis for policy and strategy development, as well as compliance measurement against targets, and helps to determine any enforcement responses. A formal structured mid-term review should be conducted by 2018 to measure the implementation of sustainability frameworks, and to ensure that the data and systems are in place to make M&E possible. Cities would be at different levels, with some having scaled-up projects, while others may have developed the framework or identified capacity gaps. If successful, by 2021 a detailed review of progress against the KPIs set out in a city framework would be possible, and the projection to 2030 could be redefined.

**Confront resource efficiency more aggressively**, based on the concept of a circular economy, whereby products are designed for ease of re-use, disassembly and remanufacturing. This would enable vast amounts of material to be reclaimed from end-of-life products and re-used, which can create the foundation for economic growth. The waste sector makes a good example where small, medium and micro enterprises will emerge, thus contributing to reducing unemployment, poverty and income inequality, i.e. the goals of NDP (NPC, 2011).

**Pursue spatial transformation that encourages compact cities** by facilitating regeneration and densification, which will result in integrated sustainable neighbourhoods. Compact cities contribute to a spatially transformed city in its broadest sense of achieving social, economic and environmental values. Public and private investment is needed for transit-oriented development that is enhanced by public transport and supported by green building.

The transition to sustainable and inclusive cities has its complexities and is a significant change process. However, the cost of not doing enough in a context of unsustainable development practices far outweighs the benefit of increased investment for sustainability. In order to facilitate the much-needed change in pace and trajectory, an institutional re-configuration that views sustainability as a way of doing business, from top management through to finance and procurement departments, is required. This will shift policies and practices away from the business-as-usual approach, which tends to stifle innovation and stunt sustainability.

