



GREENING THE BUILT ENVIRONMENT

Chapter Three

BUILDING A SUSTAINABLE FUTURE



3.1 Introduction

Greening the built environment is an inevitable requirement by any country that understands the importance of addressing its contribution to climate change, adapting to the effects of climate change and promoting sustainable development as a method of rationalising its use of resources.

Defining the Built Environment

The term “built environment” refers to all human-made structures and infrastructure. The notion of the built environment is the recognition that much of the physical world in which humans function and thrive has been deliberately created and functions as an organism in its consumption of resources, disposal of wastes, and facilitation of productive enterprise within its bounds. The human-made surroundings that provide the setting for human activity ranges in scale from personal shelter and buildings to neighbourhoods and cities, and can include their supporting infrastructure such as water supply and energy networks. In practice, it usually describes a multidisciplinary practice incorporating the design, construction, management and use of human-made surroundings as an inter-related whole as well as their relationship to human activities over time.

In order for the built environment to serve as an effective habitat for human beings, it must be designed, constructed, managed and used in such a way that the natural elements that sustain human life are preserved (air, water, soil, biodiversity).

ment is pursued applies a combination of sustainability and sound planning principles and makes use of tried and tested low carbon, alternative technologies.

Within the South African context, this is complicated by the overwhelming need to address the effects of Apartheid planning and the damaging way it has played itself out in the built environment through material deprivation and social exclusion. The country’s planning legacy based on the concept of separate development coupled with perceived personal risks to safety has also instilled particular lifestyle choices and preferences that do not necessarily lend themselves to the most sustainable outcomes possible.

Addressing the remnants of Apartheid and poverty in all its manifestations is often treated as a higher goal on the governance hierarchy. Adequate shelter is essential but no trade-off is required as long as the manner in which development of the built environ-

Greening the built environment in South Africa is thus ensuring that particular steps are taken to correct the effects of poor historical planning practices, to ensure that current planning is sustainable, and the current and future use of the built environment is sustainable. The chapter explores the vision for a healthy and content nation without compromising the environment and scarce natural resources.

3.1.1 The built environment and climate change

Worldwide, the built environment contributes significantly to global warming and plays a significant role in most economies. The link between its economic contribution and its role in climate change is its consumptive character – on average it consumes significant quantities of energy (40%), fresh water (17%), harvested wood (25%), materials (40%), and buildings are often located on the most productive land (Gibberd, 2010:35). In South Africa, the picture is no different as through electricity consumption alone, buildings in the built environment account for nearly a quarter of South Africa’s carbon emissions (UNEP 2009:33).



Pretoria skyline from the Union Buildings

Table 3.1: Carbon Emissions per sector

Sector	Carbon Emissions per sector
Commercial & Residential	10%
Residential	13%
Subtotal	23%
Transport	16%
Industry	40%
Mining	11%
Other	10%
Total	100%

Source: UNEP 2009:33

The built environment is concerned with economic activity as well as facilitating “productive enterprise within its bounds”. Greening the built environment, in the context of the National Greening Framework, will not address the transition to a low carbon, resource efficient economy, which will be set out in Green Economy Plan.

3.1.2 Greening of Urban Environments

The National Greening Framework has urban environments as its focus for two primary reasons:

1. The rate of urbanisation and consequent urban sprawl; and
2. The contribution of urban environments to South Africa's carbon footprint.

Rural settlements are equally important and deserving of support and intervention but they have distinct challenges, which require separate attention. Therefore the NGF focuses on the urban built environment only.

•Urbanisation and urban sprawl

In South Africa, urbanisation has affected metropolitan areas mainly since they are the target for three-quarters of internal migrants. The greatest movements in the country are between those provinces with larger former homeland populations and adjacent provinces dominated by metropolitan economies (Kok, P et al, 2003).

In addition to the high rates of urbanization, to metropolitan areas in particular, urban areas are affected by urban sprawl, which is the phenomenon of single urban areas spread over vast areas leading to large travel distances between places of residence and places of work.

In South Africa, urban sprawl inhibits and constrains the provision of sustainable infrastructure. Metropolitan areas are vast in South Africa. This makes for long and expensive travel distances, which when coupled with traffic

congestion results in higher carbon emissions by road vehicles and reduced economic productivity.

•Urban environments and climate changes

The second reason for focusing on urban environments is informed by their contribution to climate change as they produce most of the world's greenhouse gas emissions, use the most of the world's energy and tend to have warmer temperatures. Furthermore, they are increasingly vulnerable to the effects of climate change and coastal cities, for example, are most vulnerable and at risk from rising sea levels. With millions of people located in cities, and with the total global gross domestic product it produces, the impact of climate change on cities has profound economic implications.

Whilst rural settlements are hard hit with unpredictable and extreme weather events, they contribute less to climate and typically have a small ecological footprint. A focus for rural settlements, in respect to climate change, is mostly to enhance their ability to adapt to the effects of climate change while cities and urban environments have to develop and implement comprehensive mitigation and adaptation plans.



3.1.3 A vision for a greener built environment

Greening of the built environment should take the following into consideration:

- Creating urban spaces where people can work, socialise and live in the same area whilst being able to walk or use safe and reliable public transport;
- Promoting mixed use zoning keeping every amenity within reach throughout a neighbourhood;
- Making roads equally accommodating to cyclists, cars, public transport and pedestrian traffic.
- Incorporating the natural environment into the built environment and in so doing creating healthy recreational environments and the prevention of building emissions by reducing the urban heat island effect, such as providing roof gardens or urban parks;
- Designing, constructing and operating buildings that use natural resources sparingly; and
- Providing basic services (water, electricity, waste management) to households and businesses derived and supplied in a sustainable manner.

3.1.4 Putting policy into practice

Government is demonstrating its increased commitment to the implementation of sustainability practices throughout South Africa through major investment in programmes to address a range of environmental problems whilst addressing the twin goals of local economic development and social development. At the forefront of the pioneering approaches has been the Working for Water programme and associated initiatives. These programmes are funded through the Expanded Public Works Programme (EPWP), which promotes community-based, labour intensive methods. The Environment and Culture sector, which is one of four EPWP sectors, has also applied the same principles to

waste management and the extension of domestic waste collection services. Two different approaches have been piloted to date and will be utilised in the roll-out of domestic waste collection services throughout South Africa.

Whilst innovative sustainable development practices have been largely applied by metropolitan municipalities, the Department of Environmental Affairs has developed its Buyisela Ecotowns Programme for application to ten towns. The concept is informed by the United Nations (UN) definition of Ecotowns, which includes the use of natural resources more efficiently, zero waste, cleaner transport and energy, and sustainable human settlements. The design of the programme has, however, excluded cleaner transport and human settlements.

It is being applied in ten municipalities spread across eight of the nine provinces. Examples of projects being initiated through the Buyisela Ecotowns Programme are solar water geysers and biogas digestion facilities to supply energy to homes and school feeding schemes. Composting projects involving the organisation of hawkers into small businesses to create compost are also being piloted. In terms of waste recovery, collection points for discarded waste that can be recycled will be made available at taxi ranks and schools where recycling waste collection systems are set up which will benefit learners in a non-monetary sense.

Apart from the environmental and social benefits of these projects, there is a contribution to creating 'green' jobs, which is befitting for an EPWP-funded project.

Expanded Public Works Programme

Food for Waste beneficiary distributing black bag for waste collection in Balfour



Department of Human Settlements

Guideline for Environmentally Sound Low Cost Housing

“Environmental issues are inherently linked with the quality of life. Settlements are often strongly influenced by access to resources in the environment. On the other hand, settlements and the activities that take place in them alter the environment in which they are set.

Environmentally sound human settlements are characterised by good air quality, energy and water efficient homes, with planting that provides green ‘lungs’ or even food security.

These may be seen as healthy, sustainable settlements which provide quality living environments. The promotion of settlements with these attributes would bring social, economic and environmental benefits to South Africa.”

Green Building Council

The private sector has a major role to play in greening the built environment. Its commitment here is through the establishment by the Green Building Council of South Africa (GBCSA), which is a non-profit organisation linked to the World Green Building Council (WGBC) to promote green building principles and practices in South Africa. Its main focus is new commercial buildings and innovative ways to encourage green buildings.



3.2 Protecting & Enhancing Biodiversity

The activities and movements of humans (urbanisation, rapid population growth), especially in urban areas, threatens biodiversity because it removes and destroys habitats. For most species, the habitats in which they are naturally found are the only habitats in which they can survive. Therefore biodiversity is protected, by protecting natural habitats.

The objectives in relation to protecting and enhancing biodiversity are as follows:

- To promote urban greening;
- To ensure that future developments do not result in a loss of habitat for flora and fauna;
- To protect the existing habitats in and around built environments; and
- To create new habitats/green spaces within built environments.

3.2.1 Promote urban greening

The term greening is most strongly associated with 'urban greening', which can be described as "an integrated approach to the planting, care and management of all vegetation in cities, towns, townships, informal settlements and peri-urban areas. It includes components of urban forestry, urban agriculture/permaculture and agroforestry" (Department of Human Settlements, n.d:3).

The Department of Human Settlements, through its National Greening Strategy, has taken the lead on urban greening and its intention is to guide municipalities to develop individual urban greening policies and strategies. The strategy demonstrates the linkages between environmental management and a sustainable livelihoods approach where environmentally proactive interventions result in sustainable livelihoods.

Defining Biodiversity

The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. Biodiversity includes the number, abundance and composition of genotypes, species, populations, functional types and landscape units within a given system.

South Africa's National Biodiversity Strategy and Action Plan (DEA 2005:104)



"The role of urban greening is to preserve the environment, improve the way urban areas look and provide subsistence for poor communities by encouraging the establishment of food gardens in these communities."

*National Greening Strategy
Department of Human
Settlements*





The National Greening Strategy adopts a holistic approach to urban greening which aims to:

- To preserve the environment;
- To improve the way urban areas look; and
- To provide subsistence for poor communities by encouraging the establishment of food gardens in these communities.

The application of urban greening also aims to improve the quality of all urban open spaces. Therefore urban greening extends beyond parks and roadside to include household gardens, factories and business areas.

The strategy makes provision for the application of greening to parks and open spaces; street trees recommending a tree to be planted for every house in low income areas; community food gardens; pavements aesthetics in townships and informal settlements; and private spaces where the planting of fruit trees and individual food gardens using recycled grey water is promoted. The strategy discusses roles and responsibilities as well as funding mechanisms for the urban greening.

In addition to the Department of Human Settlements' Urban Greening Strategy, the concept of urban greening is provided for by the Department of Water Affairs' Urban Greening Strategy which is focused on the role of urban forestry in the preservation of the environment and the Department of Co-operative Governance's Clean Cities and Towns Strategy, which is particularly concerned about the state of parks and their infrastructure, which are often neglected.

At the programmatic level, urban greening is being promoted through the Expanded Public Works Programme's Environment and Culture Sector Plan. Through the Environment and Culture Sector Plan, the Department of Environmental Affairs is able to fund the greening of areas. An area of innovation is the Buyisela Ecotowns Programme as discussed in section 1.1.4. Urban greening is one of several interventions and among its different components are street cleaning and beautification, landscaping and tree planting, and rehabilitation, which align to the objectives of urban greening.



Added to the urban greening programmes is the Department of Agriculture, Forestry and Fisheries' (DAFF) Million Trees Programme. The target is to plant at least one million trees every year.

3.2.2 Responsible new development

The second objective in relation protecting and enhancing biodiversity is the concept of responsible new development whereby development does not result in a loss of habitat for flora and fauna. Responsible new development is largely facilitated by the existence of municipal Open Space Planning systems that are incorporated into municipal Spatial Development Frameworks. The aim of such systems is to identify ecological systems and green corridors and to use these as a basis for identifying the following three tiers of open space planning:

- Primary open space which comprises ecologically sensitive areas which should remain protected such as municipal nature reserves;
- Secondary open space which involves the provision of parks and open spaces which will cope with greater human activity; and
- Tertiary open space which incorporates greening requirements in densely built up areas such as the number of trees required per capita and innovative projects (such as the creation of artificial wetlands using storm water drainage).



Once these three tiers are identified, they can be used to guide land use planning and zonation. Therefore this system provides for an overall framework for the protection of local biodiversity.

With respect to individual developments, there are a number of best practice examples that may be applied:

- During site clearing, mature trees (provided that they are not invasive alien species) and natural features such as large rocks or outcrops should be retained.
- Where existing vegetation is to be cleared and is of an appropriate quality, plants can be replanted or propagated and replaced.
- In the establishment of new gardens or boosting existing gardens, endemic species should be used only. This will not only contribute to local biodiversity but is an important element of a water-wise garden.

3.2.3 *Protecting and enhancing existing habitats*

The third objective is to protect and enhance existing habitats in and around the built environment. South Africa has been extremely proactive in this regard through the Buyisela Ecotowns Programme discussed earlier, the EPWP Working for Water and Wetlands Programmes and the Urban Nature Programme, run by the South African Biodiversity Institute (SANBI). The latter seeks to promote good practice amongst municipalities and other local authorities by providing them with the expertise and knowledge required to adequately protect and enhance urban biodiversity.

Common to all biodiversity programmes and projects is the multiple benefits of protecting and restoring biodiversity, improving the state of urban communities, environmental awareness and poverty alleviation through job creation, and the promotion of ecosystem goods and services.

3.2.4 *Creating new habitats and green spaces and urban densification*

A fourth objective is the creation of new habitats and green spaces. Whilst greening of highly built up areas is important for the promotion of biodiversity, it also has enormous psycho-social benefits especially in areas where people have limited personal space

whether it be in the inner city or townships. Green spaces that serve as recreational spaces therefore bring an element of well-being to people who typically have access to very little personal space.

Urban Densification

Greening of urban environments is a necessary accompaniment to urban densification which can be defined as 'a process leading to sound management of urban space by concentrating housing, jobs and transport in an area as limited as possible...' (Christeller and Sall, 2008: 1). The more dense an urban area is, the greater the potential for effective public transport and non-motorised transport because more people live closer to their places of work. Urban densification has the potential to make urban areas more manageable in all respects. However, it needs to be done thoughtfully as increased population density also has the potential to over burden water, electricity and sewage services.

There is a concern that urban densification counteracts the efforts of creating and protecting green spaces in urban areas because it seeks to plug 'gaps' within those areas. However the gaps referred to here are not only open fields that may be habitats, but also disused land and the very gaps between buildings themselves. Furthermore, urban densification helps to protect surrounding habitats and agricultural land.

Urban densification is supported through the National Housing Code and in particular, the Social Housing Programme. The Social Housing Programme has the potential to prevent the decay of traditional central business districts by providing funding that can be utilised to renovate deserted office blocks and derelict buildings. At the same time, it fulfils the principle of locating people in proximity of employment opportunities, negating the requirement to commute long distances and the negative associated impacts.

Protecting and enhancing existing habitats

Cape Flats Nature Projects

This project promotes good practice regarding biodiversity in the City of Cape Town by developing conservation sites that are part of the city's biodiversity network of open spaces. It seeks to build a good relationship between people in disadvantaged urban areas and nature by showing them the benefits of nature conservation. Biodiversity is protected, jobs are created, the aesthetic quality of local communities improved and locals become proud of the biodiversity that they have helped restore and maintain.

Working for Wetlands

This project helps promotes the wise use of wetlands and helps to restore rivers and wetlands to their original state (the state they were in before they were negatively affected by pollution and a heavy demand for water.)

Again, this project has twin benefits as it improves wetlands, and therefore the country's water supply, as well as creating jobs, therefore alleviating poverty.



There are important synergies between urban greening and enhancing biodiversity, which have an important role to play in promoting healthy and aesthetically appealing urban environments with multiple human benefits. Conserving biodiversity is more tricky as it requires planning around existing natural, physical conditions and requirements enhancements in existing spatial planning systems and ensuring that land-use planning and individual development are aligned to local biodiversity frameworks which should form part of the spatial planning systems. The damage done is often irreversible and thus the application of biodiversity considerations requires greater emphasis and prioritisation.

3.3 Green Buildings

The term 'buildings' applies to all forms of structures that provide shelter for personal, communal, industrial and commercial reasons. Green building (also known as green construction or sustainable building) is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction.

The greening of buildings is an important element of the process to green the built environment because of their estimated contribution to climate change through the construction materials, construction methods and building design, resulting in higher than necessary consumption of electricity and water. The International Organisation for Standards (ISO) has established that the building of the construction sector accounts for about 40% of global carbon emissions, 40% of natural resources consumed and 40% of waste generated worldwide. In addition, buildings consume approximately 70% of all global timber products.

In South Africa, it is estimated that residential and commercial buildings account for a quarter of CO₂ emissions in South Africa. Furthermore, there is pressure for buildings to reduce the amount of energy that they consume in their operations. According to the National Energy Efficiency Strategy of South Africa, the residential building sector is required to reduce its final energy demand by 10% by 2015 and commercial and public building sector by 20% in 2015.

Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources,
- Protecting occupant health and improving employee productivity, and
- Reducing waste, pollution and environmental degradation.

The objectives of establishing green buildings are as follows:

- To ensure that new buildings are built according to green building principles; and
- To retrofit existing buildings so that these can meet modern green building standards.

Green Buildings

The word 'green' when applied to buildings refers to water efficiency, energy efficiency and reduced carbon emissions in the design, construction and operation of a building. This practice expands and compliments the classical building design concerns of economy, utility, durability, and comfort.



Solar water geyser on low income household.

Energy Efficiency Targets for the Property Sector

- The residential building sector is required to reduce its final energy demand by 10% by 2015
- Commercial and public building sector is required to reduced its final energy demand by 20% in 2015.

National Energy Efficiency Strategy of South Africa, 2005



3.3.1 Greening new builds

The vision for greener buildings has largely arisen as a result of shortages in electricity supply, drawing attention to the quantity of energy that buildings utilise which could be minimized through the deployment of renewable energy and energy efficient design and technologies. Targets for energy demand reduction were established for the property sector in the National Energy Efficiency Strategy of 2005 (first reviewed in 2008).

Following the principle of low cost, mass scale interventions, the Long Term Mitigation Scenarios (LTMS) identified the following key ways in which energy demand reductions in the property sector could be achieved:

Table 3.2 Application of energy efficiency interventions to the commercial and residential sectors

Commercial Sector	Residential Sector
Heating, Ventilating and Air Conditioning Systems	Solar water heating
Thermal design	Geyser blankets
Efficient lighting	Insulation/space heating
Water heating	Efficient lighting
Other appliances	

The vision for green buildings is being put into effect through the draft Regulation for Environmental Sustainability of Buildings. This applies to passive design features to residential and commercial buildings, places of learning and worship, certain medical clinics and other categories of buildings.

It will be compulsory for all new buildings to be designed and constructed to a standard whereby the energy required to meet its functional requirements is minimised. Therefore the different elements of the building envelope, such as roofs and ceilings, walls and windows will have to meet minimum requirements for preventing heat loss in winter or heat gain in summer, in order to meet energy efficient targets. All buildings will also be fitted with renewable energy water heating systems such as solar water heating systems, which would need to comply with the South African National Standards. The regulations also require that buildings, heaters, air-conditioners and mechanical ventilation systems will have to be energy efficient.

Passive Design Features

Passive design features refer to the control of ventilation and temperature without using any products that consume energy or financial resources.

Building orientation – *positioning the house to allow maximum sun in the winter and coolness in the summer.*

Solar energy – *using solar panels for water heating.*

Use of structural elements – *for example, wide eaves protect from the sun in summer and provide increased weather protection in winter.*

Ventilation – *using window joinery that allows ventilation, such as security catches allowing windows to remain partially open, or vents in the joinery.*

Insulation – *to reduce heat loss.*

Reducing, reusing and recycling building materials

Waste materials from old sites can yield unused bricks for use in new projects or old, damaged bricks can be crushed and used to produce bricks made of recycled crushed aggregate (RCA).

Materials like old timber and ceiling boards that have lost their structural strength can be used as aesthetic features like eaves and fascia boards.

The use of clean energy to produce building materials.

Due to a market demand for clean-energy produced materials, companies are switching from coal to gas-fired bricks.



Application of passive design features to the provision of housing for low-income households would be vital for achieving sustainability in the built environment.

*The Department of Human Settlements has developed a guideline, the **Guideline for Environmentally Sound Low Cost Housing**, to promote sustainability in the construction of low-income houses.*

In addition to passive design features, buildings can be greened through active features. These usually refer to the materials that are used to construct a building and there are important green trends that are emerging in this regard. These include the re-use and recycling of building materials; sourcing of locally produced building materials; and the use of building materials that have been produced using clean energy.

The Centre for Scientific and Industrial Research has a research programme dedicated to the development of green building technologies. It has been previously argued that the main drawback to the uptake of green building technologies were the costs, which were said to exceed the cost associated with conventional materials and techniques. However, this research body has established that costs are comparative and in the long run, greener technologies end up being more affordable. However, this applies to new builds only as retrofitting remains a fairly costly exercise. The latter can be offset through the savings incurred through reduced electricity and water consumption.

In terms of water usage within buildings, there is currently no regulatory provision for the introduction of grey-water systems or rainwater harvesting. This would be an important intervention for a country that is water-stressed and likely to experience greater water shortages in parts of the country as a result of the effects of climate change.

3.3.2 Retrofitting existing buildings

The focus on energy efficiency requirements (which then impact on emission reductions) is somewhat biased towards new buildings, whereas an increasing focus is required on the legacy of energy inefficient buildings that exists. Specifically, policy options along the line of those required in the UK, Australia and others requiring selected retrofitting of commercial and residential buildings on the change of ownership should be investigated and developed.

In the absence of any regulations, one of the best incentives to retrofit existing buildings is the rising cost of electricity and the proposed energy efficiency tax incentives. There is also the impact of the tax that has been placed on incandescent light bulbs, which creates an incentive to purchase compact fluorescent lamps, a far more energy efficient light bulb.

Great strides are being made in relation to the retrofitting of existing buildings, which is being led by the Department of Public Works (DPW). DPW has undertaken a process to retrofit national government buildings and some rented buildings. Retrofitting is focused on energy saving through load management and the replacement of obsolete lights with T5 fluorescent tubes that have the highest efficiency currently available. In terms of rented buildings, shared energy contracts are drafted and savings on energy costs are split between the lessor and the lessee (government) per the provisions of these contracts.

Incentives to retrofit existing buildings are the rising cost of electricity and the proposed energy efficiency tax incentives.

Energy Efficiency Tax Incentive in brief

Step 1

Determine baseline energy usage.

Step 2

Introduce energy efficiencies.

Step 3

Measure the savings.

Step 4

Apply to the Energy Efficiency Agency of South Africa which will issue an Energy Efficiency Savings Certificate based on Energy Efficiency Savings determination by a Measurement and Verification Professional.

Municipal Energy Efficiency Retrofit

The City of Cape Town has retrofitted four of its municipal buildings. The first step was to conduct an energy audit that provided a benchmark and breakdown of usage, and estimated return on investment. Interventions included the installation of energy efficient lights (with electronic control gear and high efficiency reflectors), solar water heaters, timer control, power factor correction and intelligent thermostats for air conditioning systems. In addition to this, a comprehensive awareness and training programme was undertaken with staff at different levels to get their buy-in, set up sustainability teams and ensure long term benefits.

Provincial governments and municipalities have their own programmes to retrofit the buildings that they own.

To support and drive the move to the wide scale retrofitting of buildings on a voluntary basis, the development of a Green Star SA-rating tool for existing buildings is a positive move. The Green Building Council is currently advocating a standard practice that energy data for a building must be supplied before it can be sold.

In conclusion, significant emissions reductions and energy savings can be achieved in the greening of both residential and non-residential buildings. The introduction of energy efficiency in new buildings will be made compulsory and in existing buildings, energy efficiency is, in part, being encouraged through energy price increases, the introduction of an energy efficiency tax incentive and the tax on incandescent light bulbs. In terms of water usage, there are currently no incentives or targets yet in place to stimulate water demand management although these are imminent once the Department of Water Affairs consolidates its Strategic Framework for Water for Growth and Development.



3.4 Sustainable basic service

Urban infrastructure is the supporting infrastructure for human-made surroundings that provide the setting for human activity. This includes transportation networks, water and energy supplies, waste management infrastructure, storm water drainage and waste-water treatment, and often neglected information technology networks.

South Africa is renowned for its extensive infrastructure, which has led to it being the economic powerhouse of Africa. To retain its economic value and productivity, sustained investment in this infrastructure is required for operations, maintenance and upgrades. This is of particular importance since urban areas have expanded rapidly over the last fifteen years, placing a great strain on existing infrastructure. Sustainable infrastructure demands that all forms of infrastructure are treated as valuable resources with a finite carrying capacity that should not be surpassed.

Some of the main infrastructure related problems for South African municipalities include collapsing infrastructure; traffic congestion; increasing water and energy prices; expensive, non-green buildings; urban sprawl; and over-burdened landfills.

As this urban infrastructure is the supporting infrastructure upon which human activities depend, their demise or absence severely curtails their intended role. At worst, they become a deadly threat to the health and wellbeing of human beings and the environment on which human beings depend for their survival. Furthermore, as the effects of climate change are being experienced within the built environment, the need to build the adaptive capacity for unpredictable and extreme weather events is imperative.

Outcome 10

Output 1: Enhanced quality and quantity of water resource

Sub-outputs:

- Water demand,
- Water resource, protection and
- Regulation of water quality

A distinction is drawn between the framework and the National Green Economy Plan. The latter will identify and discuss the infrastructure investments incorporating sustainability criteria and cutting edge technologies that will be required to support the transition to a low carbon, resource efficient economy. The focus of the NGF is on the sustainable provision of services to those living in urban environments in fulfilment of the Constitution and the Millennium Development Goals.

The objectives in relation to sustainable urban infrastructure are therefore the sustainable provision of services to urban communities and include water and sanitation, energy, and waste services.

Other services that rely on infrastructural development have been discussed elsewhere: transportation networks in section 1.7, and waste management infrastructure in section 1.5. Buildings, which are also a major component of the infrastructure found in the built environment, are discussed in section 1.3.

3.4.1 Water and sanitation services

Enhanced quality and quantity of water resources is an output of the Delivery Agreement for 'Outcome 10: Environmental assets and natural resources that are valued, protected and continually enhanced.'

As a water scarce country, water is a precious commodity to be protected and used as efficiently as possible. Access to potable drinking water is also a basic, inalienable human right. Water, alongside energy, is fundamental for sustained economic growth and water use is made up of several sectors including the agriculture, mining, and municipal sectors.

The municipal water sector is the second largest water use after agriculture. The focus here is on the municipal sector and in particular, the provision of water services to urban households, which is a constitutional mandate of local government.

Water demand in the municipal sector is made up of domestic water user for basic needs, other domestic uses, water use by non-domestic users (industry, commerce, institutions etc.) and lost water. Domestic water consumption accounts for between 50% to 60% of total municipal use. The demand for basic water use alone is 800 million kl pa based on a basic allocation of 50 litres per capita per day and a population of 48.5 million people. Water use in the six metropolitan municipalities dominates total municipal water use accounting for about half of total municipal use.

There are three primary issues that are raised in the framework:

- The role of water conservation and water demand management;
- The management of unaccounted for water; and
- Water and quality.

• Water Conservation and Demand Management

It is the intention of the framework to advocate low cost interventions - water conservation and water demand management interventions are the most affordable interventions amongst the various options to ensure water security. Municipalities have an important role to play by developing and enforcing bylaws to promote water conservation and demand management (such as the use of water efficient devices) in their areas of jurisdiction, as they are empowered to by the Water Services Act (Act 108 of 1997).

This will also be supported through the establishment of compulsory national standards and measures for conserving water, which is also provided for by the Water Services Act. The adoption of international best practice regarding water use efficient appliance standards, which have been successfully implemented elsewhere, could be investigated.

Legislating water savings

The United States of America managed to reduce average water use from 245 litres to 169 litres per capita per day by legislating the use of water efficient devices (cisterns that use 6 litres per flush, shower-heads that use 9.5 litres per minute and urinals that use 3.8 litres per flush).

1.4 million households do not have reticulated water in their homes.

4.5 million households do not have access to adequate sanitation facilities.

Stats SA, Community Household Survey 2007