



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.*

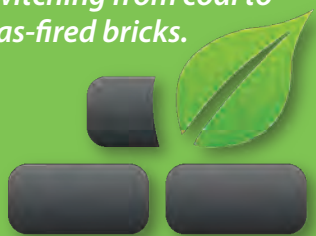
Reducing, reusing and recycling building materials

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

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

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).

Unaccounted for Water

UAW is the difference between the quantity of water that a municipality draws from bulk water sources and the quantity that it ultimately bills for. These losses are due to technical losses (network leaks) and economic losses (water used by consumers but not measured and billed).

• Management of Unaccounted for Water

Unaccounted for water concerns significant water losses which threatens the sustainability of supply to urban households. This issue is primarily to be addressed through enhanced asset management by water service authorities, which have to ensure sufficient resources to maintain, replace and refurbish water services infrastructure. It is estimated that in the region of R180 billion, which includes both operating expenditure (on maintenance) and capital expenditure (on asset rehabilitation), is required to address the current challenges with the water services infrastructure.

Intervention: Enforcement of regulations

Another facet to water losses are leakages created by the prevalence of substandard plumbing fixtures. This is in spite of compulsory national standards for the plumbing industry - 'Regulations relating to Compulsory National Standards and measures to conserve water' - prescribed by the Minister of Water Affairs. These regulations require that all consumer installation must comply with SABS 0252.

Since the regulation has been promulgated, this standard must be enforced so as to avert the use of non-compliant plumbing components. The development of legislation to prohibit the import and sale of non-compliant plumbing products to protect consumers from suppliers of sub-standard plumbing products and water loss reduction may also be considered.

• Water Quality

The third issue affecting domestic water supplies is

the quality of drinking water. This has implications for communities (poor health, lack of productivity) and the State, which must bear the resulting health care costs – health improvement is the primary objective of national government's investment in the water and sanitation infrastructure. Threats to communities' health are lack of access to water and sanitation services and poorly maintained waste water treatment works.

Access to water and sanitation services are being addressed by the Department of Water Affairs (DWA) as part of the country's commitment to achieve the Millennium Development Goals.

Intervention: Regulating water quality

Addressing poorly performing waste water treatment works is part of the bigger process to maintain, rehabilitate and replace water services infrastructure discussed earlier. A starting point to address water quality is to enhance the regulation of water quality through the DWA's Drinking Water Quality Management Performance's Blue Drop Certification Programme. This is an incentive-based regulation of drinking water quality, amongst other issues.

This programme is a testimony to the emphasis that Department of Water Affairs (DWA), in partnership with the Department of Co-operative Governance has placed on the effective monitoring of drinking water supplies. Through this system, Water Service Authorities are incentivised to meet the full monitoring requirements required for wastewater monitoring systems and to act upon the monitoring outcomes so that the quality of water is of a drinking standard.



Blue Drop Certification

Blue Drop Certification Programme makes an important contribution to greening of events and the built environment as it enables the safe consumption of tap water, avoiding the need for bottled water, which is not considered a green option.

Intervention: Alternative sanitation systems

There are massive sanitation backlogs that still need to be addressed. Existing flush systems are heavy users of water and standards and regulations could be developed that stipulate the quantity of water that such systems may use. There is also scope for water service authorities to consider and experiment with alternative sanitation systems as is the case for eThekweni Metropolitan Municipality.

Ecological Sanitation

eThekweni Metropolitan Municipality has installed 90,000 toilets that do not use water. Apart from water conservation, the aim is to buy this human waste from residents. The concept behind the pilot is ecological sanitation which regards human excreta as a source to be recycled rather than as waste to be disposed of. Recycling sanitised human urine and faeces by returning them to the soil has several benefits including the prevention of direct pollution caused by sewage being discharged or seeping into water resources and ecosystems; the return of nutrients to soils and plants and reduces the need for chemical fertilizers; and the restoration of good soil organisms to protect plants.

3.4.2 Energy Supplies

The residential sector represents almost a fifth (17.9%) of final energy use and is the third largest energy consumer after industry and transport (National Energy Efficiency Strategy, 2008). There is a national commitment to electrify all homes by 2013 driving major investment into electrical infrastructure to achieve a current electricity access rate of 70% and approximately 300,000 new connections per year.

This target may be difficult to achieve as the demand for electricity has outstripped supply, resulting in rolling blackouts. This has partly served as the impetus for the current emphasis on demand side electricity management, where electricity users are encouraged to improve their energy efficiency and to install facilities that utilise alternative sources of energy.

The issues to be addressed with sustainable energy services in many respects mirror those of the water sector: achieving universal access, asset management and infrastructure investment, demand side management, system losses as a result of faults in the electricity distribution system, and diversifying the energy mix. Whilst all homes are to have access to electricity by 2013, an energy demand reduction of 10% must be achieved by 2015. In order to reconcile these two targets, the role of energy efficiency and renewable energy becomes vital.

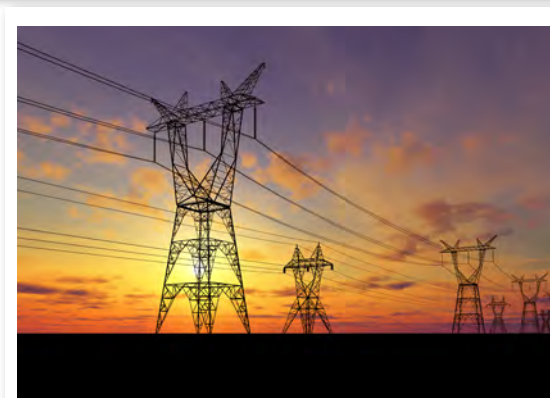
Eskom is investing R4.5 billion into through its Energy Efficiency and Demand Side Management (DSM) programme over a period of five years. This consists of Energy Efficiency initiatives and DSM which includes the installation of solar water geysers. The target that has been set is the installation of 1 million solar-water geysers by 2015.

Did you know:

- 80% of households use electricity for lighting
- 67% electricity for cooking
- 59% electricity for heating

The balance of South African households, especially those in poorer income groups and those below the poverty line, make use of alternative fuels (wood, paraffin, coal) for heating, cooking and lighting with associated negative environmental and health implications.

Stats SA Community Household Survey 2007



Action Plan: Phase-out of inefficient lamps and the introduction of compulsory standards for energy efficient lamps in South Africa.

The aim of the action plan is to contribute towards the reduction of electricity demand in South Africa and introduce continuous energy efficiency improvement into the lamp industry. The initiative will be implemented by introducing compulsory specifications in terms of the National Regulator for Compulsory Specifications Act (Act 5 of 2008) which will determine minimum energy performance requirements for all lamps. This will remove the poorest performing products from the South African market place between 2011 and 2013 and ensure that only high quality lamps are sold in South Africa.



Intervention: Energy efficient lighting

A low hanging fruit in relation to energy efficiency is the use of energy efficient light bulbs. Whilst Light-emitting diodes (LEDs) are considerably more efficient, Compact Fluorescent Lamps (CFLs) are cheaper and therefore considered more affordable. Incandescent light bulbs remain the cheapest light bulb although a tax levied on them have made them more expensive as a way of disincentivising their purchase.



The main concern with CFLs is the manner in which they are disposed of as this poses environmental risks due to their mercury content. This will be addressed through an Industry Waste Management Plan for lamps containing mercury as per the Waste Act.

To assist households in becoming more energy efficient, the Department of Energy has initiated an Appliance Labelling campaign.

Labels on household appliances inform consumers how energy efficient their appliances are. This labelling will be eventually applied to a full range of domestic appliances (fridges, dishwashers, washing machines, audiovisual equipment (radios, TVs) and tumble driers) although this is determined by the availability of technology. It is likely that regulations will be developed compelling manufacturers and retailers to enforce performance standards ensuring that all appliances meet a minimum energy performance and that this energy performance must be displayed on the label.

Intervention: Smart grids

Losses of electricity, as with water losses, occur both as result of technical and non-technical losses. Technical losses can be abated through the introduction of smart grids systems, which some of the metropolitan municipalities are considering.

In conclusion, the provision of clean water and sanitation as well as the provision of affordable energy supplies, which are basic services, are a fundamental component of sustainable urban infrastructure. Both are necessary for development and growth and both are adversely affected by lack of investment in maintenance and upgrades as well as addressing backlogs.

The use of both resources requires demand side management as the most affordable way of ensuring the preservation of supply. This can be supported through consumer awareness and the uptake of energy and water saving devices. Whilst an energy efficient appliance labelling scheme has been undertaken by the Department of Energy, a similar undertaking is under investigation by the Department of Water Affairs.

On the supply side, distribution losses are enormous for both water and electricity and point to the need for more rigorous maintenance with respect to water, the use of substandard plumbing equipment can be avoided through the enforcement of 'Regulations relating to the Compulsory National Standards and measures to conserve water'. The quality of drinking water is another vital consideration and this is being actively regulated through the Department of Water Affairs' Blue Drop campaign.

The provision of clean water and sanitation as well as the provision of affordable energy supplies, which are basic services, are a fundamental component of sustainable urban infrastructure.

Sick building syndrome

refers to occupants experiencing acute health and discomfort that appears to be linked to time spent in a building although no specific illness or cause can be identified.

Building related illness

refers to symptoms of a diagnosable illness that are identified and can be attributed directly to airborne building contaminants.



3.5 Air Quality Management

One of the significant outcomes of greening the built environment is the improvement in air quality since industrialised urban environments typically have poor levels of air quality, which are compounded by transport-related emissions.

The overall chapter addresses air quality from the perspective of the energy requirements of buildings (refer to section 1.3), yielding the promotion of energy efficiency and renewable energy for both the residential and non-residential sectors (refer to section 1.4.2), biodiversity conservation (refer to section 1.2) and urban greening (refer to section 1.2.1), and green public transportation and in particular, non-motorised transportation (refer to section 1.7). However, the more fundamental causes of air pollution, namely industrial processes are not the subject of the Greening Framework as they are a focus of the Green Economy Plan, which will address the concept of cleaner production (water and energy efficiencies, waste minimisation) and application of air quality standards to industrial processes and investment in new technologies to improve industrial performance.

The focus of this section is therefore on indoor air quality affecting the health and wellbeing of building occupants. There are two main concepts to consider. The first is the “sick building syndrome” (“SBS”) and the second is “building related illness” (“BRI”). An important distinction between SBS and BRI is that most of the SBS complainants report relief soon after leaving the building whereas BRI complainants may require prolonged recovery time after leaving the building.

Causes of SBS and BRI include inadequate ventilation, chemical contaminants from indoor sources, chemical contaminants from outdoor sources, and biological contaminants. Low income households, for example, are particularly vulnerable to chemical contaminants from indoor sources due to the inhalation of carbon monoxide and nitrogen dioxide from wood and coal stoves. Hospitals are prone to biological contaminants and have become home to super-viruses that are highly infectious and difficult to control. Therefore no matter the scale, buildings in South Africa pose risks to the health and wellbeing of its occupants.

There are several solutions to improving air quality which are usually used in combination and include:

- *Pollutant source removal or modification* is effective when sources are known and control is feasible. Interventions include regular maintenance of HVAC systems and ensuring minimal exposure of occupants to pollutants through practical measures such as using lead-free paints and products that do not contain volatile organic compounds and formaldehyde, proper storage of pollutant sources, and restricting use of polluted sources during periods of non-occupancy.
- *Increasing ventilation rates and air distribution* which can be achieved through green design maximising the flow of air throughout a building, minimising the use of HVAC systems, particularly in warmer seasons. Where HVAC systems are required to be used, these should be as energy efficient as possible and meet the ventilation standards contained in the building codes. Local exhaust ventilation is particularly important where pollutants accumulate in specific areas such as rest rooms, copy rooms, and printing facilities.
- *Education and communication* are required for both preventative and remedial indoor air quality management programmes. Indoor air quality is more effectively managed when all affected parties communicate and understand the causes and consequences of indoor air quality problems.

Basa Njengo Magogo Campaign

The Department of Energy has pioneered the intervention to address indoor air quality of low income households that rely on wood and coal stoves as a source of heat.

This is a low smoke, energy efficient technique for building indoor fires and forms part of the Integrated Household Clean Energy Strategy.

3.6 Waste Management

The built environment produces large quantities of general and hazardous wastes, the disposal of which have potentially disastrous consequences for the environment and human health.

This is certainly the case where inadequate disposal methods are deployed and quantities of waste generated exceed existing disposal capacity. The concern with visible waste in the built environment is often from an aesthetic point of view yet there are fundamental environmental and health risks that current disposal practices present that are of much greater concern.

The focus of this section is on the infrastructure required for the management of general waste, which is comprised of domestic and commercial waste that is typically disposed of at landfill sites.

In 2006/07 alone, South Africa disposed 24 million tons of general waste to landfill, a third of which was generated by six metropolitan municipalities (Municipal Waste Sector Plan, 2010). Yet, only three-fifths of the population receive some form of domestic waste collection service (Stats SA, 2010).

Extending domestic waste collection services will undoubtedly place a strain on already stressed facilities, approximately 50% of which are not permitted and cannot be permitted because they are poorly designed and or maintained. The intention, however, is not to dispose any waste for which there is still a use, whether through re-use, recycling or energy recovery. Thus, the country is on the precipice of a waste revolution as efforts to couple current domestic waste services with initiatives to introduce waste re-use, recycling and recovery.

Sustainable waste management in the South African context is a meaningful convergence of sustainable development principles as the process of cleansing can yield income-generating opportunities as well as the environmental and social benefits of living in a clean environment.

Cleansing, however, focuses solely on post-consumerist waste whilst waste minimisation, which is the first rung of the waste management hierarchy, is concerned with production related waste. Reducing the quantity and toxicity of waste, is mainly addressed by the Cleaner Production Development Strategy and is a focus of the Green Economy Plan.

The objectives for sustainable waste management in the built environment are as follows:

- To maintain a litter free built environment as part of the contribution to 'clean and green' environments;
- To provide basic and sustainable domestic waste services to South African households;
- To promote the re-use and recycling of waste; and
- To divert organic waste from landfill.

The creation of decent work through waste collection and recycling and processing systems is another policy objective but is not addressed here as this is a focus of the Green Economy Plan.

National Target

The rate of domestic waste collection services is set to improve as a 75% delivery target has been agreed in the Presidential Agreement, Outcome 9.

South Africa is on the precipice
of a waste revolution



In 2006/07 alone, South Africa disposed 24 million tons of general waste to landfill, a third of which was generated by six metropolitan municipalities (Municipal Waste Sector Plan, 2010).

3.6.1 To maintain a litter free built environment

The 2010 FIFA World Cup Soccer™ inspired the cleansing of areas in and around the stadia and popular public areas as part of the cleaning and greening campaign. These clean ups boosted morale and the commitment to clean public areas has been captured in DCOG Draft Strategy Framework for Clean Cities and Towns: 2010 and Beyond and the development of a national anti-littering awareness campaign, Make Mzantsi Beautiful.

The rationale behind the campaign is that a radical shift in perceptions and attitudes is required in order to effect the required behaviour changes. This campaign is being spearheaded by the Department of Environmental Affairs, in conjunction with its Environmental Awareness Agency, Indalo Yethu. There are also provincial and local government initiatives in place with the same intention.

Apart from awareness-raising, the issue of littering needs to be properly regulated. To support municipalities in the management of litter, the Department of Environmental Affairs is in the process of developing a generic by-law which municipalities can adopt as an update of their existing by-laws or to use in its entirety where no by-law exists. The role of enforcement also becomes a major factor as the failure to enforce by-laws allows the behaviour to persist and flourish. The designation of Environmental Management Inspectors at a local level as advocated by the NWMS will hopefully support the strengthening of compliance monitoring and enforcement of environmental laws, regulations and by-laws.



3.6.2 Provision of domestic waste collection services

Refuse removal services, which are termed in this framework as domestic waste collection services, are now recognised through the National Policy for the Provision of Basic Refuse Removal Services to Indigent Households as an essential basic service, alongside water and electricity. A target of 75% of South African households to receive this service by 2014 has been set in the Presidential Agreement: Outcome 9, which equates to the provision of domestic waste collection services to 1,650,000 households.

This target is supported by the development of a national standard to guide the provision of waste services, National Domestic Waste Collection Standards, and promotes a practical approach to waste service delivery (the collection method must mirror the physical conditions to which the service is being applied) and the National Policy for the Provision of Basic Refuse Removal Services to Indigent Households. There is ample opportunity here for job creation and through the EPWP programme, two different collection methods have been piloted and are likely to be widely deployed in the roll-out of waste services. The first is a community-based SME collection system and the second is a 'food-for-waste' system. EPWP projects are both labour-intensive and address poverty alleviation in addition to providing a much needed basic service.

3.6.3 Promote the re-use and recycling of waste

There are two components to waste minimization, which entails the application of first four stages of the waste hierarchy. The achievement of waste avoidance and reduction are integral to industrial development and concern how goods are designed and manufactured. Design can influence the quantity of disposable waste once a product has fulfilled its intended purpose (such as packaging waste). It can also influence re-use of a product and ease with which it can be disassembled into its individual parts either for individual re-use or recycling. Furthermore manufacturing releases waste products and according to estimations, 94% of all raw materials used in production become waste products and only 6% form part of the product. Through cleaner production methods, which is the subject of the National Cleaner Production Strategy, both the quantity and toxicity of waste can be reduced. These issues are, however, not a focus of this framework as they are dealt with by the Green Economy Plan.

The second and third tiers of the hierarchy involves the re-use and recycling of waste and the aim is to accelerate the rates of collection of general (typically packaging) recyclable waste (e.g. waste that is not harmful to human health or the environment) through one of two possible interventions, both of which require separation at source, which means household separate recycle waste from non-recyclable waste.

Intervention: Household recycling

The first intervention involves the door-to-door collection of recyclable materials that have been cleaned and placed into one clear bag. These are then taken to a clean material recovery facility and sorted into the different waste materials and sold.

Intervention: Buy-back centres

The second intervention requires the transportation of recyclable waste by individual households or small scale collectors to buy-back centres where they are remunerated. This intervention works well in poor, less dense areas where individual households generate limited quantities of recyclable waste compared to higher income households.

The funding of this infrastructure and recycling waste collection systems will be a combination of municipalities and industry as the generators of the waste, with potential financial support from existing funds such as Buyisa-e-Bag.

The National Waste Management Strategy recommends a country-wide infrastructure to facilitate the collection of recyclable wastes. The creation of markets for the recyclable waste so that supply does not exceed demand would be the concern of the Green Economy Plan.

It does not address the safe disposal of larger bulkier goods such as white goods and electronic goods, nor the safe disposal of CFLs, which are strongly promoted for their energy efficiency properties yet cannot be landfilled with general waste due to their mercury content. These are and will be subject to Extended Producer Responsibility schemes provided for by both the Waste Act and the Consumer Protection Act. Improved regulation of disposal practices is also being provided for by the draft standard for disposal of waste to landfill.

3.6.4 Divert organic waste from landfill sites

It is estimated that 40% to 50% of general waste being sent to landfill is organic waste (comprising garden and food waste). This has the capacity to generate significant quantities of methane gas, a greenhouse gas with much greater heating potential than carbon dioxide.

Intervention : Composting on-site

There is considerable scope for individual households and certain businesses, particularly in the hospitality industry, to compost their own organic waste and or for municipalities to establish composting projects.

A diversion strategy will be incumbent on municipalities as standards governing the disposal of waste to landfill are under development and are proposing a significant diversion target for garden waste. Composting projects are also being piloted in the Buyisela Ecotowns programme and the results will assist in the identification of the support required by municipalities in the establishment of composting facilities.



The management of waste is a sensitive issue – the presence of littering, illegal dumping and waste strewn across unserved communities acts as a metaphor for the lack of concern for the health and well being of communities or the environments they live in and depend on. By the same token, the promise of effective waste management stirs up excitement as the greening of waste management is able to address several challenges in one fell swoop: it can bring a negative environmental problem and associated health risks under control; it can create jobs; and it can create the sense that the built environment is well managed.

3.7 Sustainable Transport

Effective and efficient transport infrastructure and services are the glue that binds together the different facets of human existence. The negative effects of a dysfunctional transportation system are felt economically, socially and environmentally.

Since there are different forms of transport (maritime, air, land freight and land passenger transport) serving different purposes, the focus of this section is on land passenger transport in urban environments.

Land passenger transport covers all passenger movements from short distance urban transport to long distance inter-city, rural, and cross-border transport. It also addresses both public and private modes of travel for all purposes, whether commuting or other business-related travel, shopping, tourism, recreational and casual travel.

While the rate of private motorisation is on the increase in South Africa, public transport and non-motorised transportation are still the predominant forms of mobility for South Africans to access work, school and services. Mass motorization is not a practical goal in light of both the cost of private transportation, which is set to increase with the price of fuel, and the environmental impact. South African transport is responsible for 16% of CO₂ emissions (UNEP 2009:33). This is exacerbated by traffic congestion, which is a direct result of roads surpassing their carrying capacity. The problem is most acute in the cities and along the main thoroughfares connecting the cities to residential areas.

The goal is to promote environmentally sustainable forms of land passenger transport, which are public transport and non-motorised transport, and ensuring an integration of the different modes at an acceptable level of service.



Land passenger transport encompasses all forms of public and private passenger movement on land, including the travel modes rail, bus, minibus-taxi, metered taxi, light delivery vehicles, private motor cars, motor cycles and bicycles as well as pedestrian movement.

The White Paper on National Transport Policy

Transport Statistics

- 38 million citizens live in households with no access to a car.
- 40 million citizens do not have a driver's license.
- 14 million learners walk to school, 7 million workers and learners use public transport.

National Household Travel Survey, 2003



South African transport is responsible
for 16% of CO₂ emissions (UNEP 2009:33).

Affordability is also a factor since transport is the second largest expense for South African households. Households spend more money on transport costs than they do on expenditure categories such as education, health (excluding medical aid premiums) and clothing and footwear (Stats-SA 2008).

Transportation has another strategic role to play in relation to land-use planning. Much of land passenger areas of economic activity, is due to the effects of Apartheid planning forcing people to commute long distances to reach work and educational facilities, especially secondary and tertiary facilities. Therefore integrated transportation planning is an important accompaniment to plans for urban regeneration and densification. The goal is to ensure that integrated modes of public transportation and non-motorised transportation are adequately factored in land-use planning. The mere requirement of reduced transport distances will have a positive impact on the environment and quality of life.

The objectives of sustainable land passenger transport should be:

- To promote non-motorised transportation;
- To promote the efficient use of energy resources;
- To promote sustainable forms of public transport;
- To promote green private transport.

3.7.1 Promote non-motorised transportation

The first objective in relation to the greening of transportation is the development of infrastructure for non-motorised transportation.

Decent NMT infrastructure is vital in any context where walking, cycling, motorcycling and the use of public transport are the predominant transport modes as is the case in South Africa. Whilst NMT infrastructure has

pronounced safety, socio-economic and environmental benefits, NMT infrastructure in South African cities is lacking as NMT has not been adequately included in traditional transport planning and walkways and cycle paths have generally been implemented as an afterthought or not at all.

Safety concern is one of the biggest drivers for NMT infrastructure in South Africa. In most instances, there are no dedicated walkways for pedestrians and this can become extremely dangerous for the walking commuter since accident statistics reveal that nearly half of accidents involve pedestrians.

Improved NMT infrastructure for short distance commutes (since it is not a replacement for vehicular transport but serves as a feeder to public transport routes) can alleviate traffic congestion in particular areas, which is a threat to productivity and climate change mitigation. The socio-economic benefits include the facilitation of affordable and safe modes of transport enabling the pursuit of healthy, social and productive ways of life. NMT is cost effective as it is more affordable for the end-user and the NMT infrastructure (such as walking paths, bicycle racks) costs far less than motorised transport infrastructure. NMT is an essential component of urban renewal and densification plans and an integral facet of multi-modal transport networks.

Non-Motorised Transport

This includes all forms of movement that do not rely on an engine or motor for mobility and all means of transport that are human powered (walking, animal-power and bicycling, and variants such as small-wheeled transport such as skates, skateboards, push scooters and hand carts and wheel-chair travel).

Public Transport Strategy NMT Target

100km of walkways and cycle ways in 18 cities and districts by 2014.



Shova Kalula Programme

A complimentary initiative to the Department of Transport's NMT is the Shova Kalula programme which has entailed the distribution of bicycles to learners. It was piloted over a three year period by the National Department and handed over to provinces for its roll-out.

Non-motorised transportation infrastructure is equally lacking in rural contexts but rural environments are not a focus of the National Greening Framework and therefore the requirements of these environments which rely on animal-drawn vehicles has not been included.

2010 FIFA World Cup™ NMT Legacy

Whilst the 2010 host cities were required to develop NMT masterplans, implementation was hamstrung by a lack of funding. As part of its commitment to ensuring a positive environmental legacy, the Department of Environmental Affairs has sourced funds that will be used to implement the plans in three cities as pilot demonstration legacy projects.



The NMT Policy creates a distinction between four different types of NMT which are walking, cycling, animal drawn vehicles and innovative NMT (small-wheeled transport such as skates, skateboards, push scooters and hand carts, and wheelchair travel). Each requires different types of planning, infrastructure, regulation, and technology. Whilst the Public Transport Strategy does not prescribe targets for innovative NMT, the inclusion of facilities for innovative NMT, particularly in open spaces designated for recreational use, is recommended.

Wheelchair access is also an important consideration and the National Land Transport Act (Section 8(1)(y)) enables the Minister to develop regulations relating to “requirements and time-frames for vehicles and facilities to be made accessible to persons with disabilities, including principles for accommodating such persons in the public transport system”. Therefore in the provision of NMT infrastructure, there will be a clear requirement to incorporate the needs of people with disabilities.

The roadmap to the roll-out of NMT infrastructure starts with the preparation of NMT plans by municipalities. These plans should form part of their Integrated Transport Plans and in turn, incorporated into their IDPs. This process requires adequate support to municipalities by both the national ministry and its provincial counterparts in the form of technical and financial assistance. Technical assistance will require the development of standards and guidelines. Financial assistance can be channelled to a Municipal Transport Fund, which municipalities are enabled to establish by the National Land Transport Act for the achievement of integrated public transport networks, of which NMT infrastructure would be a vital component. Both the Minister and MECs may contribute monies to these funds and this will partially support the fulfilment of the White Paper’s policy objective ‘to promote environmental protection and resource conservation’.

3.7.2 Promote sustainable forms of public transport

The Public Transport Strategy 2007 creates a vision for the revival of public transport through accelerated modal upgrading and the establishment of integrated rapid public transport networks. The former focuses on the transformation of bus, taxi and rail services delivery in the short to medium term whilst the latter provides for the first phase of networks of rail priority corridors and bus rapid transit corridors.

As a general statement, the achievement of the Public Transport Strategy will make a major contribution to the White Paper’s stated policy objective to ‘promote environmental protection and resource conservation’ coupled with the social and economic benefits of a public transport system that offers a high quality, efficient, reliable, safe, accessible and affordable range of services, some of which would be true competitive alternatives to privatised transport.

The early stages of its achievement of establishing an integrated rapid public transport networks are being witnessed in some of the metropolitan municipalities where significant investments in mega-transport projects have been made. These include Rea Vaya, which is Bus Rapid Transit (BRT) systems in the various metros, and in Gauteng, the introduction of a first class rail link between Johannesburg and Pretoria known as the Business Express as well as the Gautrain, which links particular high use destinations in the north, south and east of Gauteng as well as supporting transport infrastructure. Much of this investment is aimed at inducing the middle classes to utilise public transport, which is reflected in the high standard of service.

REAVAYA

GAUTRAIN

BUSINESS EXPRESS

Pushing the envelope

As part of its air abatement programme, the City of Johannesburg has opted to use Euro IV standard busses for its rapid transit system. This exceeds the current requirement for busses to comply with Euro II standards, which is considered standard technology and will not make a major contribution to an air abatement programme.



3.7.3 Promote the efficient use of energy resources

The National Energy Efficiency Strategy of South Africa has, as one of its target areas, the transport sector since it uses three-quarters of South Africa's petroleum products. Its Transport Programme includes the development of energy efficiency labels for new motor vehicles, which requires the development and implementation of emission standards for new vehicles as well as the inclusion of these standards in the roadworthiness certificate; and awareness and education on driving efficiently. The National Land Transport Act also prescribes that the Minister must put in place measures that will promote the efficient use of energy resources (Section 4(g)(v)) and promote public transport that operates efficiently in the use of resources (Section 4(h)(ii)).

Intervention: Green fleets

It is recommended that in the procurement of public transport fleets, municipalities are encouraged to comply with more stringent emission standards such as the Euro V standards for the sake of improved air quality. Furthermore, this should become regulation so this provision may be enforced. Enforcement of vehicle emissions standards is the responsibility of local authorities and provision for enforcement should be included in by-laws such as the City of Cape Town: Air Pollution Control By-law.

The greening of bus fleets throughout South Africa requires incentives from local authorities, a reduction in import duties for manufacturers, the development of local manufacturing capacity, tax reductions for operators and incentives linked to the earning of carbon credits.

Intervention: Clean fuels

Another method of addressing emissions from buses, as a major component of a public transport system, is the use of alternative, cleaner fuels. Diesel itself has been required to be 'cleaner' by reducing its sulphur content, which is important for improved air quality, but there are also options to use compressed natural gas (CNG) and liquefied petroleum gas (LPG) or biofuels. Food security should always be taken into account when

considering biofuels and it is best if this could be made from a non-food source such as algae or spent oil.

SANERI's Green Transport Programme

Biofuels are comprised of biodiesel and bio-ethanol. Biodiesel, which is produced from hydrocarbons, oils and fats contained in plants and animals, is an alternative fuel for conventional diesel powered vehicles. Bio-ethanol, which is an alcohol based fuel produced from starch or sugar in a wide variety of crops, is used mainly as an alternative to petrol.

Compressed Natural Gas (CNG) is produced by compressing natural gas to less than 1% of its volume. This gas is made up of methane gas which is by far the cleanest form of fossil fuel and is present where fossil fuel deposits are found. It can be used in any existing petrol vehicles and modified diesel engine.

Liquefied Petroleum Gas (LPG) is a low carbon emitting hydrocarbon fuel also used as an alternative transportation fuel in vehicles. It is a mixture of hydrocarbon gases primarily a mixture of propane and butane and is produced as a by-product during the extraction and refining stages of crude oil and natural gas.

Research into clean fuels vehicular transit is driven by the Green Transport Programme, which is part of the South African Energy Research Institute (SANERI). SANERI has assisted the City of Johannesburg's Transport Department to run a pilot project on a selection of buses testing bio-ethanol and CNG to establish the viability of green buses in South Africa.

Whilst buying an ethanol or CNG bus is not more costly than buying a bus dependent on fossil fuel for propulsion, they are more expensive to operate and without the required incentives from government, manufacturers will not bring the buses to South Africa as there is currently no demand for them.

Intervention: Driving efficiency

Driving efficiency also has a role to play in the reducing vehicle emissions. An excellent opportunity to enforce driving efficiency is through the regulations that the Minister of Transport or MECs are empowered to make through the National Land Transport Act for drivers of metered taxis (Section 66(4)(b)) and transporters of scholars, students, teachers and lecturers (Section 72(1)(b)). A course in driving efficiency can be prescribed as a special requirement although ideally it should be incorporated in all drivers' licenses. It would have the added benefit of safer driving as typically driving efficiency relies on slower, consistent travelling speeds.

3.7.4 Promoting greener forms of private transportation

Whilst strides are being made to promote public transport and green public transport, indications are that the number of private vehicles on the South African roads is not abating. According to Statistic South Africa's 2004 study on modes of transport, there were more than 7 million cars on South African roads with a consistent rise of approximately 200 000 vehicles per year as of 1998 and an annual growth rate of 2% p.a.

Reducing the reliance of private vehicles is part of the complexity of providing a public transport system that can provide the same degree of flexibility as a private vehicle can. The problem is also part aspirational as private vehicles are popular and desirable commodities.

Intervention: Green driving

Widespread awareness about green driving practice can reduce vehicle emissions and result in reduced fuel consumption. A Green Driving Code has been developed by the Green Cab and has been included in Appendix C. Inclusion of the principles of green driving practice would be best included in the Learners' License curriculum.

Intervention: Converting to clean fuels

Private vehicles can be converted to use CNG or LPG as a result of the outcomes of SANERI's Green Transport Programme, which has undertaken extensive research on and experimentation with clean fuels. and this has application to private vehicles as well. Whilst technically possible, two main issues still need to be addressed: the accessibility of these fuels and the conversion costs, which consumers may not be willing to bear.

Intervention: Energy efficient vehicles

Enabling the purchase of efficient vehicles is regulated through emission standards for vehicles, which are determined by the SABS 20083: Uniform provision concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirement. This standard is aligned to the European Emission Standards 2 (Euro 2), which defines the acceptable limits for exhaust emissions of new vehicles sold in European Union member states.

In other countries, Periodic Vehicle Testing (PVT) systems are put in place to test vehicle emissions and such as an approach may be considered in the development of an Integrated Vehicle Emissions Strategy once the 2003 Vehicle Emissions Strategy has been reviewed. This may also lead to the development of regulations requiring the current roadworthiness testing to include emissions testing.

Intervention: Economic & information instruments

Promoting the purchase of energy efficient vehicles is stimulated partly through economic instruments and partly through awareness-raising through energy efficient labeling. Economic instruments that may influence the purchase of vehicles with lower emissions include the ad valorem emissions tax rate related to the vehicles' emissions factor, which came into effect in 2010. Furthermore, the general fuel levy is lower for diesel powered vehicles. This is an incentive to purchase diesel powered vehicles, which are more fuel efficient than their petrol counterparts. The efficiency of cars is being made explicit through energy efficient labeling. At the point of sale, there is a requirement to display, in the windscreen area of the vehicle, the vehicle's fuel economy and carbon emission figures.

In conclusion, sustainable transportation is based on the goal of promoting green public transportation. This relies on significant improvements to and expansion of the existing infrastructure with the development and implementation of non-motorised transportation plans that are part of broader municipal public transportation plans. It also relies on improved public transport services, with higher levels of reliability, flexibility, safety and affordability and the use of fleets that are well maintained and ascribe to the highest emission standards possible. Green procurement applies to transportation as municipalities and fleet operators are encouraged to invest in fleets that produce low emissions. Where public transportation cannot meet the needs of individual commuters, standards as well as economic and information instruments can facilitate and promote the purchase of energy efficient vehicles with low emissions.



South Africa

3.8 Conclusion

The built environment is a heavy consumer of natural resources and produces high levels of carbon emissions due to its consumptive character. Furthermore, in South Africa, the built environment is characterised by inequities and spatial disparities as a result of historical planning practices and racially-informed allocation of resources.

Thus, the motivation for greening the built environment is not informed by any one single imperative but by a combination of drivers, including the correction of skewed patterns of development whilst ensuring that this is done without adverse impacts to the environment. Simultaneously, there is an obligation to reducing our overall greenhouse gas emissions as a response to climate change and its devastating effects. Greening of the built environment is synonymous with providing a liveable urban environment to all its inhabitants.

The chapter identifies the opportunities for greening of the built environment. The policy and legal environment, which forms the foundation of an appropriate regulatory response to greening the built environment, is advanced in individual sectors (integrated planning, energy, water, biodiversity, air quality, transportation). The greatest advancements have been made in relation to energy, which is a direct outcome of the energy crisis confronting the country, with the establishment of targets and incentives to reduce the amount of energy consumed and to diversify the energy mix. Similar developments are expected in relation to water, which have been initiated through the Department of Water Affairs' Strategic Framework for Water for Growth and Development.

The challenge in relation to the policy and legal environment is the lack of sufficient integration in spite of the requirement for integrated development planning at a local government level and the state of legislation to address spatial and land use planning. Greening the built environment will be promoted through the rationalisation of spatial and land use planning legislation.

The commitment to greening the built environment is also witnessed in government programmes to promote urban greening, clean environments and to ensure that inhabitants have access to clean water and energy.

The chapter illustrates the shortcomings in relation to greening of the built environment. It also alludes to the lack of enforcement of existing standards and regulations, and capacity problems particularly at the level of local government, which bears much of the responsibility for greening of the built environment. Stronger local government equipped with sufficient funding is thus a powerful and decisive move towards ensuring the greening of the built environment.



Appendix B contains a comprehensive guideline to assist in the greening development in the built environment