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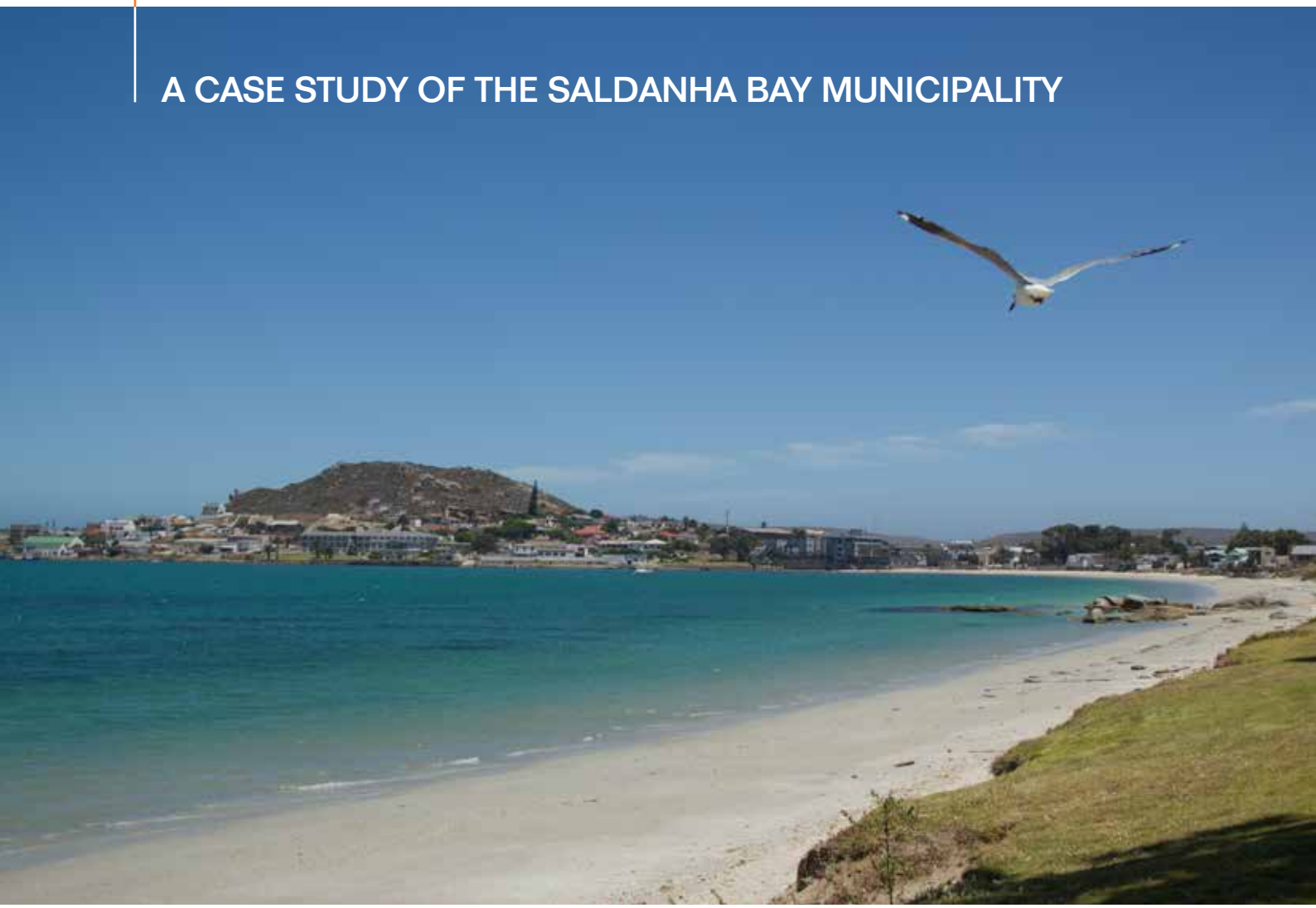
FINANCING THE TRANSITION TO A NEW INFRASTRUCTURE PARADIGM IN FAST-GROWING SECONDARY CITIES

in South Africa

A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY



ICLEI Local Governments for Sustainability

UN HABITAT FOR A BETTER URBAN FUTURE

mca urban and environmental planners

SALDANHA

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FINANCING THE TRANSITION TO A NEW INFRASTRUCTURE PARADIGM IN FAST-GROWING SECONDARY CITIES in South Africa

A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

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REPORT FOR:
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CONTENTS

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

Acronyms and abbreviations

EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GHG	Greenhouse Gas
IDZ/SEZ	Industrial Development Zone/Strategic Economic Zone
ICLEI	Local Governments for Sustainability
LED	Low Emission Development
LNG	Liquefied Natural Gas
MIG	Municipal Infrastructure Grant
MLP	Multi-Level Perspective
PDI	Previously Disadvantage Individual
SBM	Saldanha Bay Municipality
SEZ	Special Economic Zone
SUDS	Sustainable Urban Drainage Systems
TPA	Tonnes Per Annum
TNPA	Transnet National Ports Authority

UN-Habitat and ICLEI are implementing the Urban-LEDS Project in four countries (Brazil, India, Indonesia and South Africa). In each country they provide intensive assistance in developing and implementing low-emission urban development (LED) strategies to two "model cities", and a lesser level of assistance to several "satellite cities". An integral element of local-level LED strategies is how municipalities plan, procure, manage and operate their urban infrastructure.

List of figures

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

KEY RECOMMENDATIONS

Green infrastructure is a key component of the transition to increased municipal sustainability in South Africa. This is because green infrastructure offers an opportunity to negotiate the confluence of urban challenges facing the majority of metropolitan municipalities and secondary cities. This includes environmental, financial and institutional challenges that are increasingly complex in light of future uncertainty. This report uses Saldanha Bay Municipality (SBM) as a case study to ground and test this research as an area that offers the opportunity for green infrastructure interventions to address these issues. From the research undertaken, this report puts forward the following recommendations to improve and increase the adoption of green infrastructure for municipal services provision.

The recommendations are grouped into four focus areas, which include service planning and management; research and development; infrastructure funding and financing; and institutional reform and capacity building. These recommendations for all spheres of government are captured further (and in more detail) within the report. The focus of these recommendations is on the development of partnerships, increased dialogue and support networks. The list below draws out key recommendations for each of these focus areas.

Service planning and management recommendations

- There is a need to improve current services definitions to prioritise environmental considerations and to educate municipal officials, councilors and the public about the need for municipal sustainability and green infrastructure.
- That SBM consolidate partnerships with appropriate funders and support agencies in order to facilitate the planning, project design, project proposal development and implementation of a range of projects that pilot green approaches to infrastructure as outlined in this document.
- That National Treasury is to be approached to explore how the requirements of the supply chain management process can be adapted to enable municipalities to adopt green approaches.
- That SALGA, SACN or another appropriate government agency is to be approached to partner with ICLEI to prepare a set of green infrastructure guidelines for municipalities, contractors and communities.

Research and development recommendations

- There is a lack of local data and data applicable to the Global South that increases the risk of green infrastructure unnecessarily. SBM should establish a partnership with local universities to undertake detailed research into green infrastructure pilot projects in the municipality.
- That ICLEI facilitate the creation of a research and development partnership involving the Institute of Municipal Engineers of South Africa (IMESA), appropriate university departments and research organisations, other professional associations and major infrastructure contractors to promote research geared to the adoption of green approaches to the provision of municipal infrastructure services.

Infrastructure funding and financing recommendations

- That SBM prepare long-term financial plans for investments that includes its financial requirements for green infrastructure and the options for funding this that are potentially available.
- The SBM develops bankable business plans, for selected green infrastructure projects through accessing the project preparation facilities of DBSA, EIB, USAID and other donor funding agencies.
- That DCOG and NT be approached to create a specific window in the current municipal infrastructure grant architecture with a view to incentivising the more proactive provision of green infrastructure.
- NT should mobilise resources for LED through establishing a green infrastructure bond.

Institutional reform and capacity building recommendations

- That SBM establish an Infrastructure Planning Forum to address infrastructure planning, funding and operations (including maintenance). This Forum should include SBM, PGWC, SB IDZ and TNPA as core members but should also involve other relevant government departments and agencies and major private investors as required.
- That SALGA or IMESA be canvassed regarding supporting the establishment of a green infrastructure learning network involving all municipalities that have or wish to implement green infrastructure options.

Photo credit: Grace Stead

INTRODUCTION

Secondary cities play an important role in the transition toward global and local sustainability. This is due to their functional and economic importance as local service centres and hubs of fast-growing populations. The infrastructure needed to support the economy and residents in these cities strongly influences the ability of the municipality to be on a path of sustainable development and livelihoods. The nature of this infrastructure also has significant implications for their ongoing maintenance and operations budgets and for their ability to reduce resource consumption, reduce emissions and develop resilience to climate-related impacts.

In many municipalities, especially smaller municipalities, grant funding plays a significant role in their capital expenditure and building infrastructure necessary for sufficient levels of service provision. Except for the well-endowed metropolitan municipalities in SA, infrastructure investment is driven mainly by general and sector specific grants. Further, conditions attached to these grants have shaped the urban form and infrastructure priorities. The largest of these grants, the Municipal Infrastructure Grant (MIG) is currently under review by National Treasury and is a key financing mechanism analysed in this report.

Given that individual municipalities are unable to meet their expenditure mandates with existing revenue sources, the dependence on grants will continue to support infrastructure investment – particularly targeting infrastructure backlogs for the poor. Initial recommendations at this stage are focused on addressing horizontal imbalances, introducing a focus on infrastructure rehabilitation and better grant coordination. At the same time these grants are insufficient to address infrastructure challenges, and new financial instruments are required. Given the investment context as well as the resource constraints, opportunities exist in Saldanha to: (i) leverage the private investment resources for climate resilient infrastructure investment; and (ii) make recommendations on the MIG review to include criteria for greening/climate resilience, and financial innovation.

The aim of this report is to broadly frame municipal sustainability in terms of fast-growing secondary cities in South Africa and understand the important role of green infrastructure in enabling this. This includes a case study of the Saldanha Bay Municipality (SBM) to determine how the municipality could utilise grant funding and other financing mechanisms to green their infrastructure, reduce emissions and develop climate resilience whilst contributing to the long-term sustainable development of the area. It is intended that this report be used as a tool and platform to engage more deeply with relevant stakeholders and other municipalities to enable the process of greening infrastructure and service provision across South Africa.

Structure of report

This report has made use of desktop studies of existing information and interviews with a variety of relevant stakeholders including officials in the Saldanha Bay Municipality and the City of Cape Town, the Western Cape Department of Environmental Affairs and Development Planning, National Treasury, Green Cape and the Urban Water Group at the University of Cape Town. A presentation based on the work in this report was used as a basis for discussion in these interviews and meetings. This can be seen in Annexure 1. This has afforded the opportunity to learn from those working in the Saldanha Bay Municipality and, where possible, to build on existing and current studies being undertaken in the area.

The report is structured so that the chapters build on from one another. This report begins by framing municipal sustainability, the role of municipalities within broader systems of governance and the current grant and funding regime for municipal infrastructure. Bringing these aspects together leads to this report focusing on municipal infrastructure and the need for the implementation of green infrastructure approaches. The report offers a definition of green infrastructure and its implementation through three broad categories of intervention, which include biological, mechanical and behavioural. For this new infrastructure paradigm four main transition areas

are discussed and used to frame intervention and the recommendations. These areas are services, technological, institutional and funding.

The report then focuses on the Saldanha Bay Municipality (SBM) as a case study. This includes a contextual analysis of the history of growth in Saldanha Bay, current expectations and related impacts. When applying the concept of municipal sustainability to SBM, certain gaps and/or conundrums are identified. It is these conundrums that need to be addressed through innovation in the transition areas mentioned above. This report then looks to understand how green infrastructure as a new services provision paradigm can be implemented in SBM to enable increasing municipal sustainability. Firstly, this section looks at broader municipal governance structures that can be put in place to navigate this transition across all departments and in all spheres of municipal activity. Secondly, more specific project-based interventions are explored to understand ways to implement green infrastructure within the water services infrastructure, waste infrastructure and street lighting in the short, medium and long term.

This report then concludes by offering a way forward for the transition to municipal sustainability, both as it pertains to SBM and other government and private actors. This essential section looks to opportunities for further dialogue, discussion and project implementation using this report as a platform and point of departure for engagement. The aim is that the questions and ideas raised in this report are discussed further with relevant role players to begin the transition to this new infrastructure paradigm. It is through these partnerships and collaborations that it will be possible to enable increasing municipal sustainability to improve livelihoods and to return to a symbiotic relationship with the environment and supporting ecological systems.

Photo credit: Grace Stead

THE NEED FOR MUNICIPAL SUSTAINABILITY IN SECONDARY CITIES

"Because the majority of the world's population now lives in cities and because cities are where most resource consumption takes place, the pressures and potentials to find ways to reconcile economic growth, well-being and the sustainable use of natural resources will be greatest in cities." – UNEP, 2013:14

Secondary cities[1] are essential elements of local, regional and national economies and systems. They support their rural and agricultural hinterlands through the provision of social and economic services and provide links to primary, metropolitan areas (SACN, 2012). When functioning well, these urban areas also offer employment and education opportunities that attract those who might have otherwise moved to larger urban areas; thereby reducing the pressure of migration on metropolitan municipalities. At present, secondary cities in Sub-Saharan Africa are growing fast, in population and economically, and, at times, at a greater rate than their metropolitan counterparts (Roberts, 2014). If the growth of secondary cities is to follow that of larger urban centres, this growth will result in exponentially increasing resource use and environmental degradation due to inefficient, linear patterns of consumption. These secondary cities are, most often, largely unprepared for this level of growth and require large investments in infrastructure and capacity building to provide the necessary services while supporting ongoing economic growth (SAICE, 2006). In addition to this, secondary cities also have a lower rates base to draw from which can result in making the provision and maintenance of this infrastructure out of reach financially. As a result, the cost of infrastructure provision may be passed on to consumers who find it increasingly difficult to pay for these services (National Treasury, 2012). This, in turn, can result in an increase in the number of indigent households thereby increasing the burden of support on the municipality and reducing their rates base further – a potentially vicious cycle of growth. Engaging with, and intervening in, secondary cities before or during large growth spurts offers the opportunity to decouple resource consumption from growth while offering the opportunity to locate urban development within the context environmental stewardship, ecological limits and possible regenerative capabilities.

It is important to note that these ecological limits to our resource consumption are becoming increasingly constrained due to the effects of climate change. In particular, on the west coast of South Africa, climate change is expected to result in higher temperatures with associated higher rates of evaporation, lower rainfall and greater frequency of extreme events (Western Cape Government, 2015). This has the potential to severely deplete the already stressed resource base, especially water, which could further undermine food security and economic growth. These changes in the climate will occur in conjunction with an expected sea level rise and associated storm surge that could undermine the functioning of municipal infrastructure systems in coastal towns.

There is a growing urgency to make these changes in secondary cities to place them on more sustainable growth and development paths. In addition to institutional and financial sustainability, ICLEI puts forward that municipal sustainability is based on increasing resilience, decreasing carbon emissions, improving resource efficiency and productivity with a shifting mobility profile to non-motorised and public transport systems (ICLEI, 2015). To enable a successful transition to municipal sustainability, Pieterse (2011: 312) states that, "the three critical meta domains of urban transition [sustainable infrastructure, the inclusive economy and efficient spatial form, glued by processes of democratic political decision-making] need to be pursued simultaneously". This framework is represented in Figure 1 below, with this report and study focusing specifically on the role of the bio-technical aspect of the infrastructure operating system within an understanding of broader municipal (urban) sustainability. This is because the provision of municipal infrastructure for services provision, which supports the economy and residents, is vital to ensuring the ongoing sustainability of the municipality and to enabling sustainable choices by residents, businesses and industry.

[1] The term 'secondary cities' in this report refers to (Class B) local municipalities as a whole. Secondary cities do not have an agreed definition but are often defined by population size, urban hierarchy and regional contexts, and economic and social structure (SACN, 2012 and Storey, 2014).

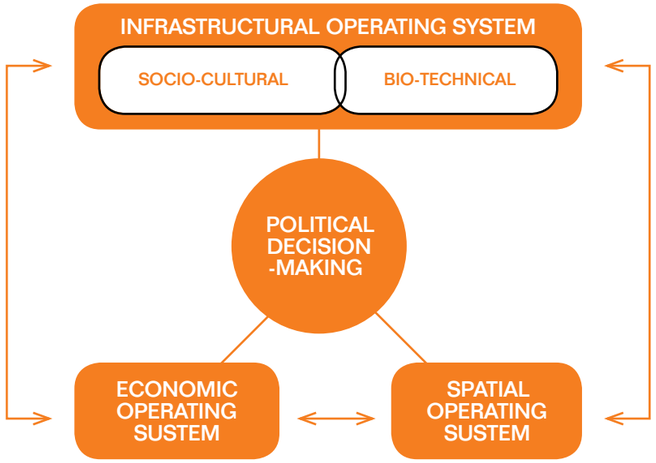


Figure 1: Framework for urban sustainability

Source: Pieterse, 2011: 313

The role of the municipality and municipal infrastructure

The municipality exists within a broader system of influence and governance, from the individual to the global scale. As illustrated in Figure 2 below, the municipality is a key interface between policy (from a global and national scale) and implementation. This is the level at which systems of delivery can be structured to enable innovation and transition at the local level. It is at this systems level that changes to the infrastructure needed to support the city, neighbourhoods, households and individuals can take advantage of the economies of this scale for improved resource and financial efficiencies. Intervention for municipal sustainability at this systems level also allows communities, households and individuals to make more ecologically beneficial choices, thereby multiplying its impact.

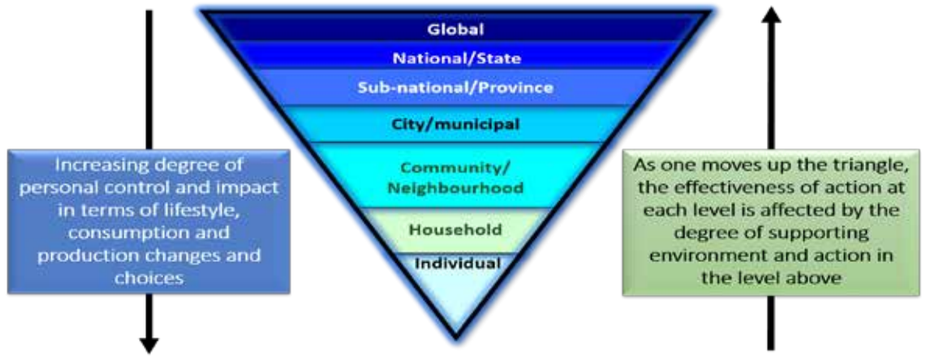


Figure 2: The Sustainability Complex - working across scales for role-player coordination

Source: Matthew Cullinan, MCA Planners

Municipal infrastructure is defined in broad terms as "the capital works required to provide municipal services. It includes all the activities necessary to ensure that the works are delivered effectively, such as feasibility studies, project planning and capacity building to establish sound operational arrangements for the works." (CoGTA, 2013: 10). The focus of this report is on the provision of bulk infrastructure services. The Department of Cooperative Government and Traditional Affairs (2004:7) states that municipal infrastructure includes the immovable infrastructure that the municipality is mandated to provide for the following basic services to all residents:

- Electricity
- Water supply
- Sanitation
- Stormwater management
- Municipal roads
- Refuse removal and solid waste management
- Street lighting

Infrastructure supports quality of life and the economy when reliable and accessible service provision meets the needs of individuals, industry and institutions. This means that service provision must be sustainable because, while the infrastructure will continue to exist (e.g. pipes, the electricity grid), without operational management and maintenance the service will discontinue (e.g. no water will flow or electricity be transmitted).

Municipal infrastructure management concerns the full delivery of a sustainable and reliable service to the public. This includes not only the construction of infrastructure but also the ongoing operation and appropriate maintenance[2] of facilities and systems. This also includes the ongoing management and maintenance of aging infrastructure which continues to require capacity, resources and financial support. Infrastructure management must take into consideration the capital, operational and maintenance costs of an asset throughout its expected life cycle and must be justified in relation to the cost of service provision. This should be budgeted for and best value for money over the full life cycle must be realised. The management of infrastructure can be used as a tool to improve service delivery and to create employment opportunities thereby supporting livelihoods and the economy.

However, the provision of infrastructure cannot continue as before. Traditional approaches of municipal/utility infrastructure provision contributes very little to address the environmental challenges of our time, including the critical need to reduce emissions. There is growing recognition that a new paradigm for addressing such infrastructure is required. Bloomberg New Energy Finance founder Michael Liebreich describes the paradigm as moving "from a centralised, fossil-based, analogue, geopolitically risky system to one which will be cleaner, more decentralised, local, smart and less exposed"[3]. This suggests that the very basis for our thinking with regard to infrastructure systems and how they are organised and managed is being disrupted by new requirements, by new technology and by new ways of doing things – borne of necessity and opportunity. This shift also has profound implications for municipal organisation, management and financial modelling in regard to providing municipal infrastructure.

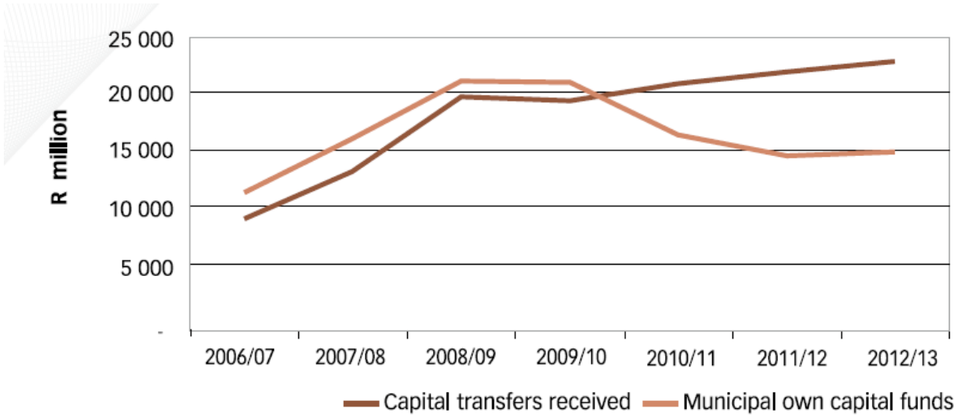
The role of grant funding

While municipalities raise the bulk of revenue from their own sources, around 80% on average across the country, grant funding continues to play a major role in addressing the backlogs in infrastructure investment and the provision of free basic services for the poor. Recurrent cost pressures on municipalities to finance basic services for increasing urban populations, rising input costs as well as institutional costs, has resulted in lower municipal contributions for capital investment. For non-metropolitan municipalities, the dependence on national and provincial grants is more significant, given the low tax base.

[2] Maintenance is used as a generic term to include planned maintenance, repair, refurbishment and renewal, and provision for replacement of the infrastructure." *(http://www.cidb.org.za/Documents/KC/cidb_Publications/Ind_Reps_Other/ind_reps_nims.pdf)*

[3] Quoted in "Peering into the future of the electricity sector", Dirk DeVos, Daily Maverick, 28 Sep 2015

FINANCING OF CAPITAL EXPENDITURE: OWN FUNDS VS. GRANTS



Source: National Treasury Intergovernmental Financial Revenue, 2010

Current grant regime

The current grant framework consolidates the previous system of amorphous inter-governmental grants, and is designed primarily to address constitutional requirements. The key principles that underpin the intergovernmental grant frameworks for municipalities include the following:

- Providing the basic services outlined in the constitution (described in Schedule 4b and 5b) to all citizens.
- Addressing vertical imbalances - financing the deficit between local fiscal capacity and expenditure assignment for basic services.
- Limiting the financing to:
    - financing a package of basic services for indigent households,
    - increasing the access to basic services for poor households, and
    - addressing the backlogs in infrastructure.

The grants are primarily divided into three broad components:

- **Unconditional Local Government Equitable Share** intended to redistribute funds from the national fiscus to balance the inequitable fiscal capacities of municipalities. National Treasury argues that the aim is to subsidise the cost of providing basic services to poor households, and to contribute to the funding of core administrative functions. In addition, there is the Regional Services Council (RSC) levies replacement grant. This is an unconditional grant to metropolitan and district municipalities to replace the (pre-2006) RSC levy or Joint Services Board (JSB) levies.
- **Conditional Grants** to finance new infrastructure and, more recently, to assist with refurbishing infrastructure. The largest of these include the Municipal Infrastructure Grant (MIG), followed by a range of sector grants for human settlement development, public transport, electrification and so on. These also include the distribution of fuel levies introduced in 2009 to assist with the financing of metropolitan municipal spending on public transport.
- **Capacity Grants** that include National Treasury's municipal finance support grant and various sector related capacity grants. In addition SETAs provide support for approved training programmes.

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

Issues and challenges identified

Despite the success in financing backlogs in municipal infrastructure over the last 20 years, a number of challenges continue to affect municipalities. The more recent trend has included a proliferation of specific grants to finance objectives of line departments. Stakeholders in the recent review of the MIG have identified a number of issues. These include the following:

1. Municipalities have raised concerns over the different processes and methodologies utilised by the sector departments – making the integration of the grants at a local level difficult. A consolidated grant with different sector objectives will increase the flexibility at the local level.
2. A related issue relates to the various requirements of the different grants that increase the transaction costs associated with managing different M&E requirements.
3. The nationally defined criteria are inconsistent with local needs, making it difficult to link grant criteria with the municipal IDPs. This is true particularly for the grants managed by line departments.
4. Need for greater flexibility to utilise the grants to address local infrastructure challenges – these include upgrading of old bulk systems as opposed to extending services, maintenance/rehabilitation vs. new infrastructure in poor communities, focusing on densification and urbanisation, etc.
5. Co-requirements such as matching funding also reduce the flexibility – forcing the alignment with national priorities.
6. Need for additional capacity to address planning, sustainability and raising alternate finance. The latter also raised the need to address the enabling conditions to increase private loan finance.
7. Creating enabling conditions to raise private resources, through streamlined partnerships agreements, to finance long-term infrastructure projects. This is particularly critical for green infrastructure where upfront capital requirements are higher, and payback periods are longer. The MTEF grant framework provides limited funding for major infrastructure projects.
8. Accounting for depreciation of grant-funded assets is a pressing funding issue that needs to be addressed for municipal infrastructure funding to be sustainable.
9. A critical challenge in the infrastructure system is criteria for (a) ensuring that bulk infrastructure can adequately support the existing economic needs, and (b) providing for future economic growth.

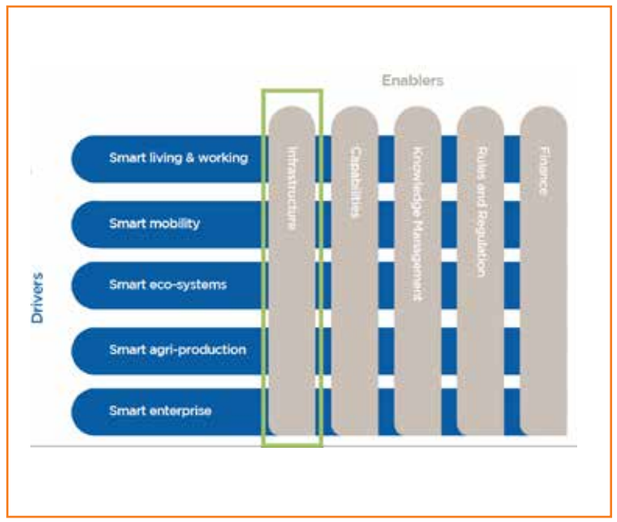
Recommendations for reforming the current infrastructure grants have been highlighted in the 2015 Medium Term Budget Policy Statement. These include "changing the structure of grants to increase differentiation between types of municipality, while also reducing grant proliferation; improving asset management over the lifespan of municipal infrastructure; and improving national support and oversight of grants. The recommendations focus primarily on increasing the efficiency of the existing grant system. The restructuring outlines incentives to encourage investment in infrastructure maintenance and refurbishment. While the refurbishment will address infrastructure leakages, with the exception of clean energy programme and public transport grants, there is no focus on providing incentives for green infrastructure. The life cycle approach focuses on asset management, and not the resource utilisation, emission levels or life cycle costing. The review excludes incentivising procurement of resource efficient infrastructure projects – particularly the need to smooth the additional upfront costs and longer term pay back periods. Further, while the review focuses on the impact of grants on private finance, it does not expressly look at enabling conditions for municipalities to increase private finance.

The role of green infrastructure

The concept of green infrastructure has been developed to address ways in which service provision needs can be met while protecting and enhancing valuable ecological systems for improved municipal sustainability. The implementation of green infrastructure is considered an international commitment by ICLEI, and associated municipalities, through the adoption of the Durban Adaptation Charter for Local Governments. More specifically, this is stated in *Clause 6: Prioritise the role of functioning ecosystems as core municipal green infrastructure:*

> *"We will ensure that sustainable management, conservation and restoration of ecosystems and the related ecosystem services are used to enable citizens to adapt to the impacts of climate change, which is known as Ecosystem-based Adaptation (EBA). We will strive to maintain and, enhance resilience and reduce the vulnerability of ecosystems and people to the adverse impacts of climate change."*

In South Africa, green infrastructure is understood to support and enable the green economy[4] (Agbemabiese, 2011). This is also noted in the Western Cape's Green Economy Strategy of 2013, as seen in Figure 3 below. It is seen as necessary for the economy's continued growth both as a job creation mechanism in the construction and ongoing maintenance of infrastructure and for improved, environmentally sound service provision. The value of green infrastructure comes to the fore with an understanding that the natural environment supports society and the economy. As discussed in the National Strategy for Sustainable Development (2011), shown in Figure 4 below, these exist within a nested system where the environment and related ecosystem services form the foundation upon which society flourishes and, in turn, the economy prospers.



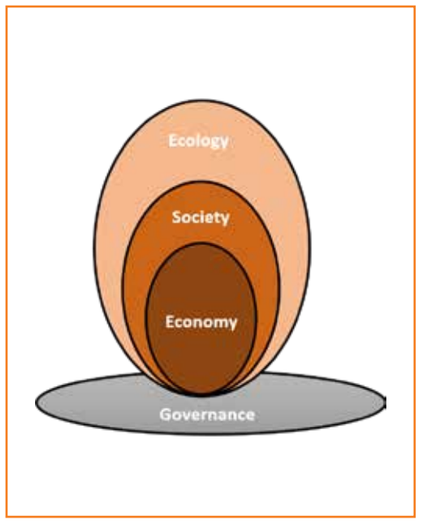


Figure 3 (left): Western Cape Green Economy Drivers and Enablers. Infrastructure highlighted as the enabler that is focused on.
Source: (Western Cape, 2013)

Figure 4 (right): Framework for Sustainable Development in South Africa.
Source: (DEA, 2011)

[4] As the UNEP's Green Economy Report 2010 puts it: "In a green economy, growth in income and employment should be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services."

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

Defining green infrastructure

For the purposes of this paper, green infrastructure is defined as:

> *"Climate resilient infrastructure systems that, all along their life cycle, minimise carbon emission, pollution, the use of energy and natural resources (soil, land, water, and biodiversity) and maximise the provision of services through the protection and restoration of ecosystems" (Giordano, 2013: 4).*

This definition, in particular, speaks to the need for infrastructure projects to include an understanding of resilience and life cycle costing. Resilience is defined as that which is able to absorb short-term shocks and the ability to self-organise to adapt to long-term stress (Walker et.al. 2004). Green infrastructure, according to this definition, would seek to support local resilience rather than erode it. The inclusion of life cycle costing of infrastructure requires that the construction, management, maintenance and decommissioning costs and impacts of the project are considered. This requires long-term and integrated planning and includes the possibility of future funding opportunities, and the savings experienced by utilising more climate-risk resilient services, e.g. not having to replace infrastructure after every severe storm event.

This definition is broad and allows for a variety of ways to implement green infrastructure. This includes:

- **Biological** (also referred to as ecological infrastructure): Utilising local ecological systems and the ecosystem services[5] they provide to complement, supplement or replace the use of grey infrastructure (man-made, mechanical systems) for municipal service provision. This requires interdisciplinary practice and involvement from multiple stakeholders to allow for the achievement of multiple outcomes from a single intervention (Bobbins, 2015). In an urban area, Kambites and Owen (2006) define ecological infrastructure as the "connected network of multi-functional, predominately unbuilt, space that supports both ecological and social activities and processes". An example of this is the development of an integrated stormwater management system that utilises vegetated channels, wetlands and well-managed river courses that also reduces the urban heat island effect while providing public open space to be used by the community. For more information on biological infrastructure, see Annexure 2.
- **Mechanical**: The use of mechanical systems that are designed or retrofitted to reduce resource consumption and reduce emissions (greenhouse gases and pollution). This can include fitting filters to exhaust pipes; using renewable energy source such as solar or wind; upgrading the pumps for improved water and energy efficiency at water and wastewater treatment plants.
- **Behavioural**: The use of demand-side management strategies and regulation to reduce resource consumption to ensure on-going availability of resources and to reduce the need for more expensive infrastructure. For example, this could be through education and awareness initiatives to teach residents how to lower their energy and water use and to separate at source to recycle. Behavioural changes could also be possible in the commuting and purchasing choices that are made, i.e. using public rather than private transport and buying locally sourced, organic, fair trade products. Behavioural interventions can also require changes in municipal institutional behaviour such as how a department or multiple departments operate, co-ordinate or integrate.

These approaches cannot exist in isolation and many situations would require a hybrid and context specific approach (which could include elements of grey infrastructure) to maximise local benefits.

[5] This includes a variety of regulatory, provisioning, supporting and cultural services that are provided by nature to the benefit of people and the economy. For more information go to: *http://www.teebweb.org/resources/ecosystem-services/*

FRAMING THE SOCIO-TECHNICAL TRANSITION TO MUNICIPAL SUSTAINABILITY

The challenge is matching the demand for infrastructure services with the ability of the municipality to supply such infrastructure and the associated services on a basis that is sustainable and affordable. This challenge is reflected in Figure 5 below.

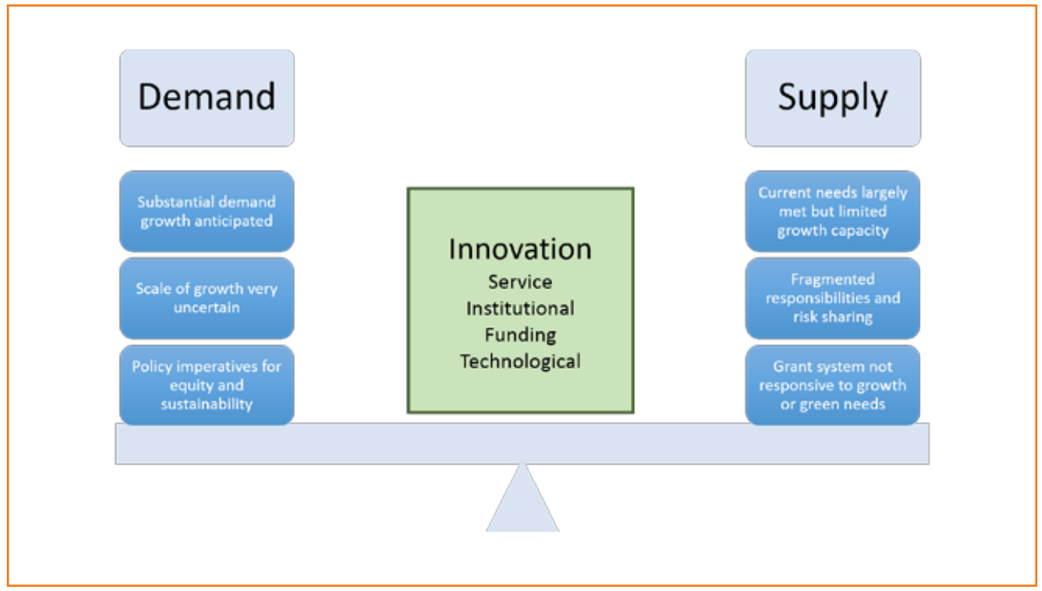


Figure 5: Matching demand and supply challenges through innovation.
Source: MCA planners

The core argument of this report is that substantial innovation is required (in how the services required, deployment of infrastructure technologies, institutional arrangements for managing infrastructure services and funding arrangements are framed). This is to ensure that sustainable and affordable provision meets the requirements of society, the economy and the environment.

Innovative green infrastructure solutions in the water provision system (which includes sanitation and waste-water management), energy provision and waste management (including managing industrial waste) should be an important part of the municipal infrastructure strategy going forward, not only because they help reduce the negative environmental impacts of municipal infrastructure services but also because they help resolve key municipal infrastructure challenges highlighted in the discussion on infrastructure conundrums.

This report highlights four major areas of innovation that are required to resolve the infrastructure conundrums facing municipalities.

Reframing service delivery and the service delivery contract.

A particular understanding of municipal infrastructure services has evolved over time and a "standard" regarding what residents and businesses or organisations should expect in an urban municipality setting has become established globally, such as tarred roads with engineered stormwater systems and traffic management mechanisms, water-borne sanitation and so on.

These "standards" are now often an obstacle to greener and sustainable infrastructure solutions and are being increasingly scrutinised globally. One critical element of a greener approach to infrastructure therefore lies in reframing the services and service standards that a municipality should provide and the respective roles and responsibilities of both the service user and the municipality. There is scope in relation to most household services to do this. Such reframing of the service and related obligations can address both the demand side (facilitating better demand management) and the supply side (privileging ecosystem and green supply options).

For example, the provision of scarce electricity and water resources should also involve the responsibility of households over time to invest in energy and water saving behavior changes and technologies. With regard to waste, service users should and, doubtless will, progressively be required to separate their waste (to facilitate recycling) and to reduce the volume of waste produced. The municipality can use its electricity, water and waste tariffs to penalise excessive use but there are many other approaches to facilitate the required behavior changes. The municipality at the same time relies on revenue from these services to fund the infrastructure and to cross-subsidise other non-tariff services. This dilemma has to be managed.

Technology innovation

The field of infrastructure services is currently experiencing extensive technological innovation in a range of areas in order to improve efficiencies, to customise services to individual needs and to reduce the environmental impact of services. Many of these innovations relate to smart ICT-based technologies but also include biological and chemical processes and so on. However, there are often challenges to adopting new technologies. The lack of long-term data about their performance over time and the long-term cost implications, for example, increases the risk of investments in such infrastructure solutions. They also often have different infrastructure management or operating skills requirements that serve to make adopting new technologies least attractive. The innovation challenge is thus complex. A forward thinking municipality will seek to manage this challenge by optimising the management of its current infrastructure portfolio while incrementally introducing new technology where appropriate in order to build a capacity for change and adaptation.

Refining institutional arrangements

There is a complexity of infrastructure provision in a municipality that has an IDZ/SEZ, a port and major industries as such a municipalit requires high levels of multi-stakeholder planning, management and operational co-ordination that few South African municipalities have been able to achieve. This is one important area requiring institutional innovation.

Another avenue involves greater participation by households, communities and developers in the provision of infrastructure to reduce the provision requirement that currently resides with the municipality. There is considerable potential to do this in the energy and water sector. For example, major industries in SBM have already indicated that they need to establish private in-house gas-powered electricity generation capacity that will reduce the public provision requirement. They have detailed plans in this regard and simply require regulatory obstacles to be overcome. Similarly, household and business investments in decentralised infrastructure services that do not require connection to the service network or grid, both potentially reduce the demand on the municipality to deliver such services and hence the requirement for extending infrastructure networks. However these create new challenges, potentially undermine the viability of existing infrastructure and require increased regulatory capacity at municipal level to ensure that such private services comply with required standards.

Expanding funding and financing menu

Typically South African municipalities have funded any expansion in their water, electricity and waste infrastructure (all of which have a potential revenue stream via tariff) by means of loan finance. This capital cost is recovered through the tariff over time. The infrastructure grant and equitable share allocations are meant to address the shortfalls in this model due to indigent residents who are unable to afford a full cost reflective tariff. There are limitations to this model going forward as already outlined. There is a critical need to expand the menu of municipal infrastructure funding and financing options. One avenue involves amendments to the grant infrastructure to reduce the risk to the municipality of proactive and green investments in infrastructure. Other options relate to finding ways to secure private sector infrastructure financing for green infrastructure solutions.

Photo credit: Grace Stead

SALDANHA BAY MUNICIPALITY AS A CASE STUDY FOR URBAN SUSTAINABILITY

Saldanha Bay Municipality (SBM) is situated on the West Coast of the Western Cape Province, as seen in Figure 6, about 140 km north-west of Cape Town. The municipality is governed by the Saldanha Bay Municipality and covers an area of 2 015 square km, with 238 km of coastline. With an estimated population of 107 000 people, Statistics SA classifies the area as largely urban. More than 95% of the approximately 29 000 households have access to basic services, and 81% have access to housing, making this one of the most highly serviced municipalities in the country.

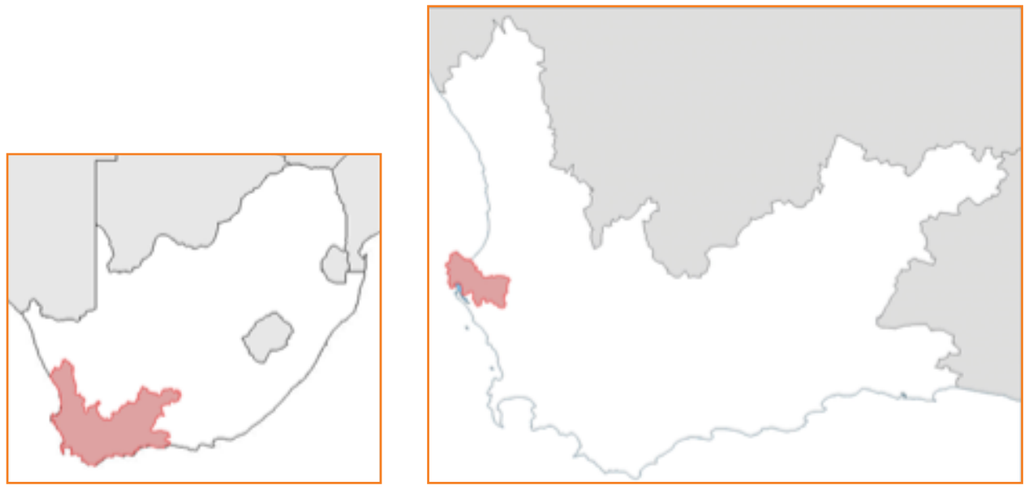


Figure 6: Map locating Saldanha Bay Municipality in the Western Cape Province
Source: MCA Planners

The local economy is largely driven by three sectors: Services (public - including military services - and private - including tourism), agriculture (including fishing) and manufacturing. The figure below illustrates the dependence on the service sector and selected large manufacturing plants.

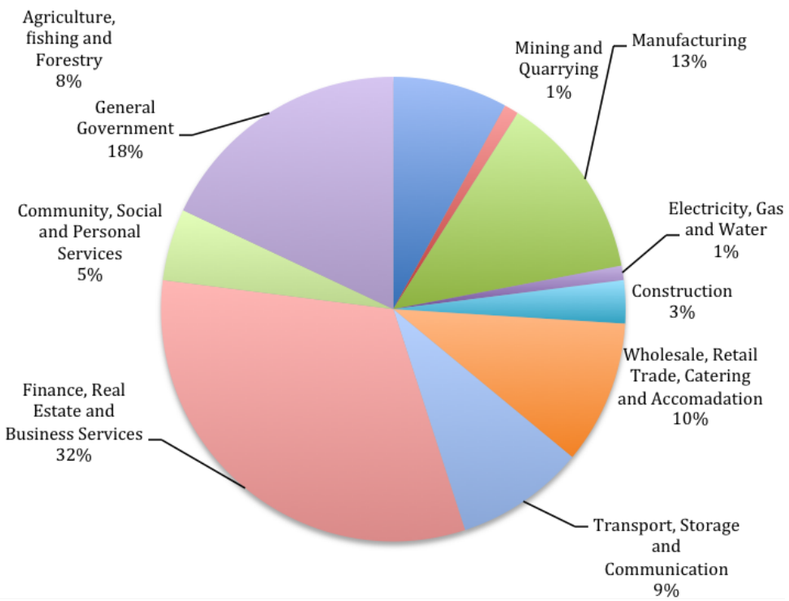


Figure 7: Saldanha Bay Municipality - economic sectoral composition 2011
Source: Adapted from Quantec Research 2013, MERO 2013

While SBM is not identified as a secondary city in South Africa (SACN, 2012), it has been propelled into this position as a result of the SEZ and related industrial growth. This makes it an interesting case study as it has not yet established itself firmly and therefore offers many opportunities to begin and enable the transition to increasing municipal sustainability. Saldanha Bay has been earmarked as an industrial growth point for many decades. The port development, the iron ore export facilities and associated rail infrastructure of the 1970s. In the 1990s investments in the iron and steel section represented major public investments intended to catalyse broader investment and growth. The anticipated "take-off" of Saldanha Bay on the scale envisaged has however not yet materialised. For a more in-depth look at the historic patterns of growth in SBM, see Annexure 3.

There is currently a renewed national and provincial government focus on SBM as a growth point. The establishment of an IDZ for oil and gas in SBM, the proposed expansion of the port and a number of envisaged new investments in the oil and gas and metals and minerals sector have the potential to generate significant growth but also pose major challenges for the municipality. This is in terms of infrastructure provision and infrastructure management given its sensitive ecosystem and resource constraints as well the uncertainties about whether and in what way such growth will occur.

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

Current municipal infrastructure grant spending in Saldanha Bay Municipality

SBM has committed itself to the path of low emissions development that has a particular focus on reducing the release of carbon related to urban activities. This follows from the SBM IDP of 2012 to 2017, which states that the mission of SBM is to:

- be a leading municipality;
- render quality service at an affordable price;
- be a place in which all have access to developmental opportunities;
- **utilise the riches of land and seas in a sustainable manner**; and strive to achieve the three aims of sustainable development, namely **human well-being, economic success and ecological responsibility.**

An analysis of the Municipal Infrastructure Grant expenditure of the past five years in SBM reveals that the MIG projects make use of conventional infrastructure designs and approaches with a focus on reducing leakages, increasing capacity, improving efficiencies and reducing operational costs. While some might argue that this does constitute the implementation of green infrastructure (the Directorate of Municipal Infrastructure in the Western Cape Department of Local Government), a more radical shift in services provision is required to accommodate the confluence of demographic, economic and ecological events and pressures. The MIG-funded projects focus on wastewater treatment (the largest proportion), roads and stormwater, transport, water supply and community security infrastructure. Of the 23 projects, 11 are new infrastructure projects. Therefore, the role of MIG as a funder for both new infrastructure and existing infrastructure places it in a beneficial position for its use to green municipal infrastructure if used more effectively and strategically to finance low-emission development. This could include waste minimisation and non-motorised transport facilities. This in turn helps to support the green economy through a range of related services and support industries being provided. If the MIG could be utilised in this way, it could become a form of seed funding that would allow for a greater economic benefit to the municipality that goes beyond the provision of basic service provision.

Conundrums facing municipal infrastructure provision for urban sustainability

High growth municipalities, although atypical, are particularly important to investigate because their challenges require innovation and can support fresh thinking. South Africa's municipal support regime is geared towards low capacity municipalities where there are extensive service delivery backlogs and poor economic performance. It does not cater easily for municipalities with accelerating economic and population growth rates. Municipalities such as SBM that are designated as growth areas face particular challenges because they have a need to expand infrastructure provision, take on major service delivery risk and address the consequences of growth that is often driven by public and private investment which the municipality itself does not control. Managing and expanding infrastructure provision is fraught with funding, timing, institutional and environmental gaps, challenges or conundrums. For more background information on these conundrums, see Annexure 4.

The environmental conundrum

What balance between environment degrading and environment regenerating activities should be sought?

The intended industrial growth node in SBM is based on environmentally polluting sectors - oil and gas and minerals and metals. They all are significant contributors to GHG emissions whether through the energy intensity and other polluting effects of metals/minerals beneficiation or the indirect effects of servicing the oil and gas sector. This is a primary driver of emissions even if the oil and gas servicing activities are not a significant emitter. SBM is also an environmentally important site in its own right with its lagoon, wetlands and its biodiversity that are also potentially impacted on by development.

The key question is the extent to which some of these impacts can be meaningfully offset by greener infrastructure, by actions to lower the immediate GHG emissions intensity of industries in the area and by actions to rehabilitate the environment, in part funded by the industrial activities. Can a green infrastructure path in SBM strengthen its investment competitiveness and help attract industries or will it have the effect of displacing investment to other locations with less stringent and/or less costly requirements?

The funding conundrum

How can SBM secure the capital and operating resources it requires to support growth given the current infrastructure funding arrangements?

The national funding regime for municipal infrastructure allocates money based on backlogs and poverty levels through the allocation of the MIG capital grant and the equitable share contribution that is meant to fund operating costs. However, this does not help a municipality with current good service coverage and relatively low levels of poverty to pro-actively put in place municipal infrastructure able to accommodate significant expansion in the number of people including poor people in the area as a result of economic growth. An increase in municipal grant funding would only be triggered by an after-the-fact increase in backlogs and/or an increase in poverty. The grant framework is also not supportive of environmental considerations such as reducing GHG emissions. The procurement rules flowing from the MFMA emphasise lowest cost provision in narrowly financial terms.

The implication is that if government is serious about reducing high rates of carbon-emissions-efficient growth, there will need to be a revision of the grant framework. This would be to consider the provision of grant or guarantee mechanisms that allow anticipatory infrastructure investments by the municipality, where justified, and that incentivise infrastructure provision that is carbon emissions efficient. This is explored further in latter sections of this report.

The risk/timing conundrum

What leads and what follows? Who takes risk?

Much potential private investment in SBM is currently on hold pending public infrastructure investments in the port, water and energy infrastructure. It is also dependent on global market conditions. At the same time, much of this public investment itself is contingent on certainty that the private investment is guaranteed because of the low capacity of the state-owned enterprises or the municipality to take on substantial risk given funding constraints. There is little public money available to fund big infrastructure as was the case at Coega and no private sector appetite to invest in this infrastructure on current terms.

This creates a major challenge for the SBM. It is possible to envisage both very high growth scenarios as well as low growth or even economic decline scenarios over the next 20 years driven by decisions of major public and private investors outside SBM's control. How does it plan for infrastructure given the massive uncertainty about the development path going forward?

Again, green infrastructure approaches have the potential to assist in resolving this challenge. Because many green infrastructure solutions are decentralised and modular and hence require lower initial investments than large-scale grey systems, they can help offset risk and can have their capacity increased over time in response to actual demand.

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

Institutional conundrum

Who is responsible?

Large-scale industrial growth initiatives like those envisaged for SBM are highly complex involving the actions of all three spheres of government as well as being highly path dependent on the actions of state-owned enterprises (particularly Eskom and Transnet) and the large private investors. This requires high levels of planning, coordination and inter-governmental co-operation to ensure that the sequencing of growth and management of its externalities and spillovers are addressed.

However, SBM lacks the financial resources, powers and capacities to manage this on its own. Other agencies such as the IDZ have some capacity but also a limited mandate. The challenge therefore is to put together joint institutional arrangements that have sufficient resources, capacity and mandate to co-ordinate and manage the growth process and its unintended consequences.

Because of current resource challenges (particularly the stability and cost of energy but also water and waste), major industries and potential investors in the area are already exploring alternative infrastructure solutions such as LNG importation, gas power generation and waste-to-energy plants as well as other recycling and resource efficiency measures. This creates great opportunities for the municipality to partner with these companies to facilitate green innovation and investment in greener municipal infrastructure and industrial technologies.

IMPLEMENTING GREEN INFRASTRUCTURE IN SALDANHA BAY MUNICIPALITY

As described earlier, green infrastructure can be implemented through biological, mechanical and behavioural interventions, and often a hybrid of these is required. This section looks at ideas for green infrastructure in Saldanha Bay Municipality in light of the uncertainty of when and if large industrial and population growth will occur. Even without high levels of growth, SBM needs to consider resilient and resource efficient approaches to infrastructure and basic services provision to enable low emissions development and climate change risk adaptation and mitigation. The current key areas of intervention are infrastructure related to water (supply, wastewater and stormwater) and solid waste. However, future areas of consideration will include energy and transport systems.

These infrastructure systems exist in a nexus where greening of the one is likely to have positive benefits for the other, and for further municipal systems beyond infrastructure. For example, by reducing water demand, the demand for electricity is reduced through not having to treat as much water and wastewater at the municipal plants. By recycling rather than disposing of waste, the municipality is able to reduce the exposure of water bodies (above or below ground) to infiltration by pollutants. Recycling also makes use of the embodied energy of materials thereby reducing local and/or global energy demand.

SALDANHA BAY MUNICIPAL INFRASTRUCTURE PRIORITIES

Saldanha Bay Municipality currently has a high level of basic service delivery in comparison with the Western Cape Provincial average, as indicated in Figure 8. There has been a general increase in the percentage of households with access to basic services even as the population has grown at 4.1% per year (SBM, 2014), as seen in Figure 9. Recent service delivery highlights include upgrades and maintenance of water and sanitation facilities and systems where the municipality has been able to increase both its Blue and Green Drop scores (SBM TDP, 2014). A challenge to the provision, operation and maintenance of infrastructure in the municipality is the ongoing vandalism and theft to facilities and systems and securing sufficient funding for future maintenance and new infrastructure to address backlogs. For a more in-depth analysis of the current infrastructure context of SBM, see Annexure 5.

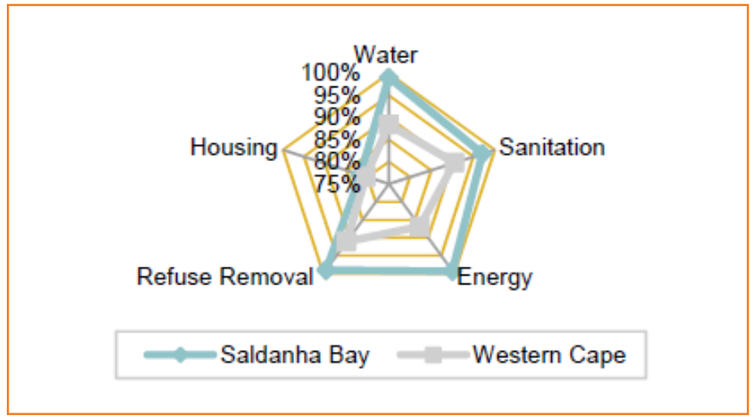


Figure 8: Level of access to basic services in Saldanha Bay Municipality and the Western Cape Province
Source: StatsSA, 2015

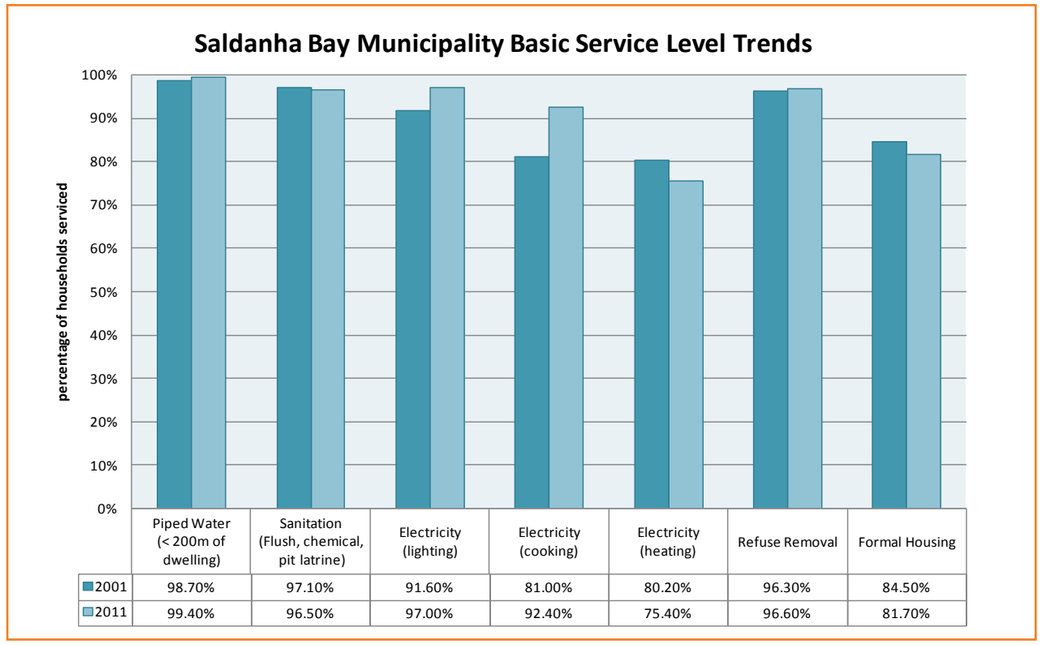


Figure 9: Trends for basic service delivery in Saldanha Bay Municipality
Source: StatsSA Census database 1996 - 2011

Infrastructure priorities

This section identifies the infrastructural priorities for SBM and focuses specifically on these. This is because it is often situations of crisis (resource shortages, impending growth that is not prepared for) that breed innovation. Drawing on a desktop review of municipal, catchment area and provincial documents and from discussions with a variety of role players, the following infrastructure priorities have been identified for SBM:

- Water supply: SBM will soon be at the limit of its water allocation with the potential of already over extracting water at times. It is essential that water demand is reduced and that alternative water sources are utilised, other than surface water from the Berg River and the Langebaan Road Aquifer. As per the WSDP of SBM, water-re-use, groundwater supply, desalination and transfer schemes are all offered as potential new sources of water. However, when considering the latter two options there is little possibility for increased water via a transfer scheme as there is limited water remaining to be allocated within the Berg River Catchment. Secondly, desalination is not necessarily a viable alternative due to the high running costs, high energy needs and the amount of brine released as effluent from the process.
- Solid waste management: The Vredenburg and Langebaan landfills are expected to reach capacity by 2020. An increased reduction in waste going to landfill is required.
- Industrial wastewater and stormwater: Currently, there is no facility to treat industrial wastewater (brine) within SBM. Stormwater is also of concern as it is unfiltered and carries pollutants to the bay and is a potential source of non-potable water through managed aquifer recharge.

Further challenges that have not yet been identified but are anticipated to be future priorities include issues around energy demand and the security of supply, and the need for a modal shift to a greater mix of transport options, with a priority on non-motorised and public transport systems.

GREEN INFRASTRUCTURE PRINCIPLES AND A FRAMEWORK FOR INTERVENTION AND TRANSITION

Infrastructure has a key role to play in the continued development and growth of SBM. Infrastructure is needed to address the current backlog in service provision while accommodating future growth in the economy and population. However, with an understanding of the limits of natural resources, emissions related to urban growth, and increasing climate-related risks; current approaches to infrastructure provision, known as grey infrastructure, are unsustainable and lack appropriate mechanisms to mitigate and adapt to these challenges (York et.al. 2015). The principles of green infrastructure therefore include reducing carbon emissions and pollution; enhancing energy and resource efficiency; and preventing loss of biodiversity and ecosystem services. Implementing green infrastructure requires a new approach to service provision; a transition from grey to green.

As is similar to the concept of green buildings, green infrastructure exists on a continuum between improving on the performance of grey infrastructure to infrastructural systems that enable restoration of the local and global environment. This is captured by Giordano (2013:5) and represented in Figure 10 below.

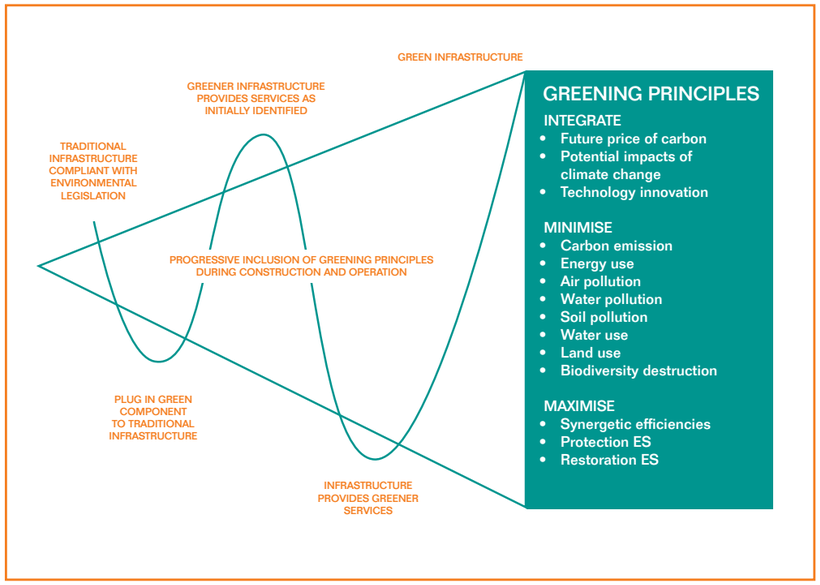


Figure 10: The continuum of intervention for green infrastructure

Source: Giordano, 2013: 5

The adoption and implementation of green infrastructure requires a paradigm shift in municipal infrastructure provision where innovation is possible. To implement this, a framework for transition is needed to achieve low emissions development; where planned phases and steps allow for both bold and incremental greening initiatives.

Green infrastructure principles for implementation in SBM:

- Minimise the demand for resources to reduce the need for new infrastructure;
- Where resources are still needed, use them efficiently through greening existing infrastructure;
- Where new infrastructure is needed, implement regenerative green infrastructure.

The Development Bank of South Africa (DBSA) (2012) has identified three primary levers to enable the transition to municipal sustainability through the implementation of green infrastructure. These include national long-term planning (in addition provincial and municipal long-term planning is a key tool too), the budget system, and the strategic identification of priority projects. These levers need to be developed and contextualised further in collaboration with the municipality. This is to also take into account the following challenges and measures for addressing them.

The following challenges have been identified from various case studies and experience with regard to transitioning to a new framework for intervention:

- Municipal capacity constraints, especially as green infrastructure can be difficult and time-consuming to evaluate and value if there is no associated training undertaken;
- A lack of data available on sensitive ecological and climatic conditions needed to harness ecological services and on the contribution of ecosystem services to the municipality;
- A knowledge and skills gap, especially with regard to the need for context-specific application through decentralised, networked and modular systems;
- The need for inter-disciplinary knowledge and working together;
- Innovation requires testing and experimentation (pilot projects) which can be difficult when funding is received from inflexible grant systems;
- Current cost-benefit evaluation techniques used for budgeting do not take into account a broad range of factors that are impacted by an infrastructure project;
- Often, a long-term planning approach is required to capture the value of green infrastructure;
- A lack of integration of environmental imperatives into municipal planning tools which do not prioritise valuable environmental systems and ecological services;
- Need to adopt a different management approach – more constant smaller actions required rather than large-scale refurbishments; and
- Education and awareness: overcoming and working to change public and professional perception and bring the community and municipal officials on board.

EVALUATING GREEN INFRASTRUCTURE

To evaluate the sustainability of municipal infrastructure, two tools have been developed. These are relatively new and are the most established tools, at present, that engage holistically with multiple types of infrastructure by focusing on crosscutting issues.

Envision is a tool that was developed by the Zofnass Programme at Harvard University. It utilises 60 credits in the following five categories to assess all infrastructure types:

- Quality of Life: the impact on the health and well-being of surrounding communities
- Leadership: commitment from the project team
- Resource Allocation: the use of renewable and non-renewable resources
- Natural World: the effect on preservation and renewal of ecosystem functions, and
- Climate and Risk: the ability to minimise greenhouse gas emissions and resilience to hazards and/or long-term conditions.

The **Infrastructure Sustainability Council of Australia** has also developed a tool to assess green infrastructure in accordance with the following aspects:

- Management systems
- Land
- Procurement and purchasing
- Waste
- Climate change adaptation
- Ecology
- Energy and carbon
- Community health, well-being and safety
- Water
- Heritage
- Materials
- Stakeholder participation
- Discharges to land, air and water
- Innovation.

These tools look at a broad range of factors to consider when implementing green infrastructure within a holistic framework. These tools aim to engage with the full range of potential impacts that an infrastructure project might have on the local and global environment. Of particular interest is the focus on procurement and purchasing in the ISCA tool to address some of the key policy challenges of the initial start up and ongoing maintenance of green infrastructure. While it is not suggested that either of these tools be adopted, in understanding them there is an opportunity to broaden the definition of green infrastructure while allowing for improved evaluation techniques to determine the best suited infrastructure approach and delivery.

The table below illustrates the differences between green and grey infrastructure and indicates various factors for consideration when contemplating a method of service delivery. The orange cells indicate the potential challenges in either of the systems. It is interesting to note that this evaluation indicates that green infrastructure is a better choice in more criteria than grey infrastructure. [Please note that green infrastructure referred to in this table is the use of biological, ecosystem services.]

Evaluation of green vs. grey infrastructure

EVALUATION CRITERIA	GREEN INFRASTRUCTURE	GREY INFRASTRUCTURE
Stakeholder involvement	Extended stakeholders are often required to support the project and may have an active and ongoing role in the project design and operation	Stakeholders are often engaged with the aim to create local support for the project, but without active involvement in the project design and operation
Engineering approach	GI solutions require a custom-made, location-specific design and do not lend themselves to standardisation and replication	Traditional engineering solutions enable standardisation and replication which can significantly reduce project costs and delivery times
Physical footprint	A large physical footprint is often required due to low energy density	Usually, only a small physical footprint is required due to high energy density
Environmental footprint	Often reduced environmental footprint due to GI solutions being nature-based and self- regenerating	Often increased environmental footprint due to material and energy intensive processes (manufacturing, distribution, operation)
Speed of delivering the functionality	GI solutions may take time (years) to grow to provide a certain service and capacity	Traditional engineering solutions provide a certain service and capacity from day 1 of operation
Susceptibility to external factors	GI solutions are susceptible to extreme weather conditions, seasonal changes in temperature or rainfall and disease	Gray infrastructure is susceptible to power loss, mechanical failure of industrial equipment and price volatility
Operational and maintenance costs	Operating and maintenance costs are often significantly lower (only monitoring and feedback is required)	Operating costs are often significantly higher due to power consumption, operational and maintenance requirements
Risk of price volatility	GI solutions are relatively insensitive to fluctuations in the cost of raw materials, oil, gas and power	Traditional engineering solutions are sensitive to fluctuations in the cost of raw materials, oil, gas and power
Approach to system monitoring and control	GI solutions are living and complex systems that can be monitored and effectively managed by a deep understanding of the key control variables	Traditional engineering solutions are man-made systems that are typically designed with established monitoring techniques to effectively manage and control system performance
Required operating personnel	No need for 24/7 operational supervision	Complex control and safeguarding systems typically require 24/7 operational supervision
Expenses for increasing capacity of system	Relatively inexpensive to extend the capacity of the GI solution, provided there is physical footprint available	Extension of capacity could be relatively inexpensive as long as significant modification or redesign is not required
Need for recapitalisation	Recapitalisation during the life of the GI solution is usually not significant. The end of life replacement/ decommissioning will vary greatly depending on the GI technology selected but is usually not necessary as GI solutions are self-sustaining and do not depreciate	Grey solutions are depreciating assets with a finite performance capacity and usually require significant replacement/ decommissioning at end of life

Source: http://www.nature.org/about-us/the-case-for-green-infrastructure.pdf

THE VALUE PROPOSITION FOR GREEN INFRASTRUCTURE (GI)

"With limited budgets and capacity, South African cities arguably have the most to gain from a green infrastructure planning approach. This is because the multi-functional nature of green infrastructure has the ability to meet a number of local infrastructural and developmental challenges associated with inequality and poor living and working environments." (Bobbins, 2015)

With the increased implementation of green infrastructure in place of grey infrastructure in South Africa and internationally, there is a growing body of research supporting the claim that green infrastructure provides more benefits at a lower cost. Choosing to implement green rather than grey infrastructure can result in capital cost savings, cost efficiencies, and reduced operational and maintenance costs (Asla, 2012). Also, as green infrastructure can exist in a self-reinforcing system, if well maintained, the system should improve and grow in capacity over time therefore adding more value while grey infrastructure deteriorates therefore depreciating in value.

Valuing green infrastructure requires the inclusion of previously unconsidered aspects, such as environmental and social impacts which, when considered more holistically, can result in cost savings for other departments, residents and industry. This is because of the multi-functional nature of green infrastructure that often offers a greater value to the municipality than single purpose grey infrastructure. For example, rehabilitating a local wetland system can help to filter stormwater while reducing the impact of severe stormwater events, therefore reducing the costs for disaster risk management. This wetland area could also offer recreational space for residents. This could encourage a sharing of the costs of establishing and maintaining the wetland with the local parks and recreation department. Another example of this is where the greening of an infrastructure system (repairing water leaks or improving infrastructure energy efficiency), results in municipal financial savings. These savings can then be used to either cover the costs of the greening programme or be used to finance a loan to do so.

The following case studies offer insight into the cost savings experienced through the greening of infrastructure.

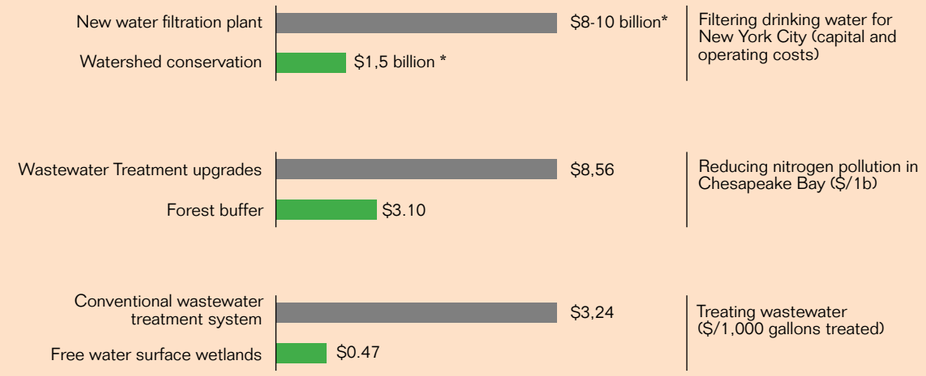
CASE STUDY: Valuing green infrastructure - Lancaster City, Pennsylvania

Additional infrastructure was required to manage increased stormwater runoff. Instead of implementing traditional built infrastructure, a local park called Brandon Park was redeveloped using GI practices. The uptake of GI rather than a traditional infrastructure approach led to the avoided capital costs of $982,476 and has resulted in additional benefits that are estimated to be worth $5,827 per annum, which include reduced pumping and treatment costs and energy related, air quality and climate change benefits.

(http://www.urbanafrica.net/urban-voices/green-assets-infrastructure-alternative/)

CASE STUDY: Valuing green infrastructure

GREEN INFRASTRUCTURE CAN BE LESS EXPENSIVE THAN GREY INFRASTRUCTURE



* Figures represent 2006 US dollars

Source: Kenny 2006; Wieland et al. 2009; Chesapeake Bay Commission 2004; Corps of Engineers 2003.

CASE STUDY: Valuing green infrastructure: Polokwane Municipality

Variable speed drive pumps at water treatment works

The replacement of pumps at the water treatment works resulted in improved efficiencies and reduced energy demand, as seen in the table below. This case study is important to note as the energy used for water treatment is a cost to the municipality and when reducing municipal energy consumption, it improves municipal revenue streams to allocate funding elsewhere and/or cover the cost of the pumps.

	Week days	Saturdays	Sundays	Total MWk
		24 Hrs	24 Hrs	
Baseline	15.2352	1,200	0,576	17,011
Actual	8,28	0.000	0.000	8,280
Impact	6,955	1,20	0,576	8,731

Source: Energy and sustainable urban africa development in Africa, 18 November 2014.
DSM Project - Replacement of old IE1 motors with new IE2 & IE4 motors and VSD's at Dap Naude dam.

MUNICIPAL GOVERNANCE FOR GREEN INFRASTRUCTURE

Capturing the value of green infrastructure requires a more integrated and co-ordinated budgeting processes within the municipality and between spheres of government to engage with the broad range of benefits possible. One of the ways in which to do so is to implement the ecoBUDGET with SBM.

The ecoBUDGET

The ecoBUDGET was developed by ICLEI, UNEP and UN-Habitat. It is a system that incorporates full costs including economic externalities - accounting for environmental management in local municipalities' annual budgeting processes. The preparation process includes developing key environmental criteria through a participative process, such as climate stability, air quality, land, water, raw materials, and biodiversity. Investment choices are made in terms of contribution towards meeting the environmental criteria targets and costs.

This is necessary because while the current budgets account only for financial resources, the ecoBUDGET considers the environmental and social resources impact on the municipality. The ecoBUDGET complements the existing budgeting process through implementing a three-phase, five-step process. Ultimately, ecoBUDGET aims to plan, control, monitor, report on, and evaluate the consumption of natural resources.

As indicated in Figure 11 below, this includes the following:

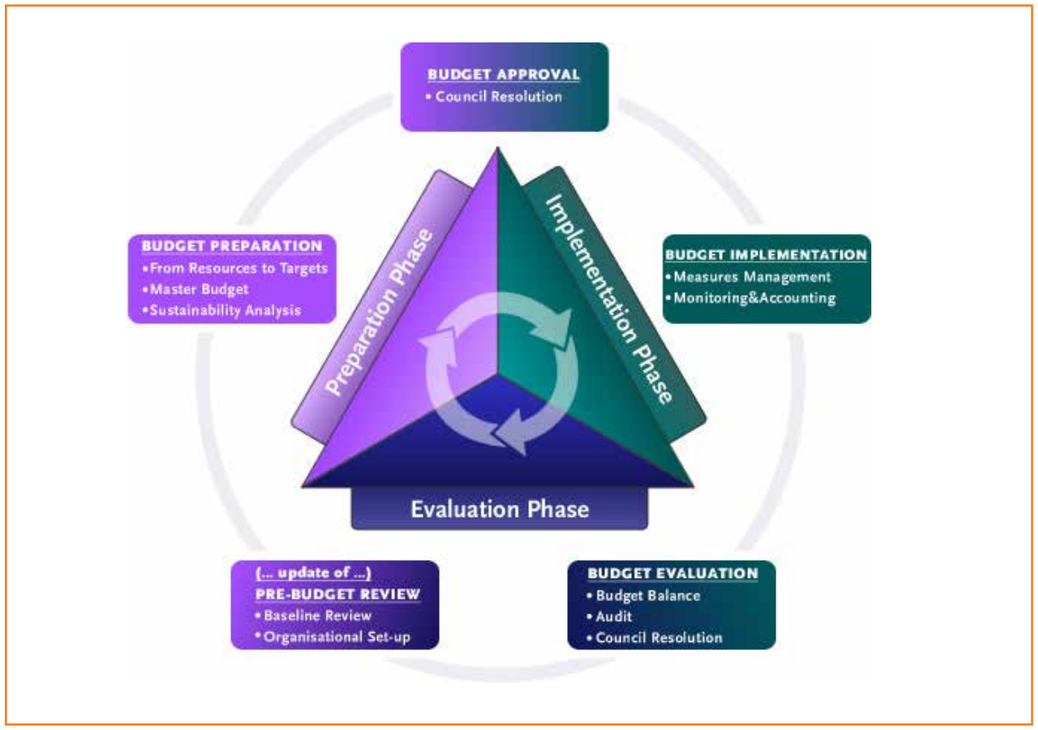


Figure 11: The ecoBUDGET process and phases of implementation
Source: http://www.ecobudget.org/index.php?id=6964

Phase 1: **Preparation**

- Step 1: Baseline review and organisational set up
- Step 2: Developing the Master Budget to –
  - Identify priority natural resources
  - Allocate environmental indicators in physical units
  - Set the long-term target(s)
  - Set the short-term target (reviewed annually)

Phase 2: **Implementation**

- Step 3: Council approval
- Step 4: Implement budget and keep account of the impact of municipal decisions

Phase 3: **Evaluation**

- Step 5: Balance the budget to determine whether the set limits on the use of natural and financial resources were adhered to

This approach could be useful in SBM to aid more intentional resource conservation, demand management strategies and low emissions development through prioritising environmental resources along with financial resources.

FINANCING GREEN MUNICIPAL INFRASTRUCTURE

Implementation of a green infrastructure project can be been broken down into six steps (refer to figure below). This section discusses step 5, how to 'access finance' and explores the funding strategies available to municipalities. Key decisions taken during step 5 include calculating the Rand value of finance required, selecting an appropriate mix of financial instruments (i.e. loans, bonds, energy performance contracts, lease-purchase agreements, and grants), and negotiating with private and/or public institutions to secure funding.

High-level generic steps to roll-out a green infrastructure project

Step 1: Develop an Internal Policy.	Create a policy that is aligned to internal planning documents, especially IDP, and budget proirities.
Step 2: Design project conceptual blueprint.	Create documentation outlining the design of the project at the level of detail required to gain approval from executive management.
Step 3: Gain executive management approval.	Submit project conceptual blueprint to executive management for approval.
Step 4: Conduct energy audit & pilot.	Conduct an energy audit to establish baseline energy consumption. Calculate potential energy savings from an engineering and financial perspective. Launch pilot to verify calculations.
Step 5: Access funding and allocate budget.	Create a funding proposal and approach different funders, negotiate terms and conditions of funding. Submit project plan to executive management for Service Delivery and Budget Implications Plan approval.
Step 6: Implement the project.	Develop an implementatiopn plan and mobilise resources to roll out the plan, paying attention to SCM, MFMA/PFMA requirements, and monitoring & evaluation processes.

Source: MCA Planners

Financing options available for green municipal infrastructure

Current financial instruments for municipalities are limited to property taxes, transfers (from national and provincial governments), loans/bonds and user fees for specific services. Fiscal opportunities for SA municipalities to introduce new taxes are severely limited, and the bearish pressures on the national income are likely to continue in the short to medium term limiting any major expansion to the current grants quantum. While greening[6] these financial instruments is necessary, given the need to make a paradigm shift these traditional instruments are insufficient. Most global organisations including the UN, argue that in the current global economic climate - traditional sources of funding for climate change are dwindling and the need to find new financing instruments to unlock private capital is essential.

[6] Greening in this context refers to specific grants or introducing a number of conditions that will reduce emission levels – e.g. earmarking funding for specific LED projects such as public or non-motorised transport grants, clean energy grants, demand management incentives, etc.

In the shift to raising private capital governments continue to have a critical role to rebalance policy distortions and monetising benefits of low-emission investments through:

- Raising additional revenue through taxes (e.g. carbon taxes, congestion taxes, etc);
- Capitalising Development Banks and Green Banks to provide concessional loans;
- Long-term purchasing agreements – e.g. power purchasing agreements by Eskom to provide appropriate incentives;
- Providing political and financial risk guarantees;
- Utilising export credit agencies – particularly to reduce exchange rate fluctuation risks; and
- Releasing specialised bonds – e.g. green bonds or infrastructure bonds.

Attracting private finance must address the need to demonstrate that the investment has an acceptable financial return, stable policy and institutional environment, mechanisms to address credit and performance risks (exchange rate risks for foreign investments), and provide the appropriate guarantees.

Attracting private-sector funding will require stable markets and policies; good return on investment and limited (or mitigated) risks. Financial innovation has made it easier and less risky for municipalities to fund green infrastructure projects. As clean development markets have evolved, a range of sophisticated financial instruments has developed, and different financial institutions have specialised in providing a specific financial instrument. For example, development finance Institutions and private equity have developed products to finance emerging technologies whereas commercial banks fund the installation of established technologies. There are many potential sources of finance and financial instruments that a municipality can select to implement green municipal infrastructure.

- Public-private partnerships (PPPs), in which the long-term risks are shared with the private sector.
- Tax Increment Financing (TIF) utilises future tax revenues to attract private finance.
- Connection and availability fees for all non-indigent households – to cover improvements to bulk and reticulation infrastructure.
- Traditional loans, bonds and equity funding instruments.
- In addition specifically tailored direct equity or private equity fund instruments are rapidly emerging to finance projects with an acceptable economic return.

To select the best possible financial model for a green infrastructure project, the municipality's selection should consider the following:

- the debt capacity of a municipality;
- the level of internal expertise to support funding process;
- the risk tolerance of a municipality;
- the cash flow position of a municipality; and
- the trade-off between accepting greater project risk (taking into consideration financial, operational, technological and performance risk) to reap a greater portion of the benefits (i.e. energy savings, reduce expenditure on basic services and additional revenue streams).

The practical implication for municipalities is that deciding on the source of funding is a strategic decision and, if the correct choice is made, it can reduce the risk-profile of a green infrastructure project. Case studies show that the successful implementation of green infrastructure projects requires using funding models that draw on multiple financial instruments and sources of funds. In this process it is important to 'match' the type and source of funding with the risk-profile of a project throughout its life cycle. Hence the most effective financing model draws on a few financial instruments from different financial institutions and third parties who are either directly or indirectly involved in the green infrastructure project.

Matrix of Funding Institutions and Financial Instruments

Finance Source Institutions	International Climate Funds	Bilateral and Multilateral ODA	RSA Public Sector	RSA & International Private Sector
Financial Instruments	Clean Development Mechanism Global Environmental Facility Global Climate Change Alliance (GCCA) UNEP and Clean Technology Funds	Bilateral Grants EU/Commission GTZ, DANIDA DFID	Intergovernmental Transfers Local Municipal and Provincial Revenue Green Fund Energy Efficiency - Demand Side Management Grants IIPSA	Grant Funding Venture Capital Equity Finance Debt Project Finance

Source: MCA Planners

Financing green municipal infrastructure in Saldanha Bay Municipality

The first step is assessing whether the municipality can fund the majority of the green infrastructure project through "own revenue", and the possibility of covering the shortfall with grants from government, parastatals, or donors. In other words, can the public entity leverage its existing resources to fund the green infrastructure project without raising capital / entering into a loan with third-party financial institutions? If the answers to the five questions (EPEC, 2012: 20) below are positive then a viable financing option could be funding the green infrastructure project from OPEX / CAPEX budget and/ or deferred maintenance budget allocations approved through the official annual budgeting process led by the Finance Department.

- Does this project have higher priority compared to other public projects competing for the same funding?
- Will the benefits achieved by a particular project outweigh the benefits of alternative projects?
- Are alternative financing mechanisms more expensive than the returns on the project?
- Is the timing of the project critical? Can the public partner afford to wait until it can raise alternative financing?
- Is there sufficient budget flexibility to recoup cost-savings over a number of years (Abramson, et.al, 2011: 8)?

The second step is ascertaining whether the municipality is in the financial position to apply for external sources of finance from various institutions to meet the shortfall between grants and available budget resources. Financial instruments and sources to consider are listed in ascending order of the complexity of the instruments, but in practice a municipality will use a few of these instruments for funding.

- **Asset-based finance, such as a financial lease,** is used to finance the purchase of green infrastructure equipment and services. The municipality secures the finance and can decide to use in-house or an external services company to manage the project.

- **Services Company (SCO) financing the Green Infrastructure Project implementation under a Performance Contract in either shared or guaranteed savings payment model.** When an SCO arranges financing and implements a green infrastructure project, the municipality is not exposed to technical, financial and performance risk, but the municipality gains from the project's benefits[7]. Case studies show that performance contracts are used in conjunction with asset-based finance. Under this finance model, the SCO is obligated to repay the lessor finance payments from energy savings stipulated in the performance contract between the SCO and the public entity. This is discussed in more detail later in the report.
- **Vender finance** is provided by large equipment suppliers to their customers to finance the purchasing of new equipment.
- **Concessionary and/or soft loans** from development finance institutions (i.e. DBSA, World Bank, DFID, etc.) or government grants. Most often a municipality uses a combination of internal funds and concessionary finance. Once the municipality has secured finance, it contracts with an SCO to implement the project on a turnkey contract on a fixed-fee basis. In particular, energy efficiency projects generally have a low-risk profile, and while this model allows a municipality to reap all the cost savings and benefits, in return it bears the financial risk. However, the SCO bears technical and implementation risks associated with procurement, installation, commissioning and performance of the equipment.
- **Commercial debt from corporate banks.** Their lending criteria and due diligence processes tend to be stricter than development finance institutions, and also commercial debt is more expensive to service than concessionary loans.

Further information on these instruments can be seen in Annexure 6.

The third step involves determining the shortfall between the debt raised, any private financing and the total project's capital requirements. Normally a municipality can access concessionary capital through government grants and DFIs that an SCO cannot access. Also, if a municipality has an arrangement in principle with an SCO to shoulder financial, performance and operational risk, it makes it easier for a municipality to access concessionary funding. Preparing proposals and negotiating terms is costly, time consuming exercise and therefore it is recommended that the municipality carefully consider how many institutions to approaches.

The final step concerns assessing whether an innovative finance structure that uses debt or equity instruments, or a combination of the two, is needed to raise any outstanding capital. These structures are designed to create tailored structured agreements between investment funds, asset owners and SCOs to overcome barriers that make it difficult to access upfront capital.

Many of these opportunities described above to raise private finance are applicable in general to any green infrastructure project. The exact design of the finance model will be determined by the design of the project, its revenue profile and its performance risk profile. The case studies below illustrate the financing sources for different project designs.

[7] The municipality only needs to make payments to the ESCO over a period of time on realised savings, as under an Energy Performance Contract (EPC) between the ESCO and municipality, energy expenditure savings are used to repay the investment made by the ESCO.

Debt-equity finance model

CASE STUDY: Example of an innovative debt-equity finance model

Based on international case studies, the most common innovative debt-financing model used by public entities is the Efficiency Services Agreement described by Abramson et al (2011- 13-14). An investment fund acts as intermediary between the municipality (i.e. asset owner) and the Energy Services Company (ESCO) that implements the project. Hence the investment fund acts as both the financier and owner of all of the assets over the duration of the project and develops two separate contracts—an Electricity Service Agreement (ESA) with the asset owner and an Efficiency Services Performance Contract (ESPC) with an ESCO.

The investment fund and the asset owner enter into an Efficiency Services Agreement stating that the investment fund must provide all the upfront capital for waste-to-gas investments. A special purpose entity is created, using a mix of equity and debt provided by the fund's capital partners and other outside banks or lenders, to finance the waste-to-gas project.

Over the term of the ESA the asset owner agrees to pay a regular service charge to the investment fund to pay off the capital investment and also give the investment fund's partners and lenders a return on their investment. The service charge is calculated to protect the building owner from paying more for energy than he or she did before entering into the agreement.

At the same time, the investment fund establishes a separate Energy Services Performance Contract (ESPC) with the appointed ESCO, covering required engineering, procurement, and construction services and also defines on-going maintenance and monitoring services that will be required after the project becomes operational to ensure, measure, and verify cost-savings.

Project financing with service companies

Given the limited capacity and experience to implement new technology solutions, a Service Company (SCO) can assist in the implementation and absorption of the risks. A service company can be focused on energy, water or a range or services but are most often used in energy efficiency and waste-to-energy projects. An SCO is a company that "delivers energy services and/or other green infrastructure improvement, and which accepts some degree of financial risk in so doing. The payment for services delivered is based (either wholly or in part) on the achievement of meeting agreed performance criteria" (EPEC; 5: 2012). Irrespective of a green infrastructure project's characteristics, SCOs incur upfront expenses in the short term when the project is implemented while the benefits materialise at a later date. In other words, expenditure in the short term allows the municipality to reduce expenditure on basics services, by foregoing resource consumption and creating alternative revenue streams.

Regardless of the type of financing instrument used to fund a project and its nature, SCOs effectively share in the benefits arising from the green infrastructure project. For example, in terms of Energy Efficiency projects, they share the energy savings achieved from reducing energy consumption by guaranteeing a portion of the energy savings achieved for a contracted period of time. If the present value of the SCO's effective share of savings over the life of the contract is greater than the present value of all costs, the SCO makes a profit. If not, it incurs a loss.

An SCO can provide a range of services:

- Analyse energy systems and integrate technology to select the optimal package of cost saving options (e.g. energy audit, energy analysis, engineering design analyses, project management services). The SCO provides all of the services to design and implement a project at the customer facility, from the initial energy audit through long-term monitoring and verification (M&V) of project savings (ICF, 2007:1).
- Offer expertise in selecting subcontractors, managing projects, overseeing construction work, and implementing quality and risk management controls.
- Offer project-financing expertise, accommodate both simple and sophisticated contracts and are conversant with relevant legal issues (i.e. financial, legal and contract services).
- Provide access to alternative sources of funding, when public authorities face constraints on their borrowing capacity. Private contractors can finance projects through mechanisms that are different from formal loans and can be tailored to the individual cash flows of each project. Hence SCOs are able to support a green infrastructure project when internal sources or on-balance sheet investments are limited.

Summary of the advantages and disadvantages of an SCO

ADVANTAGE: SCO	ADVANTAGE: IN-HOUSE
• Structure contracts, enabling savings to pay for capital improvements • Provide and/arrange for project financing off the balance sheet • Guarantee equipment performance and savings	• Cost to implement the project is less • Exercise greater control of the project from start to finish and hence has more control over the timing of the project
DISADVANTAGE: SCO	**DISADVANTAGE: IN-HOUSE**
• SCO conducts an another energy audit • Experts in a technology and bias to recommend own technology • Incur additional monitoring and verification costs to confirm energy savings, if a guaranteed savings contract is used	• Spend substantial time / resources managing and overseeing the project • Multiple decision makers could delay the project

Source: MCA Planners

SCOs are becoming an increasingly popular mechanism to raise private capital through venture capitalists:

- For a 51% stake in the 'project' and with a 30% stake given to a guarantee fund for a 20-year period, this model allows the municipality to have no financial risk.
- The municipality enters into power purchase agreement for electricity at a price that is lower than Eskom.
- The SCO will also sell other by-products (for example, fuel or pharmaceutical grade charcoal form a waste to energy facility) to assist with recovering its investment in the project and reducing the resource pricing.

Once a municipality decides to use the services of an SCO to implement a green infrastructure project, the next step is considering whether the municipality will enter into a shared savings or the guaranteed savings performance contract. The primary difference between these contracts is whether the SCO or municipality assumes the credit risk. Regarding shared savings, the SCO bears the financial risk and the benefits are shared between the SCO and municipality for a negotiated period of time. Whereas under a guaranteed savings contract, the municipality assumes financial risk and the SCO guarantees a certain percentage of benefits.

Irrespective of the contract type, an SCO's payment is determined by performance. Evaluation, measurement and verification provisions, stipulated in the contract, determine the value of payments. The SCO designs and implements the evaluation, measurement and verification plan, the municipality receives the results, and a third-party validates these results.

Under a guaranteed savings model, a municipality sources capital directly from a third-party financier and the municipality assumes the financial risks arising from the loan and the asset is placed on its balance sheet. An SCO is paid by the municipality to provide all necessary support activities and facilitate financial arrangements. An SCO provides a guarantee that the green infrastructure project will satisfy stipulated outcomes, for example energy savings, generation of base load electricity, production of by-products. The Rand contractual value of these expected savings and/or revenue streams is expected to cover either the entire loan or a large portion of it. When the SCO does not meet its obligations in terms of energy savings and/or revenue streams, the SCO is obliged to reimburse the municipality the difference. Alternatively when the SCO outperforms, the municipality keeps the excess, unless further sharing arrangements have been made.

In a classic shared savings contract, the SCO takes on the risk of third party financing from a lender, putting the loan on the SCO's balance sheet (World Bank, 2008:37). As a consequence, the SCO bears financial, operational and performance risk. Under this contract the Rand value of stipulated outcomes, for example energy savings, generation of base load electricity for resell in the municipal area, sale of by-products from waste-to-gas conversion process is distributed between the municipality and the SCO, based on a negotiated rate stipulated in the contract. If no energy savings and/or alternative revenue is generated through identified activities in the contract, the municipality assumes the costs and owes the contractor nothing for that period. In a classic shared savings arrangement, the SCO provides financing and also bears both project development and performance risk.

If there are energy savings, the SCO is still responsible for meeting financial obligations arising from upfront capital investment in equipment. An SCO is also exposed to rising resource costs beyond the escalation clause agreed to in the initial Resource Savings Agreement because one of the contractual terms is that the municipality will not pay more for the resource than it did at the start of the contract. As a consequence the municipality reaps long-term benefits resulting from the efficiency improvements. In addition a shared savings contract makes it easier for a municipality to afford an SCO, because there are usually no upfront costs, because an SCO is paid based on the resource savings produced over time.

In summary the key difference between the two contracting models is as follows: a guaranteed savings contract can be used to reduce the cost of financing a green infrastructure project because it increases the cash-flow position of the funding municipality that reduces the probability of default. Whereas a shared savings contract allows a municipality, that may not have access to up-front capital, to enter into agreements with an SCO which can secure up-front financing.

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

Comparison of shared savings and guaranteed savings

VARIABLE	SHARED SAVINGS	GUARANTEED SAVINGS
Financing responsibility and credit risk	SCO	Municipality
Performance risk	SCO	SCO
Contract on municipality's balance sheet	No	Depends on financing vehicle, but cost on municipality's balance sheet.
Is the municipality's payment affected by actual performance?	Yes. SCO payment is variable, based on value of energy savings and alternative revenue stream generated.	No. SCO payment to municipality is set regardless of performance.

Source: R20 (2013: 15), EPEC (2012), Abramson et, al (2011)

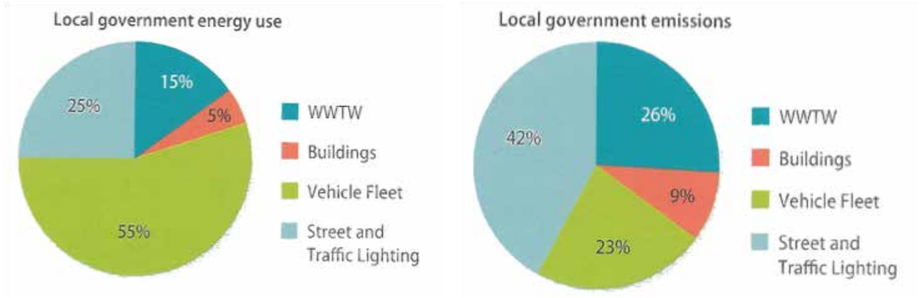
BEYOND FINANCING IN IMPLEMENTING GREEN INFRASTRUCTURE

As noted earlier in this report, the transition to municipal sustainability through green infrastructure requires intervention beyond that of funding and financing. These include the innovation in the services definition, the technological approach and the institutional arrangements. These can vary greatly depending on the project being pursued. Our discussion with the SBM highlighted the following short, medium and long term projects that the SBM will be willing to explore in their future plans. This section therefore discusses each of these transition areas in relation to projects that have been identified to address the infrastructure priorities in SBM. The figure below indicates the projects identified.

INTERVENTION TIME FRAME	GENERAL INFRASTRUCTURE GREENING	WATER SYSTEM INFRASTRUCTURE GREENING
Short term (1 - 2 years)	Street light retrofit	Reduce demand, unaccounted-for-water and non-revenue water
Medium term (3 - 5 years)	Waste recycling	Stormwater management
Long term (5 - 10 years)	Waste-to-energy plant	Water reclamation and storage (from stormwater and wastewater)

Short term: improved energy efficiency

The municipality uses electricity in municipal buildings and facilities, street lighting, and municipal infrastructure functioning such as water treatment plants and wastewater treatment works. Improving energy in municipal-owned buildings and services has a double benefit, as the municipality is saving money by reducing the use of electricity while, at the same time, the municipality is not losing revenue from improved energy efficiency. As seen below, the municipality currently uses the majority of its electricity on street and traffic lighting, which is also the greatest emitter of greenhouse gas emissions. The wastewater treatment system consumes 15% of energy and buildings consume 5%.



Source: Sustainable Energy Africa. 2015. State of Energy in South African Cities 2015.

The first proposal for SBM to improve its energy efficiency is to replace all street lighting and traffic lights with energy efficient fittings or even with solar-powered fittings, as a large reduction in the use of electricity can quickly be gained. Key to this is to ensure that the municipal procurement department has a policy in place to incorporate energy efficiency into the procurement criteria to ensure that the replacement programme is ongoing and not a once-off programme.

SERVICES DEFINITION

Retrofitting of street lights project with LED bulbs, should continue to provide the same or a better lighting service in the defined areas. The LED street lighting technology must improve overall lighting quality while ensuring:

- Uniformity: LED luminaries must distribute the light more effectively than luminaries using conventional lamps bulbs. The illumination levels should be more uniform - without any darker spots.
- Correlated colour temperature: the colour of the light produced is bright white to bluish-white. Growing evidence is showing that the higher blue light content of LEDs contributes to visibility at the light levels associated with street lighting.
- Colour rendering index: the ability of a light source to show the colour of objects is called the colour rendering index (CRI). The CRI should be higher to improve (reduce) the contrast between colours.

TECHNOLOGICAL APPROACH

Mechanical Approach: Rapid changes in lighting technology has increased its efficiency and it is now possible to realise energy savings on the scale of 30-50%. In contrast to incandescent bulbs where only 10% of the energy consumed goes into light (90% to heat), the light-emitting diodes (LED) bulbs provide two benefits:

- energy efficiency through the consumption of lower levels of energy
- lifetime of the LED bulbs - at an average of around 50 000 hours is three to five times longer than conventional lighting technology thus lowering the replacement costs.

In addition, intelligent control systems create additional savings, where the street lighting can be adjusted in relation to the level of natural lighting, thereby providing further substantial energy savings. In the Polokwane municipality, the municipality changed 12 757 x 125 W mercury vapour bulbs, for 36 W and 50 W LED bulbs. The municipality indicated that the cost savings in energy was R3 million per annum (four year pay back).

INSTITUTIONAL ARRANGEMENTS

If the capacity exists within the municipality, the Electricity Service Department, in collaboration with Supply Chain Management, can undertake the project in-house. If not, it is recommended that an arrangement with an energy services company be established.

CASE STUDY: Polokwane Energy Efficiency

Polokwane (Limpopo Province) has experienced significant growth in mining, which has placed a significant demand on energy resources in the region. Given the energy supply constraints, the municipality developed a specific strategy within their IDP to reduce energy demand in energy consumption and create capacity to support its economic growth. As part of this strategy, the Energy Services Department supported by the Environment Department within Polokwane Municipality initiated a demand side management project to replace lighting and air conditioners in municipal owned buildings and streetlights.

Project funding amounted to R32 million. The municipality provided its own resources for the initial study and financed the project management costs as part of the institutional costs of its Engineering department. The capital and implementation costs are funded by Department of Energy through a conditional EEDSM grant. This is an intergovernmental conditional grant, which follows the current intergovernmental financial transfer processes captured in the DoRA. The grants were approved on the basis of the following financial management conditions and require the municipality to:

- Ensure that the grants were implemented for the purposes that it was approved for;
- Provide the national Department of Energy with monthly progress reports against the business plans, and attend bi-monthly meetings;

- Include expenditure reports on this grant in the National Treasury standard quarterly reports in terms of the MFMA.

According to the interviewees, there were no major impediments to project implementation and they followed the standard procedures available under the MFMA and grant application processes. The municipality considered applying for climate-specific grant funding in 2008 without any success. Furthermore, they recognise that private funding and loans will require a stronger municipal balance sheet and the costs of implementing a Section 33 process is significant compared to accessing the EEDSM grants (which has a far simpler process).

Elements of the Polokwane Energy Efficiency project which may be replicated by other municipalities, include the development of a sound business plan to support the EEDSM grant application. In the case of Polokwane's Energy Efficient Project, this included:

- Energy audits and energy performance evaluation study of all public facilities in the municipality's demarcations targeted for improvements (i.e. street lighting, traffic signals, public buildings, water pumping and waste water treatment plants).
- Efficiency tests on the major energy consuming equipment, recommendations for replacing and retrofitting those that are inefficient, and calculations of projected benefits.
- Suggestions for improvements to operating and maintenance practices.
- Financial details on the investment required, including materials and potential service providers, expected savings, and payback period.
- List of the energy efficiency measures prioritised according to the highest rate of return on investment and organised into short-, medium- and long-term categories
- Risk analysis, technical & financial, including the mechanisms that need to be put in place to manage and control risks.
- Implementation plan, including system mapping of the public facilities within the municipality to cover size, geographic location, type of technology, etc.
- Energy Efficiency Awareness and Communications.
- Skills development for local energy audits, technicians and electrifications.
- Procedures for the monitoring, reporting and verification (MRV) of energy savings.

Additional features of this project, which may be replicated by other municipalities, include:

- Integrating the project into the IDP as a core element of the energy strategy;
- Investing in high-level cost-benefit analysis to support the business case for energy reduction management, including the upfront capital costs required and potential economic benefits to the region;
- Identifying the appropriate service providers and the need for timely procurement; and
- Securing the EEDSM grants by regular communication with the Dept of Energy and National Treasury.

Medium term: municipal waste recycling programme

There is a growing need to divert waste from disposal to landfill due to rapidly decreasing landfill capacity and the costs associated with managing waste at the landfill. This recycling project is the first of two waste diversion projects.

SERVICES DEFINITION

The range of services provided includes:

- Weekly collection of recyclables material
- Establishing mini recycling centres to facilitate sorting
- Compositing organics collection of green waste & cardboard
- Residual refuse collection
- Clinical waste collection
- Household waste and recycling centres
- Abandoned vehicle removal
- Waste awareness, education and campaigning.

The overall objective of the project is to minimise waste and the disposal in the landfill sites, and create income opportunities for the poor.

TECHNOLOGICAL APPROACH

Mechanical and Behavioural Approach: Waste management has the opportunity to provide significant economic opportunities while offering environmental benefits; this is known as the waste economy. The development and expansion of the waste economy allows for potential partnerships with the private sector to be formed. In other areas in South Africa, this has included informal waste recycling networks, NGOs recycling domestic waste as a funding stream and municipal-run programmes.

INSTITUTIONAL ARRANGEMENTS

Municipalities enable recycling projects through various mechanisms. These include:

- Setting standards and developing the guidelines for recycling to ensure safety;
- Providing facilities at homes for "separation at source" and bulk facilities for collection;
- Partnerships with community based organisations to increases awareness and facilitate collection companies to process the waste for recycling;
- Manage the collection service in a decentralised manner and provide facilities
- Ensure effective coordination

The City of Johannesburg has partnered with numerous community organisations and provided trolleys to 50 poor people to assist with the separation and collection of waste. In addition the city provided facilities in 100 areas covering over 30 000 households. The project has thus far diverted over 7% of the waste from the landfill sites.

The following case studies illustrate how other municipalities have undertaken this.

CASE STUDY: Solid Waste Network, Cape Town

This initiative was initiated by the Informal Settlements Network in 2005 and currently has five full-time employees and collects recyclables from 350 informal pickers. The SWN has two components: 1) the SWN as a community-based network of communities of informal waste pickers, and 2) the support system comprising the collection and management team. Research and experience has suggested that it can be highly counterproductive to establish new formal waste management and recycling systems without recognising the role of the informal sector. The aim of this project is to connect directly with those using the recycled materials to remove the intermediary thereby increasing the income of the pickers.

http://sasdialliance.org.za/projects/solid-waste-network/

CASE STUDY: Separation, sorting and recycling of commercial and industrial waste in Cape Town

Waste Plan is a Cape Town-based on-site waste management company that specialises in recycling and landfill reduction. The company works for commercial clients (e.g. shopping centres) and industrial clients and manages any client's waste on site in such a manner that it saves money and reduces the amount of waste sent to landfill.

On-site separation and sorting of the waste increases the amount of waste available for recycling and recovery and decreases the amount of commercial and industrial waste that goes to landfill. The separation, sorting, and cleaning by Waste Plan staff creates employment through the creation of low skilled jobs. A waste audit is done, and the reduction of the waste sent to landfill is calculated, as well as the savings for the company.
http://www1.uneca.org/Portals/sdra/sdra3/chap4.pdf

Long term: waste-to-energy

Two of the biggest challenges facing municipalities are energy insecurity and overburdened waste management systems. Energy insecurity has a negative effect on a municipality's ability to attract investment and increase employment, which drags down the municipal area's economic growth. Whereas unplanned rapid urbanisation has increased the cost of operating waste management systems, which includes the cost of cleaning-up the ground water, rivers, and land contamination when these systems are pushed beyond their limits.

Both these challenges place a municipality in a "vicious cycle". They reduce a municipality's revenue from supplying basic services while increasing the cost of providing these services, which places a municipality in a tight financial position, where it must either delay investment in infrastructure[9] or raise debt to cover the short-fall. However inevitably these strategies push up the direct and indirect costs, and most of these increased costs cannot be passed onto end-users, inevitably placing a municipality under greater financial stress. For example, the failure of waste management systems increases a municipality's expenditure on environmental and health services.

Also, when a municipality can no longer deliver an adequate level of service, it loses the chance of generating future revenue (i.e. there is an opportunity cost associated with delaying investment). Technological developments have created options for people to by-pass municipal services. In most municipal areas, more affluent residents have invested in solar energy as a solution to shield themselves from intermittent electricity supply and the escalating cost of electricity. In addition, the competition among municipal areas to attract business has intensified, and unless a municipality can provide high-quality services, it is not even considered as an option.

SERVICES DEFINITION

A waste-to-energy project gives a municipality the opportunity to break the "vicious cycle" of tight budgets, delaying infrastructure investment, and deteriorating delivery of essential services. The project turns a challenge - urgent investment in landfill sites and sewage plants - into a potential asset that creates additional revenue streams, lowers the cost of operating waste management facilities and supply electricity, and offering a cheaper, stable source of electricity for end-users residing in the areas increases a municipality's competitiveness.

[9] In this case the issue is the inability to finance the expansion of bulk services – for additional landfill sites, increasing waste management volumes, bulk infrastructure for sewerage treatment and related reticulation infrastructure.

SUMMARY OF A WASTE-TO-ENERGY PROJECT'S BENEFITS

ECONOMIC • Competitive positioning • Facilitation of LED strategies • Create direct and indirect jobs • Increase business development	**FINANCIAL** • Long-term price stability • Long-term price predictability • Lower price volatility • Financial cost savings • Secure future municipal revenue
ENERGY • Provide base load energy • Energy security of supply • Higher quality of energy • Multiple products and services	**ENVIRONMENTAL** • Reduce waste landfill footprint • Reduce the carbon emissions • Reduce contamination risks • Provide clean energy

Source: Renewable Energy Africa Group

TECHNOLOGICAL APPROACH

Mechanical approach: The technology uses solid and liquid waste as feedstock for the gasifier (refer to Figure 12) that creates gas and steam. Both these outputs are used to power a generator that creates electricity and a chemical conversion process that creates fuel (refer to figure below).

OVERVIEW OF WASTE-TO-ENERGY CONVERSION PROCESS

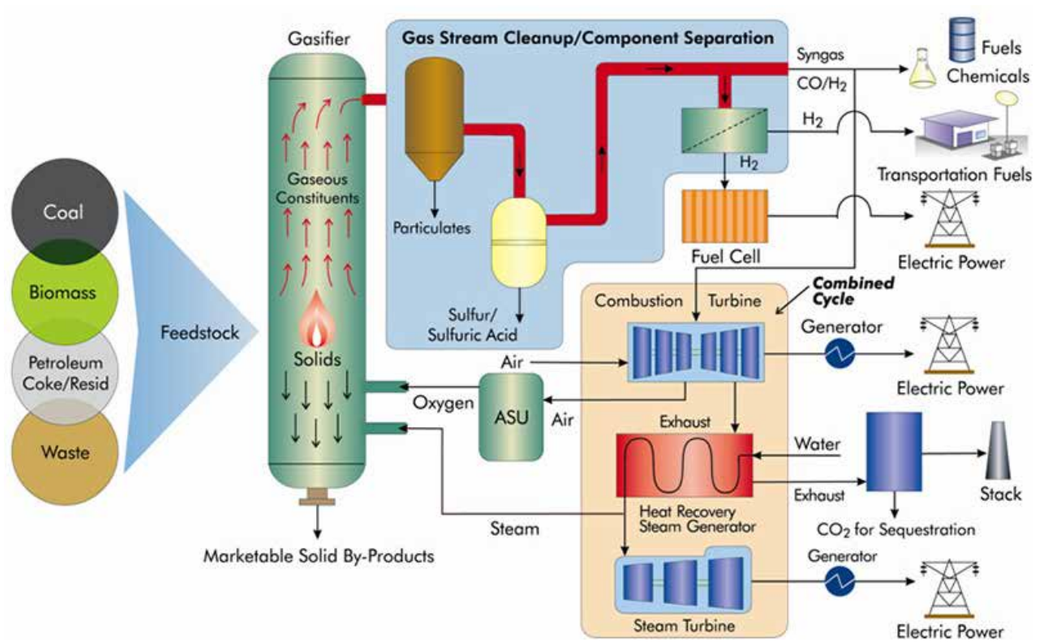


Figure 12: An overview of the waste-to-energy conversion process

Source: Renewable Energy Africa Group Presentation

Waste volume is reduced by approximately 90% which reduces the cost a municipality incurs to manage the waste management function, such as tipping fees of disposal, new landfill cell opening fees, transportation and labour. The amount of MW generated and the consistency of supply allows the project to provide base-load power and also support intermittent on-site solar and wind generation technologies. Hence improving a municipal area's energy security and availability. Also, the cost to generate electricity is cheaper than purchasing electricity from Eskom for resale. Giving a municipality an opportunity to sell electricity to end-users in the municipal area at a profit, but still at a competitive rate that promotes economic development and disincentivises end-users to "go off the grid". Other valuable by-products that can be sold onto end-users include bottom ash, biogas, bio-char, bio-oil and diesel.

The monetary value from selling electricity and fuels creates sufficient and dependable cash flows to fund the waste-gas project, taking into consideration the risk-adjusted return on capital. As a consequence the project could be fully funded by the private sector. Given the complexity of the project it is likely that an ESCO should be involved throughout the project's life cycle, from creating the business case, arranging finance, implementation and monitoring. That being said, no municipal functions will be assumed by the project which means there is no need for Section 78. Also, a permit to generate electricity from NERSA is needed; as well as a section 33 of MFMA to lease the land (however the initial agreement could be for three years – renewed thereafter); and an Energy Purchase Agreement – rate will be equal (initially) and lower than Eskom.

INSTITUTIONAL ARRANGEMENTS

The project is managed by an SPV which includes the finance partners, technology partners, O&M partners and local partners. In addition the four major agreements described below are key requirements from the municipality.

GOVERNANCE • Need established IDP or related resolution • Council resolution to implement project • Municipal support to assist with NERSA license, joint oversight, and further development	**FINANCIAL** • Determining appropriate site close to sewerage facility and grid connection • EIA - where required • Lease arrangement - Short term (extention) - Long term - comply with section 33 of MFMA
POWER PURCHASE AGREEMENT • Comply with Supply Chain requirements • Cost to the municipality is lower than Eskom's • Connection into the distribution grid required	**WATER SUPPLY AGREEMENT** • Minimal level of waste - provided on a daily basis • Not replacing the municipal function of collecting or disposal. Adding a step in the middle to process waste. No MSA Section 78 required • Includes both solid and liquid waste

GREEN MUNICIPAL INFRASTRUCTURE GRANTS - A CASE STUDY OF THE SALDANHA BAY MUNICIPALITY

CASE STUDY: Waste-to-energy project, eThekwini Municipality

eThekwini has developed two landfill gas-to-electricity projects at the Bisasar and Mariannhill landfill sites. Extracted methane gas is used as feedstock to spark ignition engines that drive generators, to produce 7.5 MW electricity. In 1994 the Cleansing and Solid Waste Unit of the eThekwini Municipality investigated the feasibility of using landfill gas to generate electricity, but the cost was prohibitive. The World Bank wanted to implement a CDM project in Africa. Based on the Cleansing and Solid Waste Unit's research on the management of landfill gas emissions, officials from the Prototype Carbon Fund (PCF) approached the Durban Solid Waste Department at the World Summit on Sustainable Development. The PCP proposed that eThekwini develop a landfill gas utilisation project. In 2003 the World Bank conducted an assessment of potential investment grade environmental projects in South Africa, and the Durban Landfill Gas-to-Electricity Project was selected as an investment project.

eThekwini Municipality, through the Cleansing and Solid Waste Unit, were the project implementers. They developed an innovative business plan, drawing on advice from experts that used multiple sources of funding.

- eThekwini Treasury raised debt financing (i.e. loans) from development finance and corporate banks. Entered into a 20-year loan worth Euro 5 million (approximately R58 million) with the French Development Bank (e.g. AfD), and borrowed R 62 million from Nedbank and Standard Bank.
- The Department of Minerals and Energy (DME) gave R 6 million worth of seed funding, approximately a million rand per megawatt generated. The funding was released in tranches, based on the percentage completion of the project.
- DTI funded R 17 million under the critical infrastructure programme to purchase equipment.

The success of the project lies in two factors. First, gaining buy-in from executive management who were prepared to play an instrumental role in unblocking bottlenecks. Second, creating a multi-disciplinary team to implement the project and the team's ability to access assistance from external experts. Both these factors came to fruition because the implementation of the project had been attached to an international event (World Summit on Sustainable Development) which elevated the project's status. Hence one of the lessons from this case study is that creating and sustaining momentum for CCR projects lies in finding ways to include climate change into existing development requirements, without calling it climate change, and using high-profile mega-events to lock in commitment from executive management.

These projects have reduced expenditure on providing basic services, saving eThekwini purchasing R 85 million worth of electricity from Eskom. The electricity generated serves peak demand, helping managing the use of electricity more strategically, which has an economic and social benefit. Also, including the potential value of the carbon credits, the project has probably recouped its initial R 120 million investment. However, in hindsight the transaction cost of the CDM programme is greater than the benefit. The CDM registration and accreditation process is complicated, onerous, and lengthy.

GREENING WATER SERVICES INFRASTRUCTURE

Water exists in a complex and interconnected system in nature that supports life. However, urban water systems have separated the provision and operations of water supply, wastewater treatment and stormwater into different institutional structures. Green infrastructure requires that urban systems become more aligned with natural systems, thereby considering the full water system rather than aspects of it in isolation. This could unlock new water sources or improve water efficiencies.

SERVICES DEFINITION

A unified Water Service Definition: The integrated management of the urban water cycle - from abstraction, treatment, distribution and storage to disposal and reuse - in harmony with and without harm to freshwater and marine ecologies. This includes the ongoing management and proactive maintenance of water services systems along with effective demand management strategies put in place. The quality of the water provided is to be matched to its intended use. This includes all the municipal (local and district), provincial and national organisational arrangements and relationships necessary to ensure the provision thereof including, amongst others, appropriate health, hygiene and water resource use education, the measurement of consumption and the associated billing, collection of revenue and consumer care.

Short term: reduce demand and unaccounted for water

As noted in the SBM Water Services Development Plan, the municipality has a Water Conservation and Demand Management Strategy that would enable a 5% reduction in water demand. This would help reduce resource consumption to more sustainable levels while reducing some of the need for new infrastructure and investment in water services.

TECHNOLOGICAL APPROACH

Mechanical and Behavioural approach: Unaccounted for water (UAW) is the difference in the amount of water supplied to a municipality and the amount of water that is metered (used) in the municipality. This difference is representative of water lost in the reticulation system through leakages, illegal connections and unmetered users. To reduce UAW, it is necessary to undertaken good maintenance practices both reactively (fix leaks as soon as possible) and proactively (good operational management and refurbishment to prevent leaks from occurring). The municipality should install water meters at all unmetered water users, which could help to reduce the number of illegal connections and to monitor water usage and request reductions in consumption if necessary.

INSTITUTIONAL ARRANGEMENTS

If the capacity exists within the municipality, the Electricity Service Department, in collaboration with Supply Chain Management, can undertake the project in-house. If not, it is recommended that an arrangement with an energy services company be established.

Medium term: sustainable stormwater management and industrial wastewater treatment

Sustainable urban drainage systems (SUDS) aim to reduce the effect of development on water and ecological systems by slowing the flow rate of water and reducing the amount of water released. Poor stormwater management can exacerbate floods and droughts. Industrial effluent from industries in the Saldanha Bay municipality is predominantly brine (salty water). The amount of brine released is expected to increase with an increase in industry and with the potential desalination plant.

TECHNOLOGICAL APPROACH

Sustainable urban drainage systems

Biological Approach: SUDS focus on the use of ecosystem services and soft infrastructure that uses natural rather than man-made systems. This allows SUDS to also protect and enhance groundwater quality as more water is filtered and infiltrates surfaces to reach aquifers in the municipality.

Space within urban areas of the municipality should be identified for the following key strategies:

- source control
- permeable surface such as previous paving or soft landscaping
- stormwater detention
- stormwater infiltration
- evapo-transpiration (e.g. from a green roof)

The use of green infrastructure to address stormwater management can and should unlock opportunities for other ecological services such as purifying air, increasing local biodiversity, providing a cultural and recreational space for the community and reducing the urban heat island effect.

CASE STUDY: Managing stormwater runoff with wetlands Philadelphia, Pennsylvania, USA

Philadelphia has a sewer collection system that is 60% combined sewer and 40% municipal separate storm sewer system. The City is working to improve stormwater management and alleviate pressure on this combined sewer system (CSS) through restoration and demonstration efforts, regulations and incentives for the private sector via a revised stormwater billing system. Philadelphia is trying to institutionalise green infrastructure as standard practice via citywide policies, such as a parcel-based billing system for commercial properties, Green Plan Philadelphia, Green Roof Tax Credit and the Green Streets program. Philadelphia set a new water billing system for commercial and industrial properties based on the amount of impervious surface on properties; also owners can get a fee credit through implementation of stormwater.

Benefits:

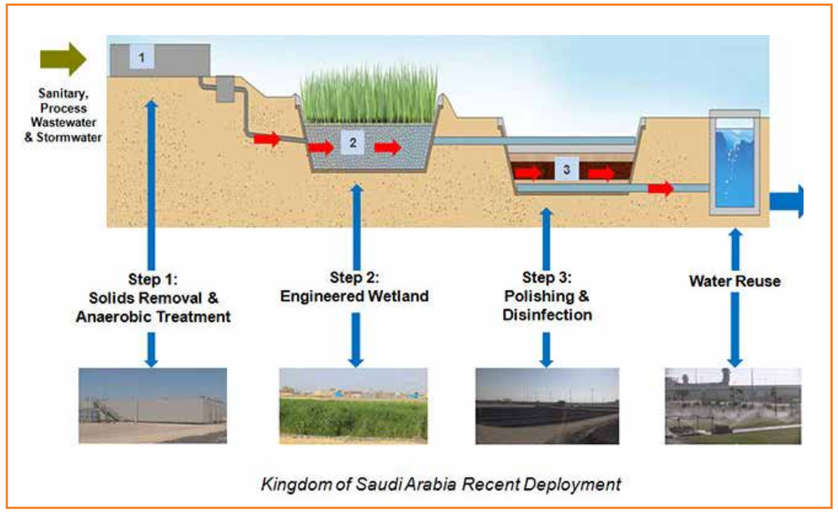
- Stormwater runoff reduction resulting in water quality improvements, relief to aging grey infrastructure.
- Create habitat for wildlife; carbon sequestration; recreation dual use spaces (ex. baseball fields).
- New practices will reduce combined sewer overflow (CSO) by 25 billion gallons, and save the city as much as $8 billion over grey infrastructure alternatives.

http://www.nature.org/about-us/working-with-companies/case-studies-for-green-infrastructure.pdf

Consider constructed wetlands for residential and industrial wastewater treatment

Biological Approach: Through the use of a well-researched and well-built constructed wetland, brine can be filtered whereby the salts are removed and this water can be safely released or reused as non-potable water.

This can occur through a stepped process where the constructed wetland is considered a key filtration tool.



Kingdom of Saudi Arabia Recent Deployment

Source: https://www.alcoa.com/sustainability/en/case_studies/2014_engineered_wetland.asp

INSTITUTIONAL ARRANGEMENTS

The implementation of these green infrastructure projects for stormwater management and the treatment of industrial effluent will require strong partnerships with the private sector; that is developers, property owners and industry. Stormwater management using SUDS is necessary on public and private land and can therefore be regulated by the municipality. These regulations should be developed in discussion with landowners.

The treatment of industrial wastewater offers an opportunity for the municipality to directly partner with industry. The municipality could act in a facilitator role to promote collaboration on a project to be shared by multiple industries. This could help reduce the environmental and financial burden on individual stakeholders.

CASE STUDY: Treatment of industrial effluent - Union Carbide Corporation, Texas, USA

Seadrift is a large industrial complex containing several manufacturing units involved in the production of plastic resins and other organic chemicals. When the "grey" system constructed to treat effluent from the complex failed to meet the discharge requirements of Environmental Authority (EA), an alternative solution was sought for treatment. Instead of a conventional wastewater system, a constructed wetland was developed which now releases effluent that is 100% compliant with EA regulations.

Benefits:

- Low initial and operational capital required ($1.2 to 1.4 million as opposed to $40 million for gray alternative).
- Low energy and resource requirements with the corresponding environmental benefits – minimal equipment, no pumps, no additives, no oxygen system, no added water, no bio solids to handle or dispose.
- Operational support drastically different as a wetland requires minimal support from operations and maintenance, while the gray alternative requires 24/7 support.
- Construction and implementation time reduced.
- Co-benefits identified but not valued: positive impact on ecosystem (provides habitat for wildlife/ educational opportunity and other soft benefits to Dow personnel and local community).
- A win in all aspects (no waste; no energy; no 24/7 operation; no landfill; safer; meets permit 100% of time at a fraction of the cost).

http://www.nature.org/about-us/working-with-companies/case-studies-for-green-infrastructure.pdf

CASE STUDY: Treatment of industrial effluent - Shell Petroleum Company, Oman

At the PDO Nimr oil fields, a tenth of the total production is crude oil. The remaining production, around 330,000 m^3 per day, is water that is brought to the surface together with the oil. This water used to be disposed of by injection into a deep disposal well. To reduce the high costs of treating and re-injecting the produced water, PDO together with BAUER, developed a project proposal that would reduce or eliminate the power consumption and CO_2 emissions associated with the operation of equipment for deep well disposal. The solution was a four-tier gravity-based wetland design.

Benefits:

- Significant capital cost savings compared to the man-made produced water treatment and injection facility.
- The gravity-based wetland design requires close to zero energy for water treatment, thus reducing power consumption by approximately 98% (for the 30vol% of water treatment) due to the elimination of electric powered water treatment and injection equipment. Also, the new facility enables an additional crude oil recovery of 200 barrels per day.
- Satisfactory water treatment performance ever since the start of the wetland operation (December 2010). The oil content in the produced water is consistently reduced from 400 mg/l to less than 0.5 mg/l when leaving the wetland system.
- CO_2 emissions reduced by approximately 98% (for the 30vol% of water treatment) due to the elimination of electric powered water treatment and injection equipment. The wetlands provide habitat for fish and hundreds of species of migratory birds. Also, the wetlands offer potential for innovative customer value propositions that could provide a variety of socio-political benefits e.g. through by-product optimisation (fresh water, biomass etc.).

http://www.nature.org/about-us/working-with-companies/case-studies-for-green-infrastructure.pdf

Long term: water reclamation and reuse

All wastewater treatment plants in the municipal area should achieve Green Drop Certification. The green drop award demonstrates that the municipality is achieving high standards in the management and delivery of an efficient wastewater service. As treated wastewater is released into rivers and the sea, the quality of water released has a direct effect on the ecological health of water bodies in the municipal area. Wastewater can also be considered a source of water for potable or non-potable uses if appropriately treated. The nutrients extracted from wastewater plants can also be used in the production of biogas for energy.

TECHNOLOGICAL APPROACH

Mechanical and Behavioural approach: Water reclamation can take place through a number of processes that are often directly linked to the stormwater and wastewater treatment systems. This can occur through upgrading existing wastewater treatment facilities or establishing new facilities to treat water to the standard needed for reuse. It is important to engage with stakeholders in the municipality to establish a market for the reclaimed water.

WASTEWATER TREATMENT WORKS

CASE STUDY: George, Western Cape - wastewater reuse for municipal drinking water

The town of George in the Western Cape has re-engineered one of its largest wastewater treatment works (WWTW) to allow for the abstraction and reuse of water from the plant. The project was fast-tracked last year due to the worst recorded drought experienced on the Garden Route in 133 years. George was severely affected, with the dam dropping to an historic low of 16.9% in February 2010. The reuse plant will supply 10Ml/day of high quality treated water into the Garden Route Dam, which is the only source of raw water supplying George with its water requirements. Not only is it a reliable water resource in times of water shortage, but is an excellent example of water demand management and environmental responsibility." The project also created job opportunities for residents living along the pipeline route, who worked 7 000 labour days at a cost of R630 000.

http://www.southafricaonline.co.za/george-mun-first-in-sa-to-implement-indirect-reuse-of-treated-effluent_article_op_view_id_5680

CASE STUDY: Langrug, Franschoek - grey water swales and living sewer

Langrug is an informal settlement in Franschoek and is currently undergoing an upgrading process. The use of grey water swales provides a method for separating polluted grey water from stormwater, cleaning and treating the water to improve the quality of soils, and to green the settlement. Micro wetlands will be coupled with stormwater swales that create a "living sewer". Plants help to filter, clean, slow down the flow, and break down waste in the water. The swales are positioned along vertical routes between the houses and improve the environment quality and health of the settlement. Each household will dispose of its grey water at specific disposal points – essentially buckets sunk into the ground and connected to underground pipes – based on the existing underground piping system previously installed by the community. The swales are designed to slow the flow of the water to reduce flooding. Trees which interconnect at points along the sewer, draw nutrients from the water, while filtering it, and giving back by creating healthy soil. The wastewater and stormwater prototype will treat about 6 000 litres of grey water a day for the 115 households.

https://www.westerncape.gov.za/110green/sites/green.westerncape.gov.za/files/documents/WASE-January-2015-p6-13.pdf

INSTITUTIONAL ARRANGEMENTS

If the capacity exists within the municipality, the Civil and Water Services Department, in collaboration with Supply Chain Management, can undertake the project in-house. If not, it is recommended that an arrangement with a water services company be established.

THE WAY FORWARD

This report indicates that green approaches to infrastructure have the potential to not only reduce the environmental impact of infrastructure services but to also to improve the performance of the municipal infrastructure portfolio. Green infrastructure approaches (biological, technical and behavioural) can help reduce the costs of such services to municipalities, they can mitigate environmental and service delivery risks, they can contribute to enhanced quality of life and they can increase the attractiveness of an area for economic investment.

The report also indicates that there are factors that discourage the adoption of green infrastructure approaches. These are embedded in current approaches to defining municipal infrastructure services, in the default technologies used to provide infrastructure services, in the infrastructure funding models and in the institutional models for delivering infrastructure services.

This section outlines a series of recommendations to both SBM and the other role-players to facilitate the improved and increased adoption of such green infrastructure approaches. It recognises that there are no simple solutions and that work at many levels is required to create the momentum to establish green infrastructure as an important part of the municipal infrastructure provision toolbox.

Recommendations for broader systems to support green infrastructure

There are a number of recommendations regarding national, provincial and municipal policy and practice that need to be considered to support the emergence of a more extensive use of a green approach to infrastructure provision. These are outlined below.

SERVICE PLANNING AND MANAGEMENT

It will be important to ensure that green infrastructure alternatives are properly considered during the service planning process. One key area of change lies in educating councilors, officials and residents about the potential benefits of green approaches and where and how these can be used.

This education role is particularly important where the green approaches involve redefining the nature of a particular service. This may lead to strong community resistance to the innovation if it is seen as an inferior service. This is a very sensitive issue in South Africa where service equity is such an important issue. An obvious example is non-flush sanitation systems, such as VIP toilets, that are clearly much more environmentally desirable but involve a change in an expectation as to the nature of the service.

Another key intervention relates to how infrastructure alternatives are costed. It is suggested that adopting a life cycle costing approach to infrastructure that also incorporates the costs and/or benefits of externalities generated by the infrastructure services will enable municipalities to make better infrastructure choices and will enable them to assess more accurately whether a green infrastructure approach to an infrastructure challenge is preferable to a more conventional grey approach.

The key recommendations are:

- That SBM position itself as a pioneer of green approaches to infrastructure provision to strengthen its positioning as an attractive site for tourism and investment. Note that this intent is already reflected in the IDP.
- That SBM consolidate partnerships with appropriate funders and support agencies in order to facilitate the planning, project design, project proposal development and implementation of a range of projects that pilot green approaches to infrastructure as outlined in this document.
- That SBM conduct a green audit of its existing infrastructure portfolio to assess other key areas where

short-, medium- and long-term savings can be achieved through adopting green approaches as an input into their IDP and service planning processes.

- That Department of Cooperative Governance (DCOG) and National Treasury (NT) together with other relevant national departments be approached to explore through the integrated development planning, spatial development planning and service planning implementing green infrastructure projects that improve the sustainability and the resilience of municipalities. Potential areas for reform include updating the guidelines for municipal Water Services Plans and Waste Management Plans to require exploration of green infrastructure options, providing financial incentives to pioneer LED investment and the adoption of a life cycle costing approach.
- That National Treasury be approached to explore how the requirements of the supply chain management process can be adapted to enable municipalities to adopt green approaches where these may be more expensive in a narrow financial sense but where the investment in the green approach may generate a range of non-financial benefits that outweigh the cost issues.
- That SALGA, SACN or another appropriate government agency be approached to partner with ICLEI to prepare a set of green infrastructure guidelines for municipalities, contractors and communities and to develop a website that promotes green infrastructure alternatives as a superior high quality form of provision in both rich and poor communities.

RESEARCH AND DEVELOPMENT

A focus on green approaches to municipal infrastructure provision is a relatively new field and there is a limited, albeit growing, base of evidence regarding the efficacy of such green approaches. There is a critical need for extensive research and development activity to test the performance of existing green technologies in relation to alternative traditional approaches. Evidence rooted in the South African municipal context about the efficacy of different green approaches creates more certainty and reduces the risk of adopting such technologies significantly.

There is also considerable potential for R&D activity to develop innovative new green infrastructure technologies geared to the South African municipal environment. Given the rapid urbanisation anticipated across the global South over the next 50 years, there is a potentially huge market for green infrastructure solutions. There is thus a significant economic benefit potentially where Africa can develop innovations that are applicable to rapidly urbanising cities with high concentrations of informal settlement and major service demands.

The recommendations are:

- That SBM establish a partnership with local universities to undertake detailed research into green infrastructure pilot projects in the municipality.
- That ICLEI facilitate the creation of a research and development partnership involving the Institute of Municipal Engineers of South Africa (IMESA), appropriate university departments and research organisations, other professional associations and major infrastructure contractors to promote research geared to the adoption of green approaches to the provision of municipal infrastructure services.
- That this partnership explore a range of activity including:
    - Establishing and resourcing a green infrastructure advisory panel comprising experts in the field who are able to provide technical advice to municipalities regarding green infrastructure approaches;
    - Supporting municipalities to pilot green infrastructure approaches through facilitating funding and partnerships and ensuring systematic evaluation of such pilot projects;
    - Facilitating a prioritisation of green infrastructure research projects by academics and students;
    - Establishing a national accreditation or assessment mechanism for green infrastructure provision where participating municipalities are evaluated as a way of promoting and incentivising green approaches to infrastructure provision (along the lines of the Green Drop awards for water provision).

- That SALGA, Department of Science and Technology (DST), Department of Trade and Industry (DTI) and Technology Innovation Agency (TIA) be approached to promote primary and applied research into new green infrastructure technologies. This should involve the creation of a fund that supports green infrastructure innovation.

INFRASTRUCTURE FUNDING AND FINANCING

As we have seen, the municipal infrastructure grant architecture does not support proactive infrastructure investments by municipalities that anticipate and promote economic growth or that support environmental considerations such as reducing GHG emissions. There are also many legal obstacles that make private investment in such infrastructure very difficult to secure. There is thus a critical need to find ways to enable anticipatory green infrastructure investments by municipalities and private-sector partners.

The following recommendations are made:

- That SBM prepare long-term financial plans for investments that include the financial requirements for green infrastructure and the options for funding this that are potentially available.
- The SBM develops bankable business plans, for selected green infrastructure projects through accessing the project preparation facilities of DBSA, EIB, USAID and other donor funding agencies.
- That SBM explore a range of green infrastructure partnerships with the private sector, particularly in the areas of waste to energy and gas-powered energy in order to develop its green energy contracting and regulatory capacity and in order to identify any regulatory obstacles to the implementation of such projects.
- That DCOG and NT be approached to create a specific window in the current municipal infrastructure grant architecture with a view to incentivising the more proactive provision of green infrastructure.
- NT should mobilise resources for LED through establishing a green infrastructure bond, a green infrastructure guarantee that helps mitigate municipal risk at least for pilot projects as well as the potential of competitive grants to incentivise green infrastructure innovation.

INSTITUTIONAL REFORM AND CAPACITY BUILDING

As indicated, large-scale industrial growth initiatives like those envisaged for SBM are highly complex, involving the actions of all three spheres of government as well as being highly path dependent on the actions of state-owned enterprises (particularly Eskom and Transnet) and the large private investors. This requires high levels of planning, coordination and inter-governmental co-operation to ensure that the sequencing of growth and management of its externalities and spillovers are addressed. There is a critical institutional challenge then to put together joint institutional mechanisms that have the resources, capacity and mandate to co-ordinate and manage the infrastructure dimensions of the growth process and its unintended consequences.

The following recommendations are made:

- That SBM establish an Infrastructure Planning Forum to address infrastructure planning, funding and operations (including maintenance). This forum should include SBM, PGWC, SB IDZ and TNPA as core members but should also involve other relevant government department and agencies and major private investors as required;
- That a long-term inter-governmental infrastructure development plan be developed under the leadership of such a forum that is binding on all the parties;
- That SALGA or IMESA be canvassed regarding supporting the establishment of a green infrastructure learning network involving all municipalities that have or wish to implement green infrastructure options.

CONCLUSION

The case for low emission development (LED) for municipal sustainability is compelling – providing compact, connected and more efficient urban environments. This report illustrates that SBM can, with adequate support, implement some of its priority green infrastructure projects. In addition, financial and technical resources are available to develop plans and implement these priority projects.

LED offers South African cities and towns a new paradigm to address the current spatial and resource inefficiencies. This must include integrating the current initiatives such as SPLUMA, SCOA, and infrastructure rehabilitation with LED principles. The challenge is to show that integrating these initiatives will contribute towards reducing poverty, unemployment and inequality while building the resilience of cities and towns. This study illustrates the need for initiatives at both the national and local levels.

At the local level, pioneering towns will assist in creating a viable carbon market. Given the maturity level in the transition towards LEDs, this phase must encourage R&D, demonstration projects, and investment in both appropriate technologies and implementation methodologies. As outlined above, the simple energy efficiency projects show significant returns, cost savings for the municipalities, and are easily funded. Long-term waste-to-energy projects shows the link to drive green economic growth, with very little risks. Much of the challenges that municipalities must overcome include: lack of capacity, regulatory caution, and start-up capital. Overcoming these barriers will require national incentives and support to develop a critical mass of projects.

Additionally, at the national level a mix of policy incentives, concessional financial instruments and capacity support will assist in developing the shift to a new LED paradigm. This will include mobilisation of funding, project preparation support, creating appropriate funding windows to finance green infrastructure, and developing a robust monitoring and evaluation framework.

SBM as the Export Processing Zone (EPZ) offers a unique opportunity to pioneer the implementation of selected green infrastructure projects, in concert with national and provincial government departments as well as the private sector to drive sustainable economic growth and resilience. ICLEI can add significant value through deepening the engagement, and the objectives of SBM to implement selected green infrastructure projects.

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