

Knowledge Week 2011

SUMMARY REPORT

Greening infrastructure programmes in South Africa



environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA



DBSA
Development Bank
of Southern Africa



Development Bank
of Southern Africa

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Knowledge Week 2011

12-14 October 2011

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In partnership with



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Foreword

Mr Ravindra Naidoo, Group Executive: Development Planning Division, Development Bank of Southern Africa (DBSA)

The Development Bank of Southern Africa (DBSA) is committed to sustainable development. As a development finance institution that focuses on infrastructure planning and implementation, this has naturally led to an emphasis on the greening of infrastructure programmes and expenditure. The Bank pursues this agenda internally through supporting green projects and applying its environmental assessment guidelines, as well as through its partnerships with key government and other stakeholders. In its role as a knowledge bank of the State, the DBSA drives the conceptualisation of what a green infrastructure agenda could look like.

Indeed, the greening of infrastructure programmes, if planned and costed correctly, could improve programme sustainability and reduce the demand on South Africa's limited natural resources, especially through enhanced life cycle costing and carefully planned maintenance. Moreover, there is a need to go beyond sustainability and to embrace regenerative systems where the focus is on producing, rather than using.

Building on work done in association with the Green Economy Subcommittee of government's Economic and Employment Cluster, and complementing its partnerships with the Department of Environmental Affairs (DEA) and the National Treasury on green initiatives, the DBSA hosted its annual Knowledge Week on the topic "Greening infrastructure programmes in South Africa". The conference, held between 12 and 14 October 2011, was presented in partnership with the DEA and supported by the South African National Biodiversity Institute (SANBI), the Council for Scientific and Industrial Research (CSIR) and the Construction Industry Development Board (CIDB).

Knowledge Week 2011 provided a platform for development practitioners to share knowledge, interact and debate on this topical development issue. It was structured to contribute to the conceptualisation of the greening of infrastructure, particularly in the priority sectors other than energy, where much effort has already been spent. The theme was topical, given South Africa's subsequent hosting of COP17 in December 2011.

In the spotlight was the critical role that new technologies play, and the need to balance what is sometimes seen as a trade-off between green and brown objectives for infrastructure development. The integration of greening considerations into the government's vision, planning and delivery agreements was deliberated, while pilot projects and case studies of practices both locally and elsewhere helped to identify practical responses and lessons to be learnt. How affordable the fiscus is likely to find a greener infrastructure agenda, as well as possible sources of finance, were also considered.

Summarising the three days' deliberations in "Ten Point Plan for greener infrastructure", the participants endorsed an approach that focuses on a broad definition of green infrastructure that is socially inclusive and focuses on mitigation, adaptation and increased efficiencies, and decreases the impact of infrastructure on the environment and biodiversity. Appropriate planning and integrated infrastructure implementation were highlighted as being crucial to achieving greener infrastructure, along with partnerships and innovation in financing. The need to monitor and evaluate progress was also seen as vital to success.

It is fair to conclude that the participants in Knowledge Week 2011 succeeded in reaching agreement on the greening of major infrastructure programmes in the country and shed some light on how to go about it. Furthermore, they identified key steps for the transformation of South Africa's infrastructure development path to one which is more sustainable, in each and every sense of the word. Knowledge Week 2011 also reinforced the existing work being done by the DBSA in collaboration with its partners, and identified new areas of work that are being pursued with relevant stakeholders.



Welcome and opening address
Ministerial address: State owned companies
Ministerial address: Key policy discussion points

Welcome and opening address

Chairperson: Mr Ravindra Naidoo, Group Executive: Development Planning Division, Development Bank of Southern Africa (DBSA)

Knowledge Week 2011 focuses on greening infrastructure programmes in South Africa and looks at how programmes, especially state programmes, may be made as green and climate resilient as possible. South Africa is currently running one of the largest public sector infrastructure programmes in the world.

In its role as state adviser, the Development Bank of Southern Africa (DBSA) advises on long-term infrastructure planning and state financing models. As the country's leading development finance institution, the Bank also finances state programmes and aims to ensure that the money the state spends on infrastructure is indeed well spent. The DBSA avoids retrofitting afterwards, and therefore attempts to gather the best lessons and examples from around the world to ensure that the Bank is prepared for climate change issues.



Mr Ravindra Naidoo
Group Executive, Development Planning Division
(DBSA)

When problems are institutional by nature, however, it is often insufficient to offer only advice or finance. For this reason, the DBSA also deploys a great deal of capacity. The Bank currently pays more than 600 full-time experts who are positioned in different spheres and at different levels of the South African government.

In order to find feasible solutions to various salient issues, the Knowledge Week conferences are designed to facilitate discussions between the DBSA, the state and key role players in society, both locally and internationally. We trust that this year's Knowledge Week will come up with fairly substantive points that can be put into action.

In 2010, the Knowledge Week focused on human settlements - housing and transport in particular, issues that are not far removed from the present topic. A number of activities have flowed from that three-day discussion. In 2009, the focus was on local government, just before the turnaround strategy discussions on local government. Many of the issues we dealt with then have found resonance in the Local Government: Municipal Systems Amendment Act, Act No. 7 of 2011.

The DBSA wishes to thank its partners and supporters of this event, especially the Department of Environmental Affairs (DEA) and the Council for Scientific and Industrial Research (CSIR), our research partner. The South African National Biodiversity Institute (SANBI) and the Construction Industry Development Board (CIDB) have also been key in both the debate around, and the implementation of, the green infrastructure agenda. We hope to continue to work with them and deepen our partnerships with them.

Going forward, the DBSA will be working with state departments and institutions to partner around components of the green economy, with a focus on

infrastructure programmes and their financing. It is crucial to put money and resources behind green programmes for transport, the built environment, water, etc. in order to place the country, and indeed the wider region, on a greener development path. We will be looking at how to choose the best planning, methods, approaches, technology transfer and development.

For this reason, the conference will draw on global and local expertise, including several case studies. During the break-away sessions, participants can focus on issues in greater depth, and engage in the discussion on priority sectors.

We trust that this conference will help to develop a concrete agenda for the DBSA, including its role of advising the government and other entities, and in partnership with the various organisations represented here. There is much work to be done to advance green infrastructure delivery. Making real strides will require a clear set of steps, and the identification of the best levers to drive change. We look forward to your assistance in working together to help us to achieve this objective.



Source : Richard Bennett

Knowledge Week Day 3 - Registration

Ministerial address: State owned companies

The Honourable Mr Malusi Gigaba, Minister of Public Enterprises

Africa is faced with an enormous infrastructure backlog. On the one hand, we may want to act in haste to address this backlog and then concern ourselves less with the sustainability of our interventions. On the other hand, Africa does not have the requisite resources to invest in large-scale infrastructure development. Those entities outside South Africa which do, and which are hungry for the country's natural resources, may bring in the kinds of investment that will harm the population in both the short and long term. The challenge, therefore, is to balance the country's urgent needs and the sustainability of any interventions.

The South African government has recognised the vital importance of greening the economy for the purpose of building a better life for its people, as well as for the particular role a green economy can play in creating jobs, fighting inequality, and eradicating poverty.

South Africa is the most industrialised country in Africa, with a population of about 50 million people. The country's national economy is built



The Honourable Mr Malusi Gigaba
Minister of Public Enterprises

on the so-called Minerals Energy Complex and is extremely energy intensive. This reflects the historical industrial policy of building power stations directly above large coal reserves to generate cheap electricity. Coal provides 75% of the fossil fuel demand and is responsible for 91% of the electricity generation at present. South Africa's industrial economy is built on cheap coal to a significant extent; consequently, it is one of the 30 largest emitters of greenhouse gases (GHGs) globally and is among the highest per capita carbon emitters.

The bulk of GHG emissions in South Africa derives from the energy sector, which contributed to 78% of the country's total GHGs in 1994 and more than 90% of its carbon dioxide emissions. In this energy-intensive, coal-dependent and high emission context, the government has adopted a proactive approach to combating the challenges associated with climate change. The policy objective is to make a fair contribution to the global efforts to stabilise GHG concentrations. At COP15, President Jacob Zuma conditionally committed South Africa to achieving a 34% deviation below the business-as-usual emission trajectory by 2020, and a 42% deviation by 2025. This commitment is conditional upon Annex 1 countries providing appropriate and adequate resources to support these mitigation efforts.

A key principle that needs to guide such efforts to reduce carbon emissions is to ensure that these initiatives and programmes have a sound economic logic and are integrated into the national economic strategy. In the absence of this discipline, it is unlikely that the transition will be sustainable or receive broad-based support. The government cannot impose undue burdens on the population and economy in a context of

high levels of unemployment and poverty. Consequently, the New Growth Path and the Industrial Policy Action Plan have identified the transition to a green economy as an opportunity to develop South Africa's industrial and technological capabilities to support economic growth and employment.

Sectors associated with the green economy and mitigation of emissions include renewable energy technologies, biofuels, energy conservation technologies, and forestry. Green technologies can also enable the economic development of remote areas that have a renewable resource, and can enable infrastructure development and integration in the region as a whole.

A key programme in support of the industrial strategy and the New Growth Path, and one in which the Department of Public Enterprises (DPE) is integrally involved, is that of the South African Renewables Initiative (SARi). This programme enables the development of renewable related industrial capabilities through defining a funding mechanism to leverage international climate finance. The objective is to procure a critical mass of renewable energy without imposing unacceptable incremental cost burdens on the South African fiscus.

As the shareholder Ministry, the DPE has begun to define a policy to guide state-owned companies (SOCs) in its portfolio in their engagement with the challenge of managing climate change and achieving a green economy. The draft policy, which is being discussed with the SOCs, is informed by the following three key design principles:

- SOCs need to focus on optimising the overlap between commercial economic developmental and environmental

objectives, while carefully managing areas where these objectives are in conflict.

- Over time, climate change and environmental and green economy considerations will be integrated into the heart of SOC planning, procurement and operational processes. However, this will be an ongoing process of learning and continuous improvement rather than a “big bang”.
- Each SOC requires flexibility in the way it responds to the challenges of climate change, given the diversity of sectors within which it operates. As a starting point, the DPE wants to ensure that SOCs begin a process of systematic, continued learning around how to engage with the associated opportunities and risks.

Consequently, the draft policy requires that each SOC should develop and submit a strategic plan for how it will engage with the issue of climate change. This is expected to be integrated into the standard SOC planning cycle over time. The plan should optimise the SOC's impact on the reduction of carbon emissions and the development of a green economy. It should outline the concrete initiatives the SOC will take to achieve these objectives, and well as how broader government support and resources could be used to accelerate or enhance the implementation of the plan.

The DPE will monitor implementation of the plan and track each SOC's impacts and learning process. It also intends hosting a workshop at Conference of the Parties (COP) 17 with a number of state shareholder manager counterparts from key emerging economies on how it can most effectively engage with the challenge of climate change. As part of the preparation for the

Ministerial address: state owned companies - continued

workshop, the DPE has commissioned research into global best practices by public enterprises. It is hoping to start an ongoing dialogue and process of knowledge sharing with its global counterparts about optimising the developmental impact of SOCs. SOCs can indeed play a decisive role in catalysing the movement to a green economy through:

- adopting technology and diversification within their core businesses;
- providing a critical mass of demand for both operational and capital inputs, which can catalyse the development of new industries;
- enabling regional infrastructure integration.

South African Airways (SAA), for example, operates in the global market. It is consequently extremely vulnerable to policies in countries that impose penalties and taxes on carbon emissions. In the short term, SAA is exploring the implementation of a voluntary carbon offset project to support the development of forestry in the region. SAA may require that biofuels make up half of its fuel supply by 2020 in order to avoid future penalties. This will create a pressing demand for an extremely large quantity of biofuels that can form a base load against which a fully vertically integrated biofuels industry can be developed locally. This will require a coordinated state programme that promotes investment in second-generation biofuel crops, both in South Africa and in southern Africa. The South African Forestry Company Limited (Safcol), an SOC with considerable experience in forestry, has been developing intellectual property to support this process.

Eskom, the South African electricity utility, is playing a small role in the introduction of renewables into South Africa's energy supply.

The company recently signed a loan agreement with the African Development Bank for the establishment of a wind farm and a concentrated solar farm in the Western and Northern Cape. It is hoped that these projects will be implemented at least by early 2012. Eskom is taking the risk of investing in the construction of the pilot wind and concentrated solar power-generating facilities, which will allow it and other producers to understand how these technologies operate in South African conditions, and also how effective integration with the grid can be ensured.

Eskom is also exploring the requirements for integrating a significant quantity of non-dispatchable renewable power into the network, and how this power can be optimally employed. This will enable the development of a renewables industry in South Africa and bring about a change in the composition of the country's energy portfolio. It is a priority to make the South African grid accessible to renewable energy generation projects in neighbouring countries, which should play an important role in integrating regional infrastructure and unlocking the region's green potential. In addition, Eskom is developing cutting-edge, climate-friendly technologies, such as underground coal gasification.

It is also worth noting that Transnet's rail business is intrinsically environmentally friendly. Rail transport is safer than road transport; involves fewer emissions; decreases road damage and congestion; and lowers overall transport costs. The challenge is to provide capacity to unlock growth in Transnet's existing key customers, as well as to move a significant quantity of freight from road to rail. This will require Transnet to accelerate its investment programme; improve its operational efficiencies; and experiment with new road-to-rail technologies.

Development finance institutions can play a key role in supporting processes such as these and we are having important discussions with the Industrial Development Corporation, led by Minister Ebrahim Patel and myself. I have noted that the CEO of the DBSA has expressed the Bank's interest in engaging with the DPE in similar discussions. There is appetite on the DPE's part for such engagement, because it believes that the balance sheet of various institutions in South Africa should be unlocked in order to make the required investments in infrastructure development.

In conclusion, I want to congratulate the DBSA on this initiative to increase the government's

knowledge around what it will take to green South Africa's infrastructure programmes and economy as a whole. There are no textbook solutions to this challenge. It is necessary to start a learning process that will result in a major transformation in the way the government thinks about the economy and the way SOCs think about themselves and go about planning, procuring and operating. Although it is a difficult challenge, it will be worthwhile if all South Africans can live in a cleaner, more sustainable world and leave this legacy for our children.



Source : Graeme Williams - MediaClubSA

Eskom's power infrastructure

Ministerial address: key policy discussion points

The Honourable Ms Edna Molewa, Minister of Water and Environmental Affairs

It has been almost a decade since South Africa hosted the World Summit on Sustainable Development in Johannesburg. As we look forward to Rio +20, the United Nations Conference on Sustainable Development to be held in Brazil in June next year, the international community is still learning from the experiences of the past 20 years.

Central to the debate on sustainable development is how to enhance environmental governance, and further articulate environmental sustainability in economic development, through the green economy concept within a context of the continuing need to eradicate poverty. There are countries across the world that are still grappling with this concept. South Africa's transition to a new green economy should simultaneously keep the aspect of job creation intact, instead of allowing jobless growth.

It is important to focus on issues of poverty alleviation, as well as to contribute to the overall attainment of a sustainable development agenda, as outlined in Agenda 21 and the Johannesburg Plan

of Action, which was formulated by countries from around the world. South Africa also hosted the first national Green Economy Summit, which was attended by the State President, ministers, deputy ministers, parliamentarians, representatives from the private sector, non-governmental organisations and labour organisations. The intention of the summit was to deepen our understanding of the green economy concept.

South Africa is indeed on track in terms of understanding and even implementing the green economy. It views the green economy as a sustainable development path based on addressing the interdependence between economic growth, social protection and natural ecosystems.

International studies, such as those undertaken by the United Nations Environment Programme (UNEP), show that some of the levers available to the public sector to promote greening of the infrastructure and the economy include the following:

- Establishing sound regulatory frameworks;
- Creating incentives for increased investment in green economic activity;
- Utilising sustainable public procurement to encourage the use of sustainable goods and services;
- Prioritising government investment and expenditure in areas that stimulate the key green economy sectors;
- Limiting government spending in areas that deplete natural resources;
- Increasing investment in training, capacity building and education in support of a green economy.

South Africa's approach is, therefore, in keeping with international best practice that increases investment in natural assets and resources used by



The Honourable Ms Edna Molewa
Minister of Water and Environmental Affairs

the poor to build green agriculture and sustainable tourism development. Rural communities are then able to move out of poverty and benefit from economic development on a sustainable basis. The government has made great strides in addressing each of these areas. The regulatory and policy frameworks make provision for thorough environmental impact procedures, which balance the need for investment and development with sustainability principles.

A green economy can be viewed as a system of economic activities related to the production, distribution and consumption of goods and services that result in improved wellbeing over the long term, while not exposing future generations to significant environmental risks or ecological sacrifices. The country has several policies that support the transition to a green economy, such as the:

- National Framework for Sustainable Development Medium-Term Strategic Framework for 2009-2014;
- New Growth Path;
- Industrial Policy Action Plan;
- Science and Innovation Plan;
- Integrated Resource Plan;
- National Skills Development Strategy;
- National Climate Change Policy;
- Carbon Tax.

South Africa is making great strides in its response to climate change, in particular. The Cabinet has approved the White Paper on Climate Change Response Strategy. This policy will help the country to map out a socioeconomic transition to a climate-resilient, low-carbon economy and society. All stakeholders will be engaged on the means of implementing the strategy.

Market-based policy measures are being implemented, such as an escalating carbon tax to price carbon and internalise the external costs of climate change. This will drive the diversification of the country's energy mix, and the implementation of energy-efficiency measures and investments in new and cleaner technologies and industries.

People must also realise that when they take care of the environment, it will reciprocate by taking care of them as well. For example, waste collection and the recycling industry make a large contribution to job creation and the gross domestic product, and there is considerable potential for expansion of these industries.

The government has adopted an aggressive approach to scaling-up and accelerating the implementation of the various "Working for" programmes for the Department of Environmental Affairs (DEA). These programmes provide an effective platform for skills development, labour-intensive job creation, and sustainable, green local economic development. An example is the pilot waste project in Mafikeng, which services more than 30 000 households and has created jobs and entrepreneurs who now own their waste collection trucks.

Since the Green Economy Summit in 2010, work has been gaining momentum to address transition issues requiring attention in the short, medium and long term. Key focus areas, or pillars, identified at the summit include:

- Resource conservation and management;
- Sustainable waste management practices - recycle, reuse, reduce;
- Water management (this is crucial - without water nobody can do anything);
- Environmental sustainability, as protected by section 24 of the Constitution;

Ministerial address: key policy discussion points - continued

- Green buildings and the built environment;
- Sustainable transport and infrastructure;
- Clean energy and energy efficiency, e.g. solar energy for heating, cooking and lighting;
- Agriculture, food production and forestry, including land and wetland rehabilitation;
- Sustainable consumption and production.

Greening of the South African economy is a critical lever for bringing about the structural transformation needed for a more equitable, inclusive economy. The government is demonstrating its increased commitment to implementing sustainability practices. Major investments have been made in programmes that attend to a range of environmental problems while addressing economic and social development. Increased investment in green economy industries is also a powerful means of job creation. By promoting green cities through sustainable, integrated planning of infrastructure and service delivery, we will be able to contribute to overall greater efficiency and productivity.

These approaches, however, require increased commitment from the government and the private sector to provide more resources in order to support institutions at local, district and provincial government level, and to up-scale infrastructure development sustainably.

Spatial planning and land-use management are important determinants of a sustainable built environment. In order for the latter to be an effective habitat for living beings, it must be designed, constructed, managed and used in such a way that the natural elements that sustain human life (air, water, soil and biodiversity) are preserved. The built environment, therefore, should be characterised by urban greening; the conservation and enhancement of biodiversity; effective waste management

services, with greater levels of recycling; and green public transportation, including the prevalence of non-motorised transportation infrastructure.

South Africa's major events of the greening programme, including the 2010 Soccer World Cup and COP 17, demonstrate the country's ability to raise awareness; minimise waste; diversify and use energy efficiently; consume water sparingly; compensate for its carbon footprint; practise responsible tourism; and construct infrastructure with future generations in mind.

It is necessary to ensure that public sector finance institutions and private developers implement more integrated and environmentally appropriate development with regard to new developments, infrastructure development, retrofitting, and ecosystem maintenance. Efforts to build a green economy should focus on supporting biodiversity and protecting our natural resources so that they are available to all South Africans on a sustainable basis.

The partnership approach of collaboration between government departments and public entities ensures that effective skills and resources can be harnessed in support of the goals of promoting sustainable development, greening the economy, and ensuring that the country's natural assets are valued, protected and enhanced.

The DBSA is a key partner in promoting the green agenda. The DEA, in collaboration with the DBSA, the Industrial Development Corporation and the Department of Economic Development, has recently produced a report in support of green economy initiatives. Together, these players have also designed programmes in support of transitioning South Africa to a green economy. These programmes focus on identifying, at a high level, green economy initiatives

prioritised according to criteria for social, economic and environmental sustainability.

The DEA's partnership with the DBSA further aims to identify the resource requirements for green programmes, with a specific focus on a proposal to establish a funding mechanism for green economy initiatives. A draft memorandum of agreement (MOA), which will soon be signed, calls for the implementation of programmes through the development of a portfolio of green projects in the DBSA. This is meant to address infrastructure-related mitigation and adaptation of climate change and generally moving towards climate resilience. The DEA has also signed another MOA earlier this year to implement a Drylands Fund, which is critical to managing the country's natural resources.

The dire need for early funding and prefeasibility work should be addressed as we grapple with new concepts, technologies and transitions. I was pleased to learn that the DBSA is looking into this. A proposal

has also been developed by the DEA, the DBSA and other key players on a mechanism for managing funds. The Green Financing Mechanism will develop a means to attract, manage and direct national and international financing for transitioning South African projects - from research and development to investment - to green economy initiatives.

I also wish to thank the DBSA for participating in the DEA's Green and White Paper processes, thereby contributing to policy initiatives to enhance our green agenda. We should emphasise the importance of building on existing processes, programmes, indigenous knowledge and initiatives in key sectors in order to shift towards a resource-efficient, low-carbon and pro-employment growth path. The government alone cannot manage and fund a just transition to a green economy, and the private sector and civil society should play a fundamental role in this regard.



Source : 123rf

Nurturing our earth





Day One



The political context: Setting the scene
Conceptualising the greening of infrastructure in South Africa
Greening infrastructure: Key considerations

Keynote address

Dr Lawrence Agbemabiese, Programme Officer: United Nations Environment Programme (UNEP)

Less than a decade ago, the idea of greening an economy, and by extension its infrastructure, was not entertained in discussions with African politicians, technocrats, academics or opinion leaders, and even certain multilateral development promoters. We would have been dismissed as being completely out of touch with the real, persistent problems of development - poverty, hunger, disease, social unrest and weak economies. The mindset was, "we are trying to solve age-old problems by using the best available technologies that have been proven to work. We are not responsible for climate change; development first".

In those days, few people would have taken seriously any kind of conference that had greening infrastructure as a theme, especially in our part of the world. As is evident from the enthusiastic participation in this conference, however, we can now talk about greening infrastructure, poverty alleviation and sustainable development in the same breath, without being driven out of the room. After a decade of research, experimentation and

networking among advocates of sustainability, the foundation of a very powerful knowledge base has been laid to inform the future development of infrastructure in a way that also takes care of development problems.

The following three examples illustrate the basis of the newfound courage that advocates of green development and sustainable development have found:

- Very solid evidence exists linking "green development", or green economy and development, to poverty alleviation. For example, the greening agriculture initiatives that concentrate on smallholders in developing countries can reduce poverty if investments are made in the natural capital on which the poor depend. Globally, the small farm sector consists of about 404 million farms under two hectares in size. The promotion and dissemination of sustainable practices could be the most effective way to make more food available to the poor and hungry; to reduce poverty; to increase carbon sequestration; and to access growing international markets for green products.

A recent review of 286 best-practice projects across 12.6 million farms in 57 developing countries has shown that adopting resource-conserving practices, such as integrated pest management instead of using chemical fertilisers, and integrated new trend management (with low tillage farming, agro-forestry, agriculture, water harvesting and livestock integration), resulted in average yield increases of 80%, while improving the supply of critical environmental services. From an agricultural point of view, which



Dr Lawrence Agbemabiese
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Programme (UNEP)

is the basis of most economies, the link between a green economy and development is, therefore, much less improbable than it seemed ten years ago.

- We now know that by increasing investment in natural assets which the poor use to earn their livelihoods and by shifting towards a green economy, livelihoods in many low income areas can be enhanced. A good example is India's National Rural Employment Guarantee Act (NREA) of 2006, a social protection and livelihood security scheme for the rural poor that invests in the preservation and restoration of natural capital. This public works programme guarantees at least 100 days of paid work per year to every household which volunteers an adult member. The scheme has grown; last year it created three billion workdays benefiting nine million households. About 84% of the investment goes into water conservation, irrigation, land development and infrastructure. In many developing countries, one of the biggest opportunities to speed up transition to a green economy is to invest in the provision of clean water and sanitation services to the poor.

For the first time, therefore, we have a good idea of where to focus our greening efforts and we can speak authoritatively about priority sectors based on research that has been done. For example, the Green Economy Report of the United Nations Environment Programme (UNEP) identifies the key sectors as agriculture, transport, buildings, energy, industry, fisheries, forestry, tourism, waste, and water. How these issues are prioritised in order to achieve real development objectives remains a national, or even a local, matter. However, in a resource-constrained world, just knowing which baskets to put one's eggs

in can already be a very powerful tool for effective planning and policy.

- For the first time, the new green economy community is able to produce plausible estimates of how much it will cost to achieve the transition to a green economy. For example, existing estimates focus on what may be needed to achieve carbon dioxide emission reduction targets by 2050. Although there is rough consensus, the figures differ on how much investment into clean energy is required per year in order to restrict global warming to less than 2°C. The fact that the figures differ should not be discouraging, as having estimates is a step in the right direction and it now becomes a matter of fine-tuning them.

We also have a better idea of the financing resources - some financial services and investment sectors control trillions of dollars and are positioned to provide the bulk of financing for the transition to a green economy. It is not so much the quantity of money that is the real problem, but rather the absence of enabling frameworks that clearly elaborate on the risks involved, so that financial institutions and stakeholders can weigh the risks versus the returns when considering whether to make an investment. Public financing will also have a key role to play, specifically in jump-starting green economy transformations.

From total marginalisation as a field of study, green economy has become a mainstream topic for discussion at the highest political levels. How this came about is set out clearly in UNEP's Green Economy Report,¹ and I would really urge you to at least go through the very well-articulated description in the executive summary.

¹United Nations Environment Programme (UNEP), 2011. Towards a green economy: Pathways to sustainable development and poverty eradication. Online: [http://www.unep.org/greeneconomy/greeneconomyreport/ tabid/29846/default.aspx](http://www.unep.org/greeneconomy/greeneconomyreport/tabid/29846/default.aspx)

Keynote address - continued

One fundamental reason for the progress made is that we have become much better at defining the green concepts, and most people can agree essentially on what we are talking about. More importantly, we have become better at translating green economy into a language that stakeholders can understand. Some of the earlier advocates of a green economy either did not really know what they were talking about, or they simply failed to communicate effectively in a language accessible to critical audiences, such as politicians and policy makers. The growing body of literature suggests that this problem is now firmly behind us.

Some basic concepts should be kept in mind when we speak of a green economy. It is essentially an economy that increases human well-being and social equity while significantly reducing environmental risk and ecological scarcities. More simply, it is the kind of economy that is low carbon, resource efficient and socially inclusive. 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 protect the laws of biodiversity and ecosystems.

The notion of a “green infrastructure” as distinct from a “green economy” arose in the 1990s in the United States, where the former term was defined as an approach to infrastructure design and planning that highlights the national environment in decision making. There is an emphasis on life-support functions provided by natural ecosystems, with an equal emphasis on interconnectivity in order to support long-term sustainability. Greening infrastructure is, therefore, a particular aspect of greening an economy. A lot of the discussion about a green economy and what it means can be inherited directly by green infrastructure-related work.

Development planners would also say that a green infrastructure is a means to achieving a green

economy, which in itself is a stepping stone to sustainable development. It is a development path that maintains and enhances natural capital as a critical economic asset and as a source of public benefits, especially for poor people whose livelihoods and security depend on nature.

The link between green infrastructure, green economy and sustainable development has also been aided by a growing number of practical success stories, a good number of which have originated from South Africa. Through monitoring and evaluating these kinds of success stories we are starting to build an expanding universe of evidence that debunks several myths that had consigned green economy thinking to an intellectual doghouse until the recent past.

- Perhaps the most widespread myth has been the idea that there is a kind of inescapable trade-off between environmental sustainability and economic progress. However, substantial evidence shows that the greening of economies neither inhibits wealth creation nor employment opportunities - there are many green sectors that offer significant opportunities for investments and related growth in wealth and jobs. A caveat, however, is the need to establish new enabling conditions, including institutional re-engineering, to promote the transition to a green economy. This is where urgent action is required of policy makers around the world.
- Another myth that has been debunked by the flow of solid evidence coming from best practices and case studies is that a green economy is a luxury that only wealthy countries can afford. Contrary to this myth, we can indeed achieve sustainable improvements in living standards and income by following a cleaner development

path. There is a plethora of examples of greening transitions that are taking place in various sectors in the developing world, which deserve to be emulated and replicated elsewhere, and even within the same countries. The problem of development is not so much the absence of resources - they exist, but they are scattered and not linked together. Isolated pockets of innovation need to be linked and transformed from individual projects into programmes that can be duplicated.

- Despite all these favourable developments, we still seem not to be moving as fast as we would want to. My colleague Professor Bill Vanderberg compares physical infrastructure to the tip of an iceberg. Below is the actual iceberg, or “knowledge infrastructure” - the processes and bodies of specialised knowledge that are responsible for creating what we see on the surface. The decisions we make on a daily basis, and which inform the physical things that manifest in the real world, are based on that knowledge infrastructure. Therefore, even if we have a well-developed concept of a green economy, it is in the nature of human society to fall back on old habits of thoughts and action. In the biblical sense, we tend to pour new wine into old bottles, and then the bottles break and we do not understand why the wine is not filling up. In this case, we do not see why our green economy and green infrastructure are slow in terms of skilling up from projects to programmes and replicating.

Professor Vanderberg states that our ways of life, including the physical infrastructure that we build to support those ways of life, are grounded in the “transmission, development and application of highly specialised knowledge, including the institutional

framework, that basically informs the decisions we make on design choice of technology and so on”. We are all caught in, what he calls, a “labyrinth of technology”. Just as simple societies of the past developed a particular culture that was based on interaction with nature, we, through interaction with technology, phones, computers and roads, are developing a particular mindset and a way of looking at things. We are producing knowledge which, in very subtle ways, can actually hamper efforts at green economies achieving sustainable development and that is what makes it so dangerous. We are not even aware of the effects of technology on our way of thinking and the way we produce knowledge. For instance, we may be looking at new technology that could power us into a green and sustainable future, although it is a so-called pseudomorph - a promising technology that is transforming into something that resembles promise but will actually prevent us from moving forward.

When the knowledge infrastructure that we are now trying to green confronts a problem, how do we deal with it? Professor Vanderberg says that we tend to rely on the intellectual and professional division of labour as the basic structure for beginning to generate new knowledge to address a problem. So we first look for a specialist. The specialist offers a solution to problems that fall within his or her sphere of specialisation, but the consequences of implementing that solution then fall into other people's specialisation fields. Most of us propose solutions in our little disciplinary world, although we are neither equipped nor even concerned about how the matter works out beyond our little sphere. We expect the consequences of our decisions to be dealt with by others who have their own specialisation fields and their own desired outcomes. The knowledge infrastructure base thus creates problems, which we then basically try to solve by adding more devices. In the end, although we think we are solving a problem, we are

Keynote address - continued

simply creating more - but we do not see it because it does not fall within our field of specialisation.

Far from solving any given problem completely, our system simply displaces the problem. Examples include the following:

- A dam is built to produce electricity, but then we have to build communities to house all the people who have been displaced by the dam and we also have to deal with the problems of disease.
- Fertilisers are produced to improve crop yields and then we have to install control devices to keep them from polluting water streams, so we landfill them and put up plant fill sites.
- On the surface, the Bus Rapid Transit (BRT) system is an excellent green technology, with public transit minimising road usage and so on, but then we have forgotten about the other problems that it can create.

Examples such as these can be observed all around us and, as a result, we should refer to the solutions we are trying to find as “signals”. We are looking for signals, but then the problems that are created as a result of a specialised approach to solving the original problem become “noise”. We then have a very bad signal-to-noise ratio in the way the knowledge infrastructure solves the problems. This was the case even before green economy ideas took hold. In fact, this situation actually contributed to many of the problems that the green economy is currently trying to address. This is what drove UNEP several years ago to develop guidelines for environmental due diligence of renewable energy technologies. We felt that people were looking at such renewables as clean, whereas in actual fact they also had their own problems. For example, how do you dispose of batteries for solar systems?

We are, therefore, seeing the beginnings of the greening of our knowledge infrastructure as well. There are new attempts to measure the “noise” generated by economies in terms of the impacts they have on reducing ecosystem service delivery. We know, for example, that water is becoming scarce and water stress is projected to increase, with water supply satisfying only 60% of the total world demand in 20 years' time. The very fact that we are beginning to look at these kinds of external areas to our normal disciplinary fields is a step in the right direction. Green economy advocates are now driving a force to enhance the role of governments in international processes that can promote coherence and collaboration in the transition to a green economy.

The realisation is growing that the present knowledge infrastructure has weaknesses and tends to produce multiple interpretations of a problem, which accounts for the lack of an integrated approach to the green infrastructure and green economy agenda. The idea is to work more closely both at an international level, and at a national level, to build stronger mechanisms for collaboration among multiple disciplines. What each disciplinary expert today must do is to start by questioning the fundamental assumptions of his or her discipline. For example, economies have to begin to rethink the assumptions behind much of economic theory, such as the assumption of rational behaviour and of the power of the market. We have worked with such assumptions for so many years, but now they appear to be inappropriate for helping us to inform the economics of the green economy.

In this kind of discussion, therefore, more than bringing together different experts, the individual experts who take part in your group discussions should also begin to re-examine the fundamental assumptions they bring to the discussion.

All of this, of course, requires a level of government support. At a national level there is a growing movement, including in South Africa, to ensure better integration of a green economy and a green infrastructure agenda. In this country, for example, the establishment of the Presidential Infrastructure Coordinating Commission (PICC) sends a very strong message confirming the government's commitment to

the renewal of the knowledge infrastructure that would inform a more integrated approach to greening infrastructure in South Africa. I really hope that this expression of political support translates into the promotion of new regulations, incentives and rules that would collectively ensure that those stakeholders who are involved in this system can make some progress.



Source : DBSA

Vibrant discussions during a coffee break



Source : DBSA

Good attendance throughout Knowledge Week 2011



Conceptualising the greening of infrastructure in South Africa

Chairperson: Mr David Jarvis, Divisional Executive: Strategic Operations Unit, Development Planning Division (DBSA)

The eco-economy: Implications for greening infrastructure

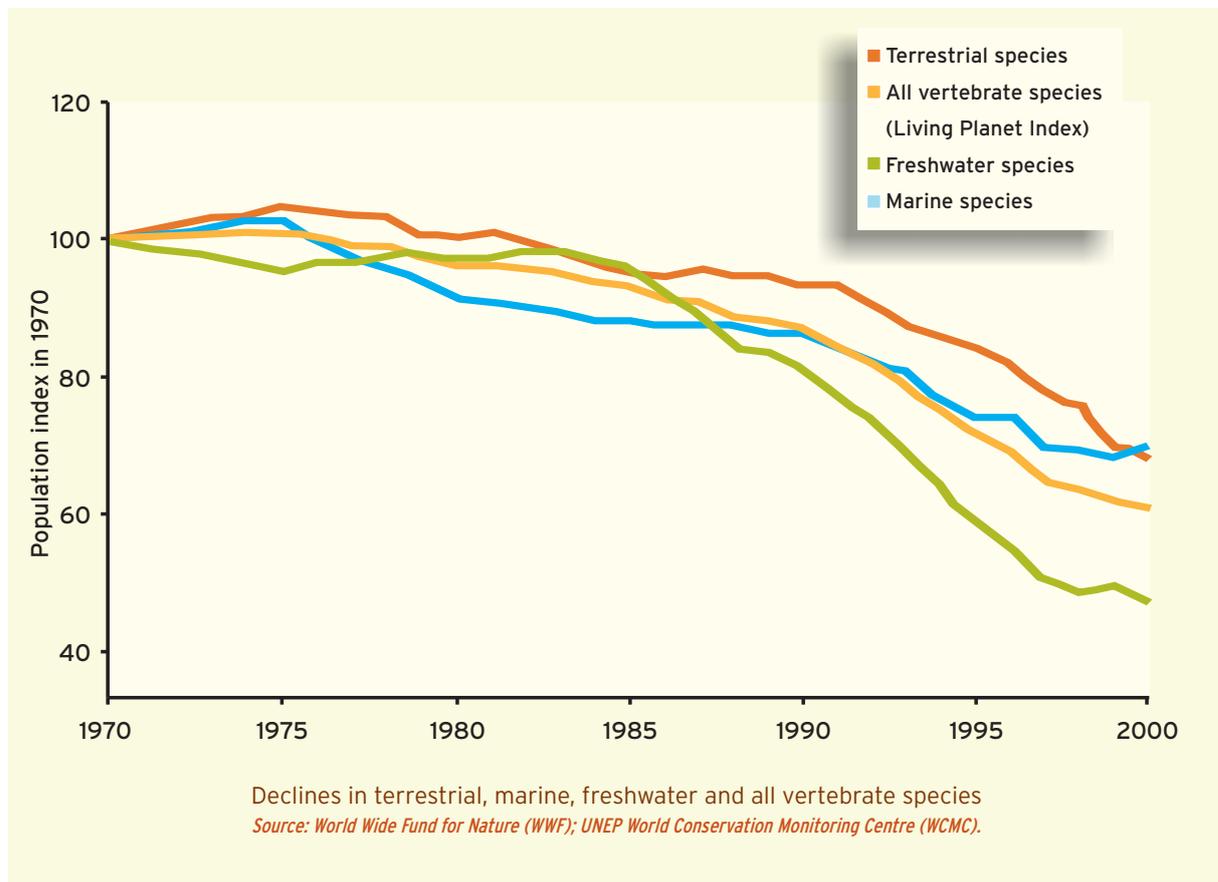
Mr Llewellyn van Wyk, Architect and Principal Researcher: Built Environment (CSIR)

The main challenge facing the world is the fact that countries' economies are carbon based. Economic growth, therefore, implies carbon growth. How, then, do we move as speedily as possible to a carbon-neutral economy, and from there to a carbon-free economy? Quite clearly, the economic growth that is required to meet the needs of a growing number of people will result in increased carbon emissions.

In 2002, for example, carbon emissions from fossil-fuel burning by sector were as follows: electricity generation 35%; residential and commercial 25%; transportation 20% and industry 20%. This is the basic picture of the built environment in which we operate daily. In fact, buildings account for 23% of the total carbon emissions in South Africa, plus an additional 5% for material manufacturing. These figures are relatively low, compared with the global average of 40%. However, this is not the result of good behaviour,

but is due to the many households that are not yet serviced by electricity and/or are unable to afford extensive consumption of electricity.

A press release in October 2011 concerning a study by the University of East Anglia reported that the construction of infrastructure has resulted in a substantial increase in China's carbon emissions. This is a rather startling finding, given the carbon-reducing initiatives that are in place in that country. It should sound an immediate alarm bell, as this is the same trajectory that South Africa is on with its massive infrastructure development drive. The main issue at stake involves ecological goods and services. These are the benefits arising from the ecological functions of healthy ecosystems and which we as a species, together with other species on this planet, enjoy.





Source: NATIONAL GEOGRAPHICS Photograph by Randy Steffens

Ecological goods and services are the benefits arising from the ecological functions of healthy ecosystems

These include such function as:

- | | |
|--------------------|--------------------------------------|
| Fresh water | Natural hazard protection |
| Pollination | Erosion regulation |
| Seed dispersal | Water purification and water cycling |
| Climate regulation | Nutrient cycling |
| Pest regulation | Production of atmospheric oxygen |
| Disease regulation | Soil formation |

These ecosystem functions are performed by nature daily, free of charge, and without them we simply would not survive. However, there are at least two critical impacts that humans are having that are undermining healthy ecosystems, namely cultivation (especially monoculture farming, such as large wheat fields or vineyards) and the formation of human settlements.

These impacts are progressively wiping out ecosystem diversity, and the increasing fragmentation of the landscape is threatening ecosystem health and resilience. In many cases, the original ecosystem that underpins the continued survival of humans, and that

of other species, is simply destroyed to make way for a built environment.

The steep declines in terrestrial, marine and freshwater species, as well as all vertebrate species (as per the Living Planet Index), are represented in the chart above. The 2010 report indicates that these rates of decline are continuing and, in some instances, have been aggravated. If the four graphs above are projected forward at the same rate, the green graph representing freshwater species hits zero around 2030/2040, and the black graph representing all vertebrate species reaches zero in about 2070. Although we personally may not be around in 2070, our children will be - that is the immediacy of the demise of the life system on which we depend.

Another rather unsettling trend is that the number of extreme weather events (hurricanes, earthquakes, wildfires, floods, etc.) is increasing, and so too the costs of such events. However, there is a growing disparity between these costs and payouts by the insurance industry, which is obviously reducing its risk.



The eco-economy: Implications for greening infrastructure - continued

Some steps for ensuring successful adaptation and mitigation strategies are listed below against this background.

Step 1: Impact mapping: This strategy systematically unpacks the likely impacts of events, which will affect where and how infrastructure is constructed. Mapping is used to investigate anticipated and actual situations layer by layer, such as climatic zones, geology, precipitation, sea surges, wetlands, and demographics.

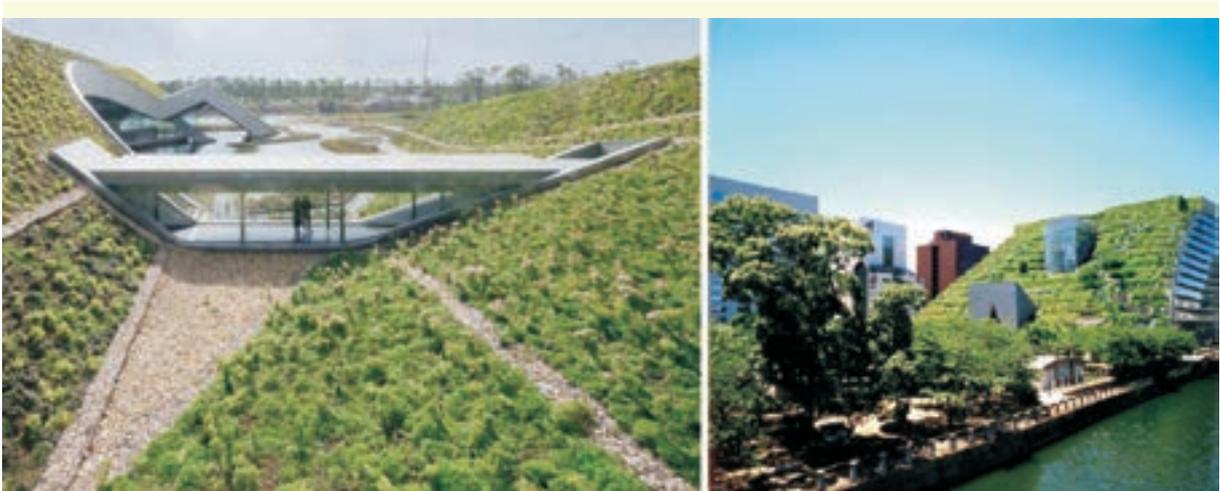
Step 2: Design for change: South Africa's climatic zones may be subject to change in the future. For instance, rates of precipitation are likely to increase along the East Coast and decrease along the West Coast. Sea surges may increase, particularly along parts of the Eastern and Western Cape coasts. Such impacts need to be understood in order to ensure that the infrastructure built today is robust enough to withstand the expected changes. Buildings generally last for 50+ years and infrastructure for 100+ years, yet the possible consequences of climatic changes, such as heaving clay, drying clay and landslides, may impact on the choice of infrastructure.

Step 3: Set goals and target: A good example is Lloyd Crossing, an urban development in the City of Portland

in Oregon, United States. The planners started with the baseline of what they thought Portland looked like prior to human settlement. Mapping was used to analyse each component of the existing development, such as water use, land use, energy use, use of space, and the habitat.

They then looked at how the displaced components could be reinstated. The Lloyd Crossing Sustainable Urban Design Plan, the infrastructure and development programme for the area, also includes long-term objectives for improving the area's environmental performance, for instance raising the tree cover from the present 14.5% to 30%; increasing solar utilisation from 2% to 13.7%; and having almost 90% of the power coming from renewable sources.

Step 4: Land use and ecology planning: "City Block as a Cell" is a concept for understanding the way land is used and the resulting ecological impacts of developments. If we study a built area shown in an aerial map, it is easy to see that the original ecosystem has been displaced. It then becomes a matter of looking at examples and lessons from other similar areas to begin to thread back that ecosystem in support of ecological goods and services.



Source : CSIR

Adaptation and mitigation strategies: Integrate ecosystems and architecture

Step 5: Green infrastructure planning: The City of Philadelphia in Pennsylvania, United States, has a programme where everything done currently in terms of infrastructure needs to have a green base to it. They look at the way they deal with water (condensate harvesting; rain harvesting; grey water harvesting; passive irrigation); hard surfaces (pervious pavements; perforated pipe and overflow inlets); buildings (green roofs; green walls); and the landscape (bioretention; green streets; rain gardens). Another example comes from Lloyd Crossing, Portland, where a residential block of flats is situated next to an office building. While the office building is operating maximally between 08:00 and 17:00, the residential building is idling. At night, the situation is reversed. The buildings have been designed so that whatever one building is generating in terms of rainwater harvesting, energy generation, etc. can be sent to support the other building when it is operating maximally.

Step 6: Integrate ecosystems and architecture:

Ecosystems and architecture have to be integrated so that a loss is not suffered every time something is built. "Replace what you have displaced" is the rule that has been followed in the examples shown below.

Step 7: Strive for net-zero buildings: The aim for the actual building itself should be net-zero conventional energy, net-zero conventional water supply, net-zero waste, net-zero emissions, and a net-zero loss of ecosystems goods and services. This is possible.

In closing, a framework for resilient human settlements would involve the following:

- Secure the community's political will and commitment.
- Future-proof human settlements (e.g. examine various climate scenarios and risks and integrate these into development planning).

- Prioritise the building sector (e.g. integrate interdisciplinary decisions, solutions and approaches; re-examine building codes).
- Empower communities (e.g. help people to live with the risks and adapt to future changes; promote disaster reduction at local level by enabling community coping strategies).
- Communicate effectively (e.g. about climate change, early warning systems, health status, rainfall changes).
- Create institutional capacity for better flows of information so that the right decisions are made.

It is clear that the way we thought we invested in, planned for, designed and managed our environment has no ongoing value. We have to reinvent these aspects to respond to the very simple challenge of finding a balance between people and planet, and ultimately to improve the quality of life for all living beings.



Source: DBSA

Green infrastructure planning



Green infrastructure, environment and climate change: The opportunity

Dr Richard Worthington, Climate Change Programme Manager (WWF)

One of the concepts currently used in South Africa is that of an embedded approach to sustainable development, unlike the former view of having different pillars of sustainable development. A country's economy is rooted within its sociopolitical systems, which in turn are embedded in ecosystems, or "ecosystem services". Infrastructure cuts across all of these components, and proper governance is needed to guide the way in which such integration is managed.

The Living Planet Report² is the world's leading, science-based analysis that reports on the impact of the human footprint on the health of the planet. The key finding of the report is that humanity's demands and activities exceed the planet's capacity to sustain the natural resource base. The rate at which ecosystem services are being eaten into is steadily increasing. Humans are consuming at a rate of about 30% beyond the regenerative capacity of the planet.

Existing assumptions therefore need to be reassessed:

- Much of the discussion around infrastructure still centres on serving extractive industries; for instance, how and where railways and roads should be built in order to extract mineral wealth, and how to monetise the wealth so that development can be supported. This model is not sustainable.
- The merits of globalisation versus localisation should be considered - where it would be appropriate to tap into global opportunities, and where it would be better to keep things local.
- Traditionally, infrastructure is thought of as very large. Yet, if resource efficiency and the scale at which resources are used

are considered, rather than simply looking at economic efficiency, the assumption that large-scale infrastructure is needed to move forward may be challenged.

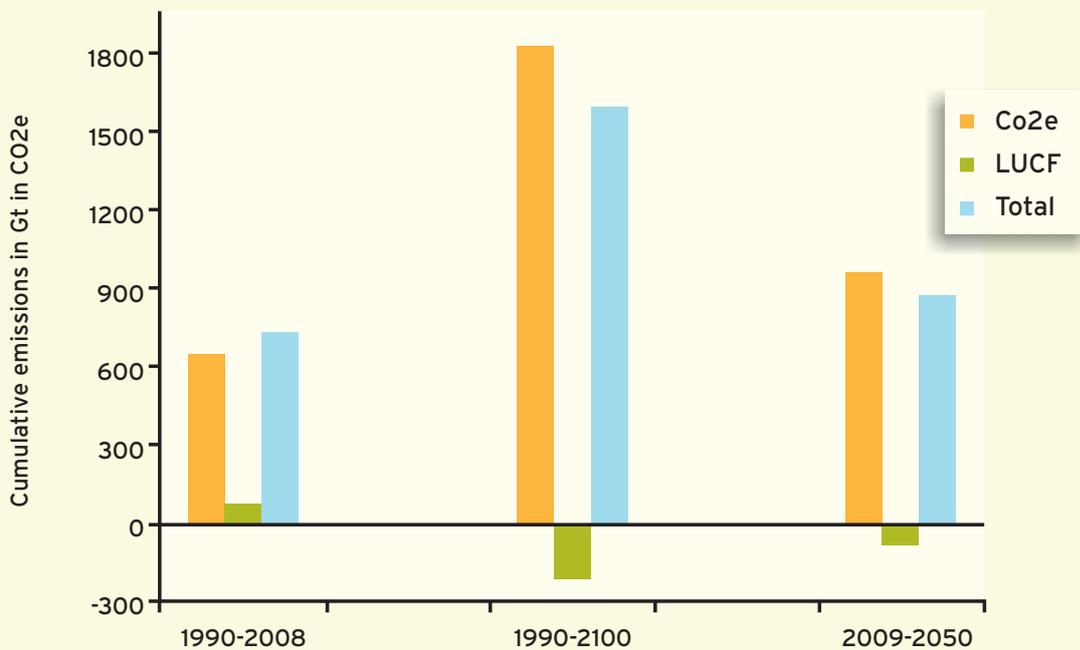
- Large sums of money are spent on building large volumes of physical infrastructure, based on the assumption that the world can continue to use fossil fuels. However, in order to limit the increase in global warming to less than 2°C, about 80% of all conventional fossil fuel recoverable reserves will have to be retired by 2050.

The goal of limiting the global temperature increase to 2°C was adopted under the United Nations Framework Convention on Climate Change (UNFCCC) for two reasons:

- The impacts of variability and change start to escalate considerably in the projections beyond 2°C, particularly when it comes to water scarcity, impacting billions of people.
- There is a risk of runaway climate change from feedback effects, such as the loss of albedo. (Albedo is the fraction of solar energy that is reflected back into space from the earth) As the icecaps are lost, they reflect less energy back into space because the oceans are darker and, instead, absorb more of the energy. As the oceans warm up faster, more ice is lost and more albedo is lost.

There are several such feedback effects and the risk of runaway climate change increases considerably above 2°C. The International Energy Agency (IEA) has set the cost of failure to keep the Copenhagen Accord at USD500 billion per year. For a 50% chance to keep below the crucial two-degree threshold, the

² World Wide Fund for Nature (WWF), 2010. Living Planet Report 2010: Biodiversity, biocapacity and development. Online: http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/



The global carbon budget for greenhouse gas emissions

Source: World Wide Fund for Nature (WWF)

IEA proposes that greenhouse gas (GHG) emissions be stabilised at 450 parts per million. This will require the global economy to be carbon neutral, or carbon free, by 2100. (The term “carbon neutral” is more correct, as we exhale carbon dioxide when we breathe. The carbon will therefore continue to cycle, but the net contribution of humans to that cycle needs to be zero.)

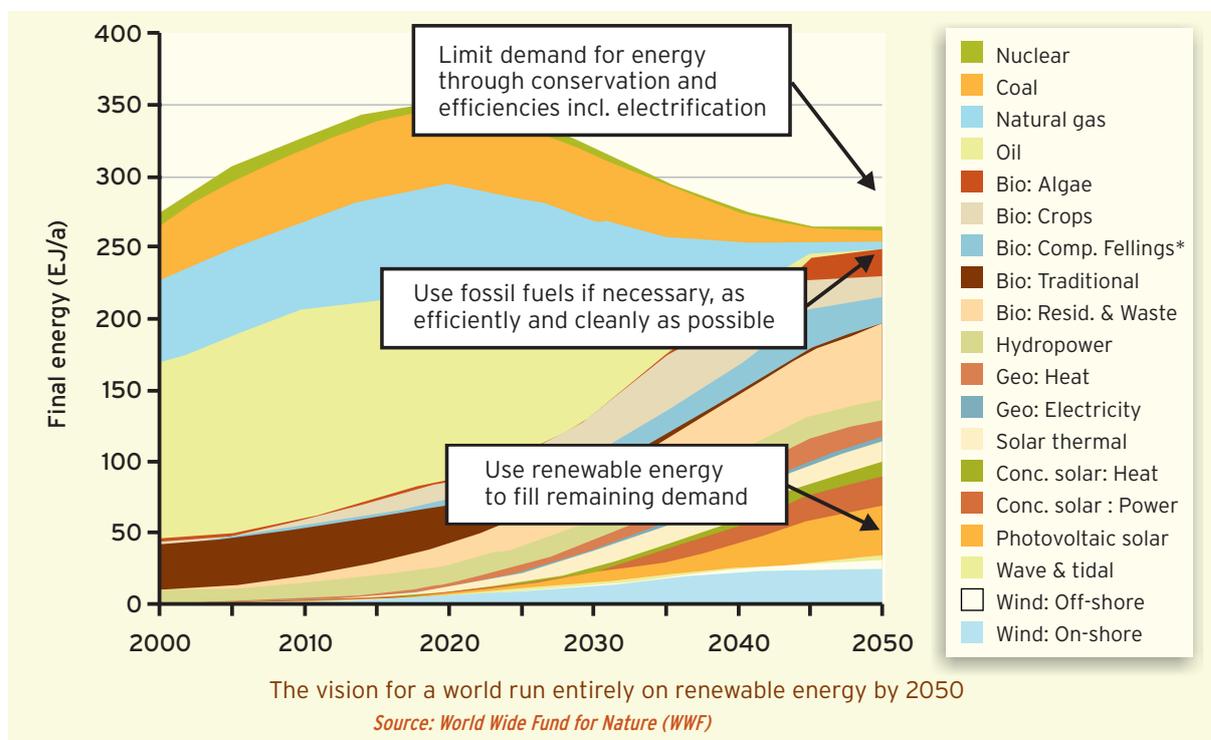
A global carbon budget for GHG emissions, based on the goal of achieving stabilisation at 400 parts per million, is represented by the second graph in the chart below. The red bar indicates the total that the atmosphere can carry, estimated within the two-degree threshold. The black bar shows what carbon dioxide (CO₂) emissions could be emitted if the portion shown in green is being absorbed due to land-use change and forestry (as trees and land-use changes allow the carbon cycle to move into an

absorptive state). The first graph on the left shows the levels of emissions between 1990 and 2008, indicating that we have already used 40% of the carbon budget for the century.

The third graph on the right of the chart shows what remains of the budget - about 1000 gigatons of CO₂ equivalent. By comparison, burning the current, existing fossil fuel reserves (recoverable oil, gas and coal) will emit almost 6000 gigatons of CO₂, according to the Intergovernmental Panel on Climate Change (IPCC). The global carbon budget, therefore, requires retiring a significant proportion (at least half) of the total known fossil fuel recoverable reserves. This kind of science needs to inform all infrastructure choices, in order to reduce the ecological footprint and possible misuse of materials and resources.

³ World Wide Fund for Nature (WWF), 2011. The Energy Report: 100% renewable energy by 2050. Online: http://assets.panda.org/downloads/the_energy_report_lowres_111110.pdf

Green infrastructure, environment and climate change: The opportunity - continued



There are several reasons for using only renewable energy:

- It will ensure at least 80% less GHG globally by 2050.
- Oil and gas are conventionally scarce.
- Unconventional fuels (e.g. coal to liquids, gas to liquids, deep water oil, shale gas, and tar sands) have far greater impacts on ecosystems.
- Nuclear development is quite unnecessary and also unsustainable.
- Greater equity in terms of energy poverty will be possible, as currently 1.4-2.7 billion people lack access to safe cooking energy.
- These are no-regret technologies that are easy to implement, use hardly any fuel, and involve minimised adaptation costs.
- Although high costs are needed upfront, there will be massive savings in the long term, for example in operational costs (primarily fuel).

We need to look at the world differently and change our thinking around infrastructure investments, while also scrutinising existing assumptions. For instance, why are smart grid technologies essential? They allow a better deployment of resources, better balancing of the load, healthier management of equipment, and better transmission and distribution. Such thinking matches supply and demand, whereas doing supply-side planning only will run into barriers.

Spending on the public works programme, Working for Energy, is small in comparison with the massive infrastructure projects being planned. The programme can, however, be used more effectively as a form of infrastructure intervention to develop skills; reduce urbanisation drive; retain value within communities; stimulate small businesses; and develop local resilience. For example, scale can be achieved by designing and installing multiple mini-grids (thousands of biogas digesters) now that can be linked to a smart grid system in future.

Going forward, we need to incorporate externalised costs. People assume that there is an endless carrying capacity, or cycling capacity, for GHG in the atmosphere, but there is not. Carbon tax will become necessary, forcing polluters to pay for their actions. Patient capital (long-term capital) is also a challenge. Climate bonds or ethical bonds are possible ways of securing investment that is not premised on short-term returns.

Paradigm changes are needed. For instance, shareholders should focus more on quality than quantity. Indices, such as the Human Development Index (HDI), should be the indicators of success and growth, more than the gross domestic product (GDP).

Resource management should be circular, rather than linear. Demand management should have priority over supply increase. Fundamental shifts (such as electrification of passenger vehicles, fleet public transport, and transporting much more freight on rail) should take precedence over incremental shifts (e.g. using biofuels).

The finance required could come from a maritime bunker fuel levy, which would raise fuel costs by 10%. The total revenues generated may be allocated to the Green Climate Fund, and compensatory rebates paid to developing countries according to their percentage share of global imports by sea.



Courtesy: Gautrain

Public Transport: Key to bringing down carbon emissions



Greening the state's infrastructure programmes: Critical considerations

Ms Judy Beaumont, Outcomes Facilitator: Environmental Assets (DPME), Presidency

“Greening the economy” is about decoupling rates of economic growth and improvement in well-being from the rates of resource consumption and the associated environmental impacts.

It results in improved human well-being and social equity, while significantly reducing environmental risks and scarcities. Greening is also a new area with job creation potential. It requires substantial investment in reducing carbon emissions and pollution; enhancing energy and resource efficiency; and preventing loss of ecosystem services. It therefore aims at rebuilding natural capital as a critical economic asset.

The national green economy landscape contains various pieces of policy direction, such as the 2009-2014 Medium-Term Strategic Framework; the New Growth Path; the Industrial Policy Action Plan 2; the National Strategy on Sustainable Development; the National Climate Change Policy; the National Planning Commission's Low Carbon Growth Work Stream; the Science and Innovation Plan; the Integrated Resource Plan 2; the National Skills Development Strategy 3; and environmental fiscal instruments, such as carbon tax. One of the key issues is the need to ensure a coherent policy framework.

South Africa's natural resource characteristics give an indication of the direction the country has to take in terms of greening. At present, South Africa is:

- Heavily reliant on coal;
- A significant emitter of carbon dioxide (CO₂), with the main source of carbon being the energy sector;
- Potentially vulnerable to international measures for reducing emissions through climate change regulation; trade barriers; shifts in consumer preferences; and shifts in investor priorities;

- Vulnerable to increasing oil prices, as 16-20% of the country's oil needs are met by imported oil - this has implications for transport infrastructure;
- Water constrained, as a high percentage of the available surface water resources has already been allocated. Moreover, there is limited dilution capacity due to increasing water pollution; backlogs exist in infrastructure maintenance; and the water reconciliation strategies of the Department of Water Affairs (DWA) show some urban areas to be in water debt (i.e. they potentially do not have enough water for the future demands of growing cities). This has implications for water infrastructure.

In addition, South Africa has:

- Increasing quantities of solid waste; increasing costs of managing landfill sites; limited recycling of domestic and industrial waste; and backlogs in permitting and maintenance of landfill sites.
- Only 13% arable land and is exceeding the soil capacity to meet growing food requirements, while facing the mounting challenges of erosion, soil compaction and loss of soil fertility.
- A wonderful biodiversity, yet a high percentage of the country's ecosystems is classified as threatened - terrestrial 34%, freshwater 82% and marine 65%.

Although there are relevant policies, programmes and legislative interventions in place, as well as very interesting projects, the challenges listed above are a constant reminder that South Africa's economic base rests on a vulnerable set of natural resources.

Three kinds of infrastructure need to be greened, namely:

- *Economic infrastructure:* major infrastructure, such as bulk network systems, pipelines, highways, railways, dams, ports, power stations and treatment plants.
- *Social infrastructure:* the “local distribution” that takes place in cities, towns and rural nodes, such as water reticulation, electricity distribution, municipal roads, schools, hospitals and waste management.
- *Environmental infrastructure:* this vital kind of infrastructure is often neglected. Among other things, ecosystem services produce food, fuel and fibre; assimilate waste; and enhance adaptive capacity.

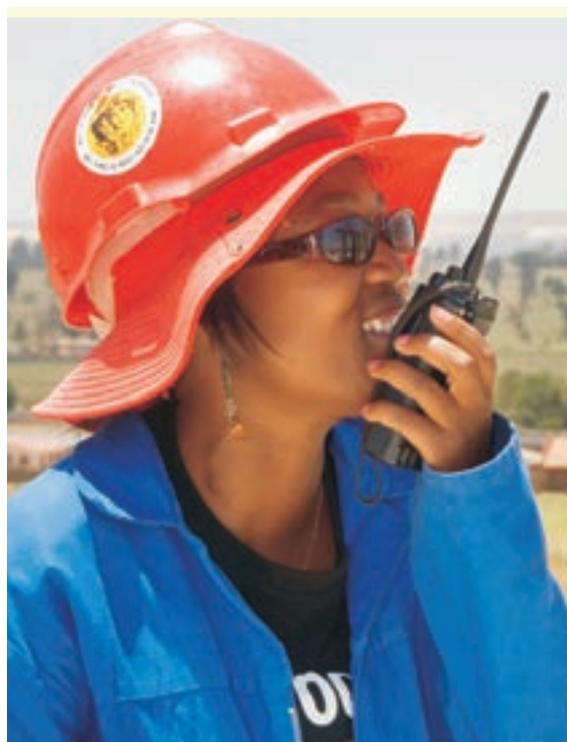
Key considerations in greening infrastructure require the following actions:

- Increasing economic, social and environmental efficiencies.
- Reducing the environmental impact.
- Building resilience to the physical, economic and social impacts of climate change.
- Investing in ecosystem services as an economic asset.
- Conceptualising the transition in short, medium and long-term planning.
- Minimising the lock-in of infrastructure that is resource intensive (i.e. good long-term planning, as infrastructure has a lifespan of 50-100 years).
- Monitoring and tracking progress, using the right data and indicators.
- Where possible, building in flexibility in our planning and implementation that

will allow adjustments to be made to correct the course if necessary.

In practice, this means considering the implications of each action listed above in the various sectors, such as energy, transport, water, human settlements, health, education, etc. The extent of progress made should be assessed. For example, are there existing policies and programmes? Is the issue captured in the key planning and monitoring instruments, such as delivery agreements or the National Planning Commission's (NPC) diagnostic?

The broad parameters for each of the various sectors are to: increase efficiencies; reduce impact; build resilience and sustainability; conceptualise and plan the transition; minimise lock-in; and monitor progress. The table below summarises the action to be taken by the four sectors within these parameters.



Source: DBSA

Women and technology feature in the greening of infrastructure

Greening the state's infrastructure programmes: Critical considerations - continued

Parameter	Energy sector	Transport sector	Water sector	Human settlements - Urban
Increase efficiencies	Establish energy efficiency across sectors.	Improve efficiency of the vehicle fleet.	Incentivise water-use efficiencies in all sectors; scale-up demand side management programmes.	Incorporate thermal efficiency into building design; scale-up the use of solar water heating.
Reduce impact	Bring renewable energy increasingly into the energy mix.	Invest in and incentivise cleaner fuel technologies and alternative fuels.	Reduce water pollution; address ageing and failing sewage infrastructure.	Scale-up grey water separation technologies; enhance waste management and scale-up recycling.
Build resilience and sustainability	Scale-up carbon constraint in energy planning over time.	Integrate climate change information into transport planning, in order to minimise risk to infrastructure from extreme weather events.	Strengthen catchment and water management practices to enhance water security and resource protection under changing climatic conditions; keep a regional perspective for (transboundary) water resources management.	Ensure that urban infrastructure planning accounts for water supply constraints and the impacts of extreme weather-related events.
Conceptualise and plan the transition	Research and develop innovation in cleaner technologies and alternative energy sources; and draw up an investment and financing plan.	Integrate land-use and transportation planning to encourage public transport; incentivise modal shifts (passenger to public transport; freight to rail); conduct R&D on innovation in cleaner technologies and alternative fuel sources.	Integrate climate change information into water planning, in order to minimise risk to infrastructure and supply; conduct R&D on new and unused resources (ground water, reuse of effluent, desalination).	Integrate human settlement planning with public transport planning; use water-sensitive urban design.
Minimise lock-In	Plan a way out of coal-fired power stations; invest in clean coal technologies; use thermal efficiency and emission standards for existing coal-fired power stations.	Plan a way out of reliance on road freight.	Plan a way out of reliance on cheap water.	Plan a way out of dysfunctionality in urban areas
Monitor progress	Diversify indicators of progress beyond cost efficiency, to include environmental efficiency.	Diversify indicators of progress beyond cost efficiency, to include environmental efficiency.	Diversify indicators of progress beyond cost efficiency, to include environmental efficiency.	Diversify indicators of progress beyond cost efficiency, to include environmental efficiency.

The table above reflects only some key considerations that need to be looked at in infrastructure planning. It is clear that all of these issues are interlinked. We cannot just focus on the infrastructure, but also have to consider the other issues that support the greening of infrastructure. Some planning tools are slowly being brought into place. There are serious challenges in terms of policy alignment. We are also struggling with both implementation and long-term planning. In addition, the right kind of data is needed to enable us to adjust our plans and track progress.

In terms of conceptualising the transition, the key question is how to plan and manage the transition to a greener growth path in a manner that will also create job opportunities, promote economic growth, and reduce poverty.

Transition requires prioritisation, as we cannot do everything. The type of actions that are possible need to be categorised in order to optimise positive spin-offs. We need to be clear on sequencing in the short, medium and long term, as well as on the path dependencies - for instance, which policy frameworks have to be in place before a certain programme can be implemented.

Catalysts with multiple outcomes need to be selected using certain criteria, such as creating employment; developing local industry development; enhancing competitiveness; building on existing infrastructure; and enhancing natural capital. Some of the main tools for achieving this transition are the following:

- Policy instruments that promote complementarities (economic, social and environmental) and leverage change, while avoiding policy conflicts;

- Fiscal instruments that use measures which give a real price to environmental goods;
- Strengthened institutional arrangements that function within increasing levels of complexity, cutting across sectoral silos and political boundaries (e.g. provincial or national);
- A new generation of financial instruments that will enable risk sharing between the government and investors, in order to make new technology affordable and workable;
- Preferential procurement of green products, especially in government spending;
- Development of a new set of skills to support emerging green sectors in the economy;
- Targets and trajectories that allow the right information to be gathered in order to monitor progress;
- Innovation planning that aims at continual innovation in materials, product design and manufacturing techniques.



Source: DBSA

Job creation with the economic infrastructure



Greening infrastructure for future resilient cities: Global perspectives

Ms Kobie Brand, Regional Director: ICLEI – Local Governments for Sustainability

ICLEI – Local Governments for Sustainability is a global network of approximately 1300 cities. It is acknowledged that any national or global policy is actually implemented at the local or city level. It is at the level of communities, households, schools and networks that perceptions and living patterns have to change.

As Martin Lees of the Club of Rome described it, our common 21st century issues – including economic, environmental and social issues – are inextricably intertwined, culminating on an unprecedented scale. The issues in question are systemic, non-linear and constantly in a process of rapid, dynamic change. As global, high-risk concerns, they are demanding cooperation and urgent action in ways that have not been experienced before.

For the past 17 years, the world has not managed to find solutions that effectively address climate change. Rio Plus 20 is coming up and many of the issues around sustainable development, which were debated in Rio 20 years ago, will be back on the table. Innovative mechanisms are needed, as well as other actors with stronger voices, to find solutions that can be up scaled for swift global change.

As the Global Footprint Network regularly points out, humans are currently eating away at future natural resources. The earth can no longer produce all the resources that humankind is consuming. There will be an expected 10 billion people on the planet by 2050; and, by then, some of us will still be here. Although cities occupy only a fraction of the earth's surface, humans have already consumed 75% of the planet's energy and other resources.

The 19th century saw the Industrial Revolution, which set the world on a path with fantastic opportunities, but with consequences that need to be addressed now. The 20th century brought the Technological

Revolution, with such innovations as computers and the Internet. Interestingly, most technological innovations have come from cities where people live in close proximity to one another and engage with one another in centres of excellence, so that their ideas find springboards and can be turned into something very concrete.

The 21st century heralded the Urban Revolution. It is estimated that over 66% of humans will live in cities by 2050; and over 90% by 2090. Urbanisation has been an unbroken, unbreakable global trend for the past 4000 years. It is in these urban regions that our economic future lies, and it is necessary to look at the positive opportunities that the close proximity of human beings living in confined spaces can bring.

Africa has 15 of the world's 50 fastest growing cities. According to research, however, it is not the big cities that will grow phenomenally, but those cities in the developing world with fewer than 500 000 inhabitants. We should therefore focus on the smaller secondary cities in South Africa and sub-Saharan Africa. In Malawi, for instance, the population in Lilongwe is expected to double in just a decade. However, as many of the people currently living there do not even have basic services yet, that city will have to find ways of providing basic services, albeit based on a completely new mindset.

This is where the potential for innovation really lies and where national and international policies and agreements can be turned into definitive, up-scaled action. We should foresee which cities will be growing, and then focus on finding completely new mindsets for building the required infrastructure and providing services to these people.

The “one hundred to one” (100:1) challenge refers to the fact that, by 2050, the current infrastructure in

the world will have had to double. This means that, within 40 years, the same urban capacity that was built over the past 4 000 years will have to be built.

This is a phenomenal opportunity to do things radically different. We do not have all the answers yet, but already there are innovative examples in all parts of the world, where cities are indicating that they will not wait until international agreements are in place or science has found the perfect solution. Although climate change is inherently unpredictable, we can build infrastructure more resiliently, making use of new technology that emerges every day and learning from each other as we trail-blaze into the future.

On the one hand, global issues, such as population growth, urbanisation, global warming, water supply, soil quality, food production, mineral resources and health, demand innovative initiatives, and nations are rightfully making an effort to define and enable relevant policy frameworks. On the other hand, it is really at the door of the local mayor where these things come together, in the form of housing, green-space, jobs, water, sanitation, energy, transport, childcare and healthcare. This is the person to whom people turn when the water runs out, electricity bills have to be paid, the transport does not run or basic healthcare is required.

It is at this basic level where solutions are needed for services, job creation, water supply, and the like. We need to work with communities in new ways that will empower them to take action in addressing the cumulative global challenges. Many answers can be found in the cities, and they can be up-scaled through cities working together and sharing best practices. As Achim Steiner, Under-Secretary-General of the United Nations and Executive Director of the United

Nations Environment Programme (UNEP), puts it: “The quest for sustainability will increasingly be won or lost in our urban areas. With foresight, political will and intelligent planning, cities can be the blueprint and map to a sustainable future.” International organisations, agencies and leaders are sending out this same message.

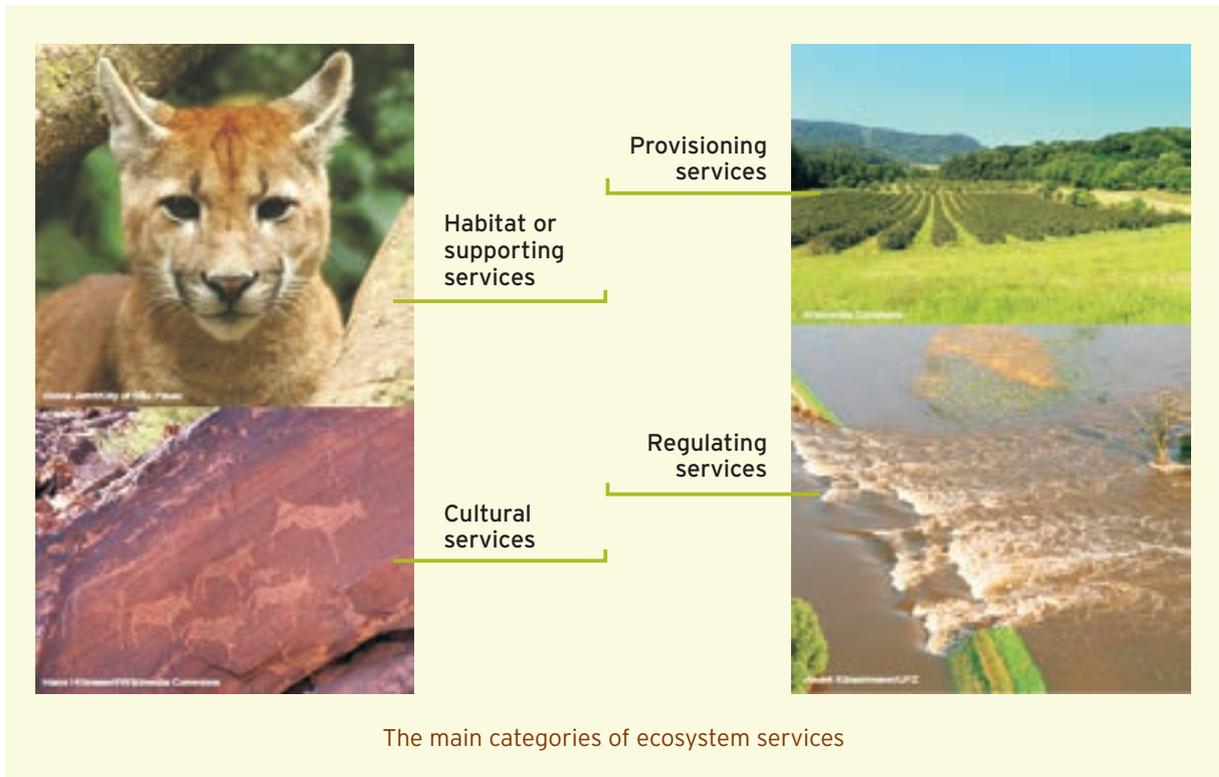
It is well known that the ecological footprint and human development go hand in hand in a way that does not paint a pretty picture. Biodiversity loss is escalating; sea levels are rising. If we know this is a probability for an area, how are we designing new cities in that area? The planners, engineers and builders of cities need to take into account that some of the worst-case scenarios may be very real in 50 or 100 years from now. We cannot invest in infrastructure that is going to keep us on the present vulnerable, exposed path of development.

Not all catastrophes such as droughts, floods, earthquakes and landslides can be attributed to climate change or global change, but we have a very good record-keeping system that is becoming increasingly more sophisticated at the global level. This system keeps track of catastrophes as they happen, and reveals that more catastrophes are happening and that they hit where we are most vulnerable, such as the least resilient parts of cities; the urban poor; cities based on poor planning decisions of the past, such as cities in low-lying areas, close to the coast, etc.

The earth's ecosystems are also extremely vulnerable and are bearing the brunt of all these cumulative issues that are being imposed on them. Quoting from the AR4 Report⁴: “The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate

⁴ Intergovernmental Panel on Climate Change (IPCC), 2007. Fourth Assessment Synthesis Report (AR4).
Online: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

Greening infrastructure for future resilient cities: Global perspectives - continued



change, associated disturbances (e.g. flooding, drought, wildfire, insects, ocean acidification) and other global change drivers (e.g. land-use change, pollution, fragmentation of natural systems, overexploitation of resources.”

It is impossible to place an estimated value on the world's natural ecosystem services - nature's benefits, as categorised in the diagram below. A new generation of economists is required who do not require ecological data in the form of figures in an economic context before they will act, but who are able to respond to the science that already exists.

Ecosystem services are nature's gift to humankind. Unfortunately, in very dense, high-built environments we have tended to keep nature out. When whole city blocks consist of hard infrastructure it does away with almost everything from nature. However, if we plan with nature in a sensible way, we can bring food and

water closer to the people; we can harvest the rainwater and become more energy efficient by using sustainable and renewable energy resources. Ecosystems services can improve water quality and support habitats. Even in inner cities there are examples of species being brought back from the brink of extinction and becoming a thriving community again. Ecosystems and local governments are interconnected in so many ways - through health, biodiversity, water availability, food security, poverty reduction, energy resources, spatial planning, etc. An engineer, a city planner or even a financial manager of a city cannot start to plan a city, draw up a budget or compile any aspect of an integrated development plan without taking the existing services of ecosystems into consideration.

The Economics of Ecosystems and Biodiversity (TEEB) study⁵ is a major international initiative that draws attention to the global economic benefits of

⁵ Described at <http://www.tweebweb.org/>

ecosystems and biodiversity. It highlights the growing costs of biodiversity loss and ecosystem degradation, and draws together expertise and best practices from the fields of science, economics and policy in order to enable practical actions to be taken, many of which concern the urban context. ICLEI is proud to be part of this initiative.

One of the TEEB's Local Action for Biodiversity (LAB) cities⁶ is Edmonton in Canada⁷ with its urban forests and parks containing 12.8 million trees. These green areas help to cleanse the air, remove carbon from the atmosphere, and reduce stormwater. Initiatives in cities such as these hold economic benefits; provide habitat services; remove pollution; and improve quality of life.

Globally, trillions of local currencies will be spent on fixed urban assets. Most of the resources will be destined for developing urban areas and a large portion will go to engineering, construction, architectural, technological and consumption companies. This reality offers a tremendous opportunity for greening the economy. Cities have to be turned away from being extractive and resource consuming, to becoming productive systems. They should be redesigned to generate substantial amounts of their own resources (food, energy and water) within the urban regions. Investment in the resource productivity of cities and urban systems is needed. This vision encapsulates the green urban economy of the future.



Source: Swartland Wine Route

Western Cape Province - These green areas help to cleanse the air, remove carbon from the atmosphere, and reduce stormwater.

⁶Other LAB cities are case-studied at <http://www.iclei.org/index.php?id=8886>

⁷See also <http://www.edmonton.ca/environmental/natural-areas.aspx>



Greening infrastructure: key considerations

Chairperson: Mrs Libby Dreyer, Manager: Advisory Unit, Development Planning Division (DBSA)

The greening of infrastructure and socio-economic development: Friends or foes?

Mr Rudi Dicks, Executive Director (Naledi)

The National Labour and Economic Development Institute (Naledi) is primarily the research arm of the Congress of South African Trade Unions (Cosatu), one of the largest federations in South Africa. In a project sponsored by the World Wide Fund for Nature (WWF), Naledi developed a climate change policy framework for Cosatu in December 2010. We are of the opinion that climate change will have the greatest impact on the poor. Quoting from the 10th National Congress of Cosatu in 2009: "It is workers, the poor and developing countries that will be adversely affected by climate change [...] unless the working class and its organisations take up the issue of climate change seriously, all the talk about 'green jobs' will amount to nothing."

When looking at climate change and a green economy from a pro-labour, pro-poor perspective, it is important that the shift to a low-carbon economy should be just. The impact on communities that are dependent on the existing kind of energy uses, including workers in coalmines, for instance, should be given serious consideration. The three key principles in shifting to a green economy are as follows:

- Workers and the poor should neither be disadvantaged nor disproportionately affected;
- Developing countries should not have to bear the burden of the cost of moving into an adaptive phase, without financing and support from developed countries;
- Developing countries should nevertheless take action to reduce their carbon emissions.

A shift to a green economy is an opportunity for deeper transformation, including the redistribution

of power and resources. When cities are rebuilt we have the opportunity to address some of the fundamental flaws in the legacies of apartheid.

Shifting to a green economy also means dealing with sustainable social growth. It is vital to provide space in which countries can develop their productive forces in an environmentally sustainable way. The main concerns include a lack of adequate water and sanitation systems; the requirement to expand electricity generation based on renewable sources; and the need for safe, low-carbon and affordable public transport systems. Any such industrialisation should be provided in a sustainable manner.

One of the weaknesses of South Africa's New Growth Path is that it does not pay detailed attention to some of the particular areas around sustainable development. Dealing with climate vulnerability must be an integral part of urban and rural development and planning exercises. The country cannot continue to develop in the way that other countries have developed previously. Cosatu's policy framework emphasises the following four basic aspects of a just transition to a green economy:

- Investing labour-intensively in environmentally friendly activities that create decent jobs, meet standards of health and safety, promote gender equality and are secure;
- Implementing comprehensive social protection measures to protect the most vulnerable and poor communities;
- Conducting research into the impact of climate change on employment and livelihoods in order to better



Source: Guy Stubbis

Job creation through the development of infrastructure

inform social policies. For example, as the mining shift has in fact been to platinum and coal, with reserves for the next 50-60 years, what will the impact on employment be?

- Ensuring skills development, training and retraining of workers so that they can be a part of the new low-carbon development model.

The New Growth Path identifies infrastructural investment as a key job driver, creating an envisaged 250 000 jobs a year in infrastructure and housing up to 2015. This offers an opportunity for massive expansion in investment and job creation through providing:

- new kinds of energy production (e.g. solar, wind and water power);

- more and better public transport;
- more recycling and better waste management;
- renovating and insulating already existing buildings, including homes, with energy-saving and carbon-reducing devices.

The key issue is how to harness the opportunities opened up by this environmental approach in order to ensure that they create labour-intensive jobs, and are not merely capital-intensive projects. The ideal would be for such jobs to be created directly by the state, via existing or new state-owned enterprises, and through all levels of government.

Urban and rural development under the New Growth Path requires better located and designed human shelter, infrastructure and settlements that are climate resilient. Urban design is a central element of



The greening of infrastructure and socio-economic development : Friends or foes? - continued

climate mitigation strategies. Perpetuating apartheid spatial patterns, with the associated problem of people's places of residence being far from their places of work, leads to greater inefficiencies and larger environmental footprints for cities. For instance, greenhouse gas (GHG) emissions increase because people have to use public transport, or their own transport, to get to work.

The densification of residential accommodation should be balanced by the creation of a greater number of public open green spaces that are accessible to all. In the Braamfontein City Centre Precinct where I work, for example, there is massive investment in buying up old buildings and turning them into residential complexes, but there is no strategy for greening those areas. There are no parks, only sparsely populated trees along the walkways. The development of new building codes is, therefore, essential.

As regards energy, a twofold strategy is required to reduce the dependence on fossil-fuels but, simultaneously, to expand household electrification rapidly. Expanding households' actual access to electricity (and not merely their connection to a grid) should be complemented by reducing levels of household consumption through the construction and retrofitting of energy-efficient homes. This includes the fitting of solar water heaters; the installation of decent ceiling insulation; and the design of houses to best take advantage of the sun's natural light and warmth.

Policies are needed to internalise environmental externalities. There is also a need for a greater focus on, and investment in, demand-side management, alternative renewable energy, and energy efficiency. Renewable energy targets are currently largely ignored in favour of providing cheap power to industry. Cosatu does not support nuclear energy, as

it is too expensive; it is dangerous to maintain or even decommission safely; it creates fewer jobs; and it promotes an over reliance on skills from outside South Africa.

The country needs a genuine commitment to review and scale-up existing targets for renewable energy (e.g. solar and wind energy), as well as to set new, credible targets. This requires an enabling environment and adequate incentives in support of development of a local renewable energy industry. Renewable energy has much unrealised potential and technological learning curves. It is, therefore, likely to contribute to the creation of more jobs and significant cost reductions in the long run, and will allow South Africa to take a leading role in providing renewable energy in the region.

As regards water, adapting to increasing water stress requires:

- investing in improved infrastructure to avoid leaking municipal as well as domestic pipes, which account for massive amounts of wastage daily;
- valuing and safeguarding the natural sources of water - aquifers, groundwater, water catchment areas, rivers and wetlands;
- having zero tolerance for polluters, and imposing significant penalties for offenders;
- implementing zero-waste industrial processes, thus eliminating the contamination of water by pollutants;
- maximising rainwater harvesting through local systems;
- supporting the development of water collection technologies for a broader range of water harvesting at local level.

These kinds of inventions are fairly labour intensive and can potentially create tens of thousands of new jobs, if localised. They provide a sense of jobs and communities will buy into that.

As regards transport, it is estimated that transport in South Africa amounts to around 12% of the country's GHG emissions, as 32% of commuters daily travel to work in private vehicles - the majority being one person per car. The most obvious intervention to reduce transport emissions is to ramp-up the provision of subsidised public transport. Massive public investment is required to make this possible, but the spinoffs would be significant - in respect of not only reduced carbon emissions, but also job creation. However, public transport services will have to be safer, more reliable, more frequent, more comfortable, and more affordable.

Two additional and potential job drivers in transport could be the local manufacture of public transport vehicles that use cleaner fuels; and investment in fuel transport infrastructure (e.g. shifting from road to rail) that enables the movement of cleaner fuels.

As regards construction, the non-residential and residential building sectors account for around 10% and 13% of South Africa's total GHG emissions respectively. Large-scale public infrastructure, therefore, also requires better choices in construction design and materials. The government, as part of an energy-efficiency drive, has introduced SANS 204, a set of standards for new government buildings. The objective is to cut energy demand by 15% by 2015. The question, however, is whether there are sufficient measures in place to monitor and enforce such standards.

There is a greater likelihood of new jobs being generated in retrofitting, because it would amount to accelerated refurbishment above current target rates. Retrofitting requirements could be introduced at the time of building, but there should also be a required set of standards for when the building changes owners. The government should take the initiative in retrofitting government buildings, and set clear and achievable timelines for implementation.

Institutional arrangements for construction nationally and at local government level should be reviewed. There should be a return to local government housing construction and maintenance programmes. Building standards should be solidified, as they allow reasonable standards of labour decency, as well as skills formation and transfer. This could also facilitate local community-driven housing projects, in a move away from poorly constructed, poorly insulated RDP houses.

The construction industry has long been run as a cartel, with extensive collusion, and a number of companies have already been prosecuted in this regard. Essentially, five players virtually control the entire value chain, from quarrying to materials production to actual construction, and in so doing control (primarily state) infrastructural and housing projects. These companies are not necessarily concerned with either the socio-economic impact they are having, or the environmental sustainability of their construction. If we want to set into motion the kind of regulations that deal with decent work, sustainability, growth, and skills transfer, we would fundamentally have to address this particular problem. There is, therefore, an urgent need to deal with construction oligopoly.



Greening infrastructure: key considerations

Ecosystems as infrastructure: Life's fundamental building blocks

Dr Tanya Abrahamse, Chief Executive Officer (SANBI)

Ecosystems form a subsector of the concept of biodiversity. Biodiversity is the amazing variety of life on Earth, and refers to both genetic diversity and species diversity. Together, the diverse forms of life and nature are found in various ecosystems, which play a large number of vital roles on the planet. It is the original, natural infrastructure that humankind has inherited.

Infrastructure is the foundation on which the growth and continuation of a community or a state depends. Green infrastructure, therefore, is any infrastructure that has an environmental benefit or a reduced environmental impact. Ecological infrastructure, in particular, refers to strategically planned and managed networks of biodiversity that maintain integrity of ecosystems and provide benefits to society.

South Africa is the third-highest biodiverse country, which is an amazing achievement, but one that unfortunately tends to be ignored most of the time. Interconnected living things and natural systems form the foundation for economic growth (jobs), social development (service delivery) and human well-being (quality of life).

This country's biodiversity infrastructure asset is about much more than tourism or conservation. For example, biodiversity sustains, nourishes, enriches, heals, inspires, amazes, teaches, pleasures, protects, connects and empowers. More specifically, ecosystem services rendered by nature include benefits such as the following:

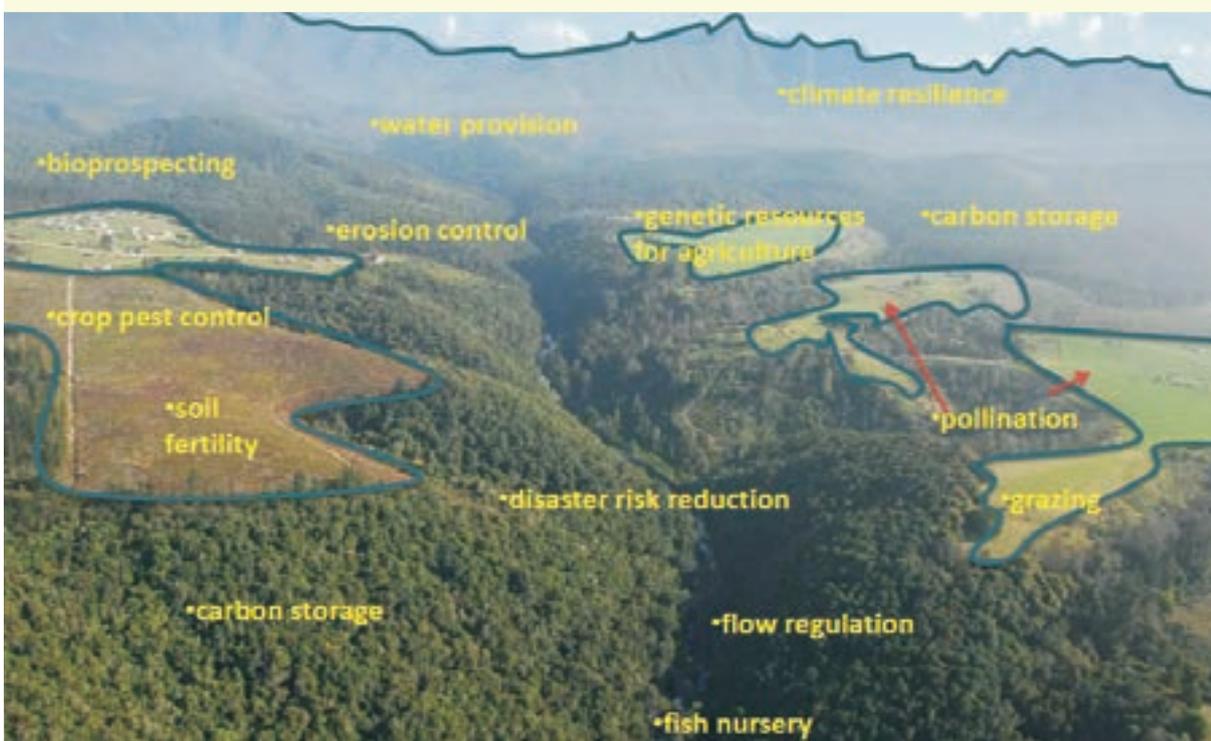
- *Provisioning*: food, fresh water, wool, fibre, medicine, fuel, and seed;
- *Supporting*: nutrient recycling, soil formation, primary production, photosynthesis, and habitat;
- *Regulating*: temperature regulation, flood regulation, disease regulation, water purification, trapping of carbon, pollination, and prevention of erosion;
- *Culturalising*: aesthetic, educational, recreational, spiritual, and stewardship.

Biodiversity impacts on our daily lives. According to the Millennium Ecosystem Assessment, a global assessment by the United Nations Environment



Source: i23rf

Nature's model of integrated planning



Source: SANBI

Ecosystem goods and services - a landscape view

Programme (UNEP), it contributes to the constituents of well-being, namely:

- *Basic needs for living:* sufficient nutritious food, shelter, adequate livelihoods, and access to goods;
- *Health:* clean air, clean water, strength, and feeling well;
- *Security:* personal safety, secure access to resources, security from disasters;
- *Good social relations:* social cohesion, mutual respect, and helping others;
- *Freedom of choice and action:* the opportunity for individuals to achieve what they value doing and being.

As the third-most biodiverse country in the world, it makes sense not only to boast about South Africa's national asset, but also to be at the forefront of using that asset in order to have such impacts on socio-economic development as those listed above. There should be a broader, "landscape" perspective in dealing with the natural environment, as is illustrated in the picture above.

When talking about brown or green projects (e.g. finance, energy, infrastructure), the natural ecosystems - the landscape within which our work is done - should be brought into the planning to ensure that they are used sustainably. When planning for optimal development, green landscapes should be taken into account in a way that maximises long-term productive capacity through holistic asset accounting (and impact accounting), as well as landscape planning.



Greening infrastructure: key considerations

Ecosystems as infrastructure: Life's fundamental building blocks - continued

The optimal use of ecological infrastructure and biodiversity assets supports a range of productive, extractive and non-extractive economic activities. Clever multilevel and multi-factor thinking and planning are necessary to live with complexity, as exclusivity is not possible. There is no “silver bullet”, linear type of relationship.

An optimal development future requires strategic leadership, strong enabled governance and true integrated planning, accompanied by holistic asset and impact accounting and mapping. All the users in the “mosaic” design should be taken into account and the benefits catalysed among the different players.

The contribution made by biodiversity should not be recognised sector by sector, but working across the whole landscape. The various infrastructures - engineered, green, and ecological - are planned in tandem, and not one over the other, in order to achieve more optimal development outcomes. Biodiversity and ecosystems provide the foundation for individuals' and communities' resilience to climate change by means of “climate proofing”. Planning should take a long-term view

to optimise economic benefits and maximise efficiency. The focus should not be project by project, site by site, or from funding cycle to funding cycle.

Thanks to about 15 years of work done by various scientists and institutions, South Africa's ecological infrastructure and biodiversity assets have now been mapped in some detail. The maps show assets such as the country's carbon sink potential, water yield areas, mountain catchment areas, wetlands, marine protected areas, World Heritage sites, coastal habitats, estuarine functional zones, etc. They also point out areas of soil erosion, as well as endangered and critically endangered ecosystems.

Working for Water and Working for Wetlands are two programmes that have created numerous jobs and have had success in their efforts to restore ecosystems. Some of the damage they are trying to undo could have been prevented by better long-term planning, for instance by keeping wetlands in a healthy condition.



Source: SANBI

Mount Fletcher Dam, Eastern Cape, in need of desilting

Mount Fletcher Dam in the Eastern Cape, pictured below, is an example of what happens to many dams. It was built at great cost for some previous Medium-Term Expenditure Framework (MTEF) cycle, but is now silted to the point that the dam is a burden on the current MTEF cycle. Huge costs are involved in desilting a dam like this.

Financial modelling should change so that it becomes clear what the future fiscal cost is of not protecting nature's various environmental services. We should also look at human capital development in order to create a cadre of people with long-term, sustainable jobs and careers in retaining, restoring, maintaining and enhancing these ecosystem services that will otherwise cost the country an enormous amount later on. Holistic planning in the beginning will save money further down the line.

Ecological infrastructure is, therefore, not just about recognising and using the services rendered by

nature. It is also about planning for better returns on state investment. Jobs can be created through proper management of ecological infrastructure and labour-intensive maintenance.

Integrated development planning should be improved and informed by the existing ecological infrastructure. Local economic development should be focused on maintaining the ecological infrastructure at local level. It is necessary to move away from project-based natural resources management (NRM) models, and secure recognition of the critical need to improve and maintain the country's ecological infrastructure. Human capital development is foundational to unlocking the biodiversity component of the green economy. South Africa's amazing natural assets will, indeed, power the green economy we are striving towards.



Source: i23rf

Sustainable ecosystems



The role of standards in greening infrastructure: Global and local practice

Dr Sadvir Bissoon, Executive: Standards Division (SANS)

The world faces an unprecedented challenge resulting from growing concerns over the supply of fossil fuels and the clearly discernible effects of climate change. Energy consumption in buildings represents close to 40% of the world's total energy use, including energy for climate control, appliances, lighting and installed equipment. The global demand for energy has outpaced the capacity of new supply to reach markets, and a reliance on non-renewable energy resources is, by definition, unsustainable.

The significance of energy efficiency is widely recognised. Reducing overall energy use, and especially fossil fuel consumption, requires greater reliability and availability of energy, as well as low operating costs. More than just an environmental issue, energy management is equally an economic and a social issue, and supports the three pillars of sustainability, namely the economy, the environment and society.

South Africa's economy is largely based on energy-intensive mineral extraction and processing. The reduction in greenhouse gas (GHG) emissions is an urgent concern, as the country is one of the highest CO₂ emitters globally per capita. We need to invest in energy-efficient infrastructure and to secure the environmental and economic spinoffs. The development of large-scale renewable energy supplies is strategically important for environmental sustainability.

Renewable energy is energy derived from natural processes that are replenished at a higher rate than they are consumed. Common sources are solar, wind, geothermal, hydro and biomass energy. The use of renewable energy has seen growth rates of 30-40% in recent years due to market-creating policies and cost reductions. A number of standards have been developed for solar and wind energy.

It is important to understand that most of South Africa's electricity consumption is for heating, cooling, ventilation and hot water generation. Proactive engagement with industry and the government is vital to initiate a wide variety of programmes for energy-reduction technologies; to develop relevant standards that take South African conditions into account; and to launch a platform for effective energy management and sustainable technologies.

Standards are created in an open, consensus-driven process by those organisations that need to use them. They establish a level playing field that reduces unfair advantages, inconsistent benchmarks, and uncertainty in the market. These normative documents are an essential part of the complex technical infrastructure that contributes to economic efficiency and quality of life. They improve consumer understanding and confidence, while also influencing behaviour and choices. In terms of green infrastructure, standards will:

- make efficiency measures more reliable and competitive in green infrastructure management and public administration;
- reduce technical barriers in energy efficiency and in the energy savings trade;
- encourage new green infrastructure projects and policy instruments;
- facilitate access to new energy savings markets;
- increase awareness of energy efficiency measures among providers and users;
- encourage acceptance of green infrastructure products with high added value;
- offer solid support for GHG reductions.

Many countries have taken the first steps in introducing measures for green infrastructure.

In Australia, for example, the National Australian Built Environment Rating System (Nabers) measures an existing building's environmental performance during its operations, in categories such as water, waste, indoor environment, etc. These environmental indicators and the associated measuring techniques have been researched extensively, and have resulted in an efficient rating system and consequent reductions in energy use.

In Singapore, the BCA Green Mark Scheme was launched in January 2005 as an initiative to drive that country's construction industry towards more environmentally friendly buildings. This green building rating system intends to promote sustainability in the built environment and to raise environmental awareness among developers, designers and builders, starting at conceptualisation and design, and continuing during construction.

There are many other technologies for which standards can be developed to ensure that they have the desired impact. An example is the batteries used in vehicles. Although a battery-only vehicle may fill a specific niche, market hybrid vehicles that can run on either fuel or electricity are likely to have a much broader appeal. The combination of new standards for the fuel economy and GHG emissions and the utility interest in selling electricity can drive battery costs down. The potential for reducing emissions is also enormous.

The Energy Star rating system is in use in several countries. In South Africa, many offices and buildings have their lights on during the day instead of utilising natural sunlight. Load shedding may easily be repeated, as the demand for electricity is increasing due to recent infrastructure developments. The government has, therefore, developed and reviewed various relevant policies, including the Energy Efficiency Strategy, which

produced the South African National Standard (SANS) 204 for energy efficiency in buildings.

SANS 204 is a minimum standard for new buildings in respect of their site and building orientation, shading, building design and sealing. It does not put forward best practice, but aims to reduce poor practice cost effectively. SANS 10400-XA is another building standard, while SANS 1307 covers the mechanical and thermal performance of domestic solar water heating.

Energy-efficient infrastructure will significantly contribute to a reduction in GHGs and to greening the infrastructure. Green infrastructure is associated with a variety of environmental, economic and human health benefits, many of which go hand in hand. They are particularly accentuated in urban and suburban areas, where green space is limited and environmental damage is more extensive. Such benefits include:

- reduced and delayed stormwater runoff volumes and reduced stormwater pollutants;
- improved human health and air quality;
- increased carbon sequestration;
- mitigation of urban heat islands;
- reduced energy demands.

Being a semi-arid country, fresh water is South Africa's most limited natural resource. Water supply may become a major restriction to the future socio-economic development of the country. Some standards for water conservation include SANS 10252-1, which is concerned with water supply and drainage for buildings; SANS 10254, which deals with fixed electrical storage water heating systems; and SANS 1352 for domestic air-source water-heating pump systems.



The role of standards in greening infrastructure: Global and local practice - continued

All standards around water efficiency will be reviewed. There are also standards and guidelines for ecosystem preservation, such as the SANS 14064 series (for quantifying, reporting and monitoring GHG reductions); SANS 14065 (the requirements for GHG validation and verification bodies for use in accreditation or other forms of recognition); SANS 14066 (competence requirements for GHG validation and verification teams); and ISO 14006:2011 (guidelines for incorporating ecodesign into any management system).

Many South African national standards have been developed to support energy efficiency and energy-savings applications. The National Building Regulations (NBR) Part X (Environmental sustainability) and Part XA (Energy usage in buildings), supported by SANS 10400-XA, incorporate existing standards into a holistic overview of building construction. SANS 10400-XA is a single reference for stakeholders to ensure compliance with energy efficiency requirements as per the NBR.

ISO 50000 is a management system for energy. SANS 50001, adopted by the South African Bureau of Standards (SABS) as a national standard, provides organisations and companies with technical and management strategies to increase energy efficiency, reduce costs, reduce pollutants, and improve environmental performance. ISO 50000 could influence up to 60% of the world's energy demand, primarily in the commercial and industrial sectors.

ISO 50001 is based on the same Plan-Do-Check-Act approach of ISO 9001 and ISO 14001, drawing extensively on quality management and energy management systems. Its implementation is likely to be different, as it involves laws and regulations, a market drive, certification programme support

and technical support. SANS 50001, which is referenced in the National Energy Act's "Regulations on the allowance for energy efficiency savings", is a standardised approach to reporting energy savings in order to benefit from tax incentives.

To conclude, standards are the "glue" that holds together technological advancement in sustainability. Through partnerships with various stakeholders, the SABS is responsible for developing these national standards. It is the Bureau's mission to support the government and the public sector alike in creating sustainable jobs and standardisation activities in this manner. The voluntary use of standards is considered key to the attainment of sustainable green infrastructure.

Case study: Enerkey - lessons from the University of Johannesburg programme on infrastructure and cities

Ms Maria-Joe Coetzee, Research Group Leader: Regional and Urban Planning: Built Environment (CSIR)

The major trends of urbanisation and migration across South Africa, where many people move from rural areas to cities in search of a better life, are in line with similar trends globally. It is expected that by 2030, at least 71.3% of South Africans will be living in the country's cities. This makes it crucial to understand how individual components in an urban context can be mixed in the right way in order to achieve sustainable outcomes.

Cities and city regions account for 39.5% of the national population, 62.4% of the national economic activity but only 2.4% of the surface area. In order to have the most impact, strategies would have to focus on these areas. Key considerations are how a city or city region's physical form and infrastructure affect its sustainability; and which spatial policies and instruments can assist in developing cities that are more sustainable in the long term.

Generally, South African cities appear to be very dispersed compared with urban forms in most other developed and developing countries. It is believed that very dispersed urban settlements may not be as sustainable as very condensed urban settlements.

However, when considering how efficient or not cities are, not only the spatial footprint should be taken into account, but also the total economic production of the area; the area's percentage of total energy demand in the country, etc.

There are usually dispersed settlements on the outskirts of cities, with the economic and employment opportunities centralised around an urban nucleus. However, these outlying settlements are not all low-income developments, there are also some high-income ones. They form



Source: 123rf

There is critical need for alternative sources of energy



Case study: Enerkey - lessons from the University of Johannesburg programme on infrastructure and cities - continued

for different reasons, therefore, it is important to look at what is happening internally in a city and to consider what this means for its sustainability. South African cities typically consist of the following residential developments:

- very high income, combined with retail;
- mixed high and middle high income, at a significantly greater density;
- mixed income, with a range of different income groups;
- middle-high income;
- low-middle income, often with outbuildings accommodating second and third families;
- low income, e.g. RDP developments with a huge proliferation of backyard shacks, where the infrastructure was not planned for such major densification.

Only once it is known how cities function and how interactions play out in them, will it be clearer what needs to be done in order to improve their sustainability and resilience, also in terms of energy efficiency and carbon efficiency. It is not merely about meeting the demand for infrastructure or service delivery, but also about factoring in the impact of major urbanisation and planning for this within a range of possible scenarios and futures. It follows that special tools are needed for doing this.

The Council for Scientific and Industrial Research (CSIR) established the Urban Dynamics Laboratory in 2007. After a long review of the international state of the art, the CSIR decided on two Open Source modelling systems: UrbanSim and MATSim (Multi-Agent Transport Simulation). The CSIR is using these systems in the Integrated Planning and Development Modelling (IPDM) project, which

was initiated by the Department of Science and Technology, in order to understand the dynamics of urban form and interactions in space.

Integrated land-use and transportation modelling capacity has been achieved through data exchange between UrbanSim and MATSim. The different simulations of possible urban growth patterns explore a range of employment growth, population growth and spatial planning scenarios. Households' demographic profiles are also important, as different households have different energy demands and generate waste in different ways. The simulations begin to quantify these kinds of pressures in cities over the longer term.

The results of the simulation process will enable metros and city regions to plan more proactively for the long term, by better understanding:

- future patterns of the demand for infrastructure, facilities and services, such as water, electricity, sanitation, schools, clinics and hospitals;
- investments required to sustain the economy, including public and private transport;
- how the future urban form may impact on the sustainability of cities, by using indicators such as travel time and cost, access to social and economic opportunities, and energy and carbon efficiency.

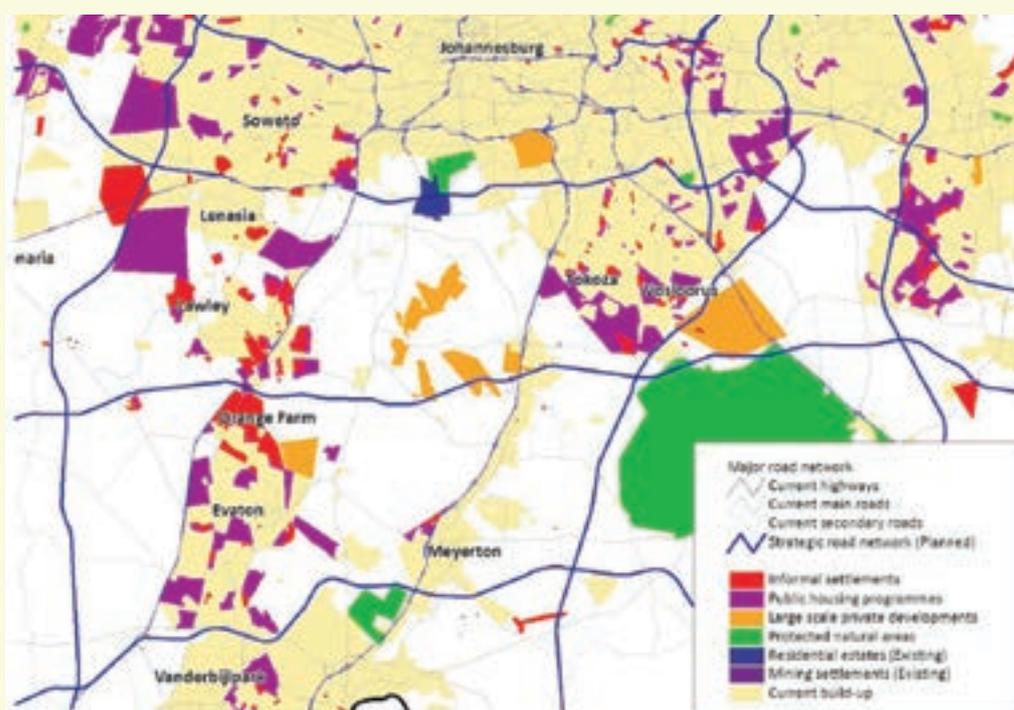
The simulations make use of a collaborative or "living laboratory" process, comprising interactive work sessions with end users in real-life contexts. This is done to ensure the participation and collaboration of relevant municipal officials in the process of developing, testing and applying the urban simulation platform.

Cities in such projects assist in developing a range of spatial scenarios; provide information; and help with model specification and evaluation of the results. Metros may use common instruments and measures in their spatial development frameworks to manage urban growth and urban form. However, they combine these instruments in very different ways, and with different emphases and approaches. The outcomes and results of these strategies are, therefore, quite different and highly dependent on contextual conditions.

The Living Lab Process has been applied to three metropolitan areas, namely eThekweni Metro, Nelson Mandela Bay and the City of Johannesburg. It was recently started with Gauteng and the Enerkey project. This project aims to develop and implement innovative projects in urban energy supply in order to improve sustainability in Gauteng. It views energy as a key element of sustainable transformation and integrated climate protection.

The simulation for Enerkey assesses the energy and carbon emission implications of two spatial scenarios, allowing researchers to zoom in on smaller areas within a larger mosaic of metros and districts. Fragmented scenarios can be extracted which focus, for instance, on informal settlements, high-income settlements on the outskirts of the city, etc. Combining this with the Gauteng long-term strategic road network, for example, the information can be run through the model and show the impacts on urban growth 30 years hence.

Such simulations allow metros to run a host of questions through the modelling platform, ultimately enabling them to make sounder decisions. Transport simulations are also possible when it is known where households are; how many vehicles they have; and where they work. Actual trips between work and home can then be modelled, noting where congestion occurs over a



A fragmentation scenario, with the red areas representing densities of up to 200 units per hectare

Source : CSIR



Conceptualising the greening of infrastructure in South Africa

Case study: Enerkey - lessons from the University of Johannesburg programme on infrastructure and cities - continued

24-hour period and how it intensifies in different sectors.

By modelling the current and probable future urban form it becomes clearer which types of urban forms should be encouraged in the different metropolitan areas of the country. This kind of work challenges conventional wisdom and thinking, which is not as focused on individual indicators and variables. It is already evident that the goals of achieving a low carbon economy and a lower energy demand, and of satisfying the access of communities to opportunities, are not mutually exclusive and can be reached jointly.

The main objective is to use an urban simulation platform customised for South African conditions in order to supply each metro with the following: customised Open Source UrbanSim and MATSim software; a set of high, medium and low population projections in the form of Excel spreadsheets with annual control totals for 2001-2030; a fully prepared relational data set for each metro; simulation results for agreed-upon policy scenarios; as well as capacity building and training of nominated officials on how to use the platform.



Source: Photograph courtesy of Mike Marker - DBSA Specialist

Public transport: Taxi rank at Warwick Junction - Ethekewini



Day Two



Greening infrastructure experiences: Case studies
Greening infrastructure enablers and constraints: Finance
Sectoral perspective on transport and logistics
Sectoral perspective on buildings
Sectoral perspective on ecosystem infrastructure (including water)



Greening infrastructure experiences: case studies

Chairperson: Ms Chantal Naidoo, Divisional Executive: Environmental Finance Unit (DBSA)

The South African Renewables Initiative: A green energy infrastructure finance case study

Dr Edwin Ritchken, Strategic Projects Advisor (DPE)

Globally, renewable programmes are driven by industrial policy as well as clean energy goals. The territory of Ontario in Canada, for example, is seeking to become the “silicon valley of renewables”, by securing the best equipment and industrialisation processes and creating 50 000 jobs within three years. Germany has integrated its renewables programme with the development of technological and manufacturing leadership. Its Ecological Industrial Policy has provided over 275 000 jobs, with an expected figure of 400 000 by 2020. In Brazil, the ProAlcool bio-ethanol programme has been a key strategy for energy security and job creation since the 1970s. India is aiming to generate solar energy for energy security and solar thermal manufacturing. China has become the foremost manufacturer of wind energy by entering into a sustained programme of procurement that has built up its natural industries.

Another key context is the recognition that, over time, high levels of carbon contained in commodities exported from South Africa will be taxed. Some R85 billion of the country's energy-intensive exports are vulnerable to the threat of R2.7 billion of carbon border tariffs. Likely sectors to be targeted are non-ferrous metals; iron and steel; paper, pulp and print; chemicals and petrochemicals; textile and leather; and wood and wood products. The challenge is to ensure that instead of these commodities being taxed offshore at their export locations the premiums should be paid in South Africa for the development of alternative low carbon energy sources.

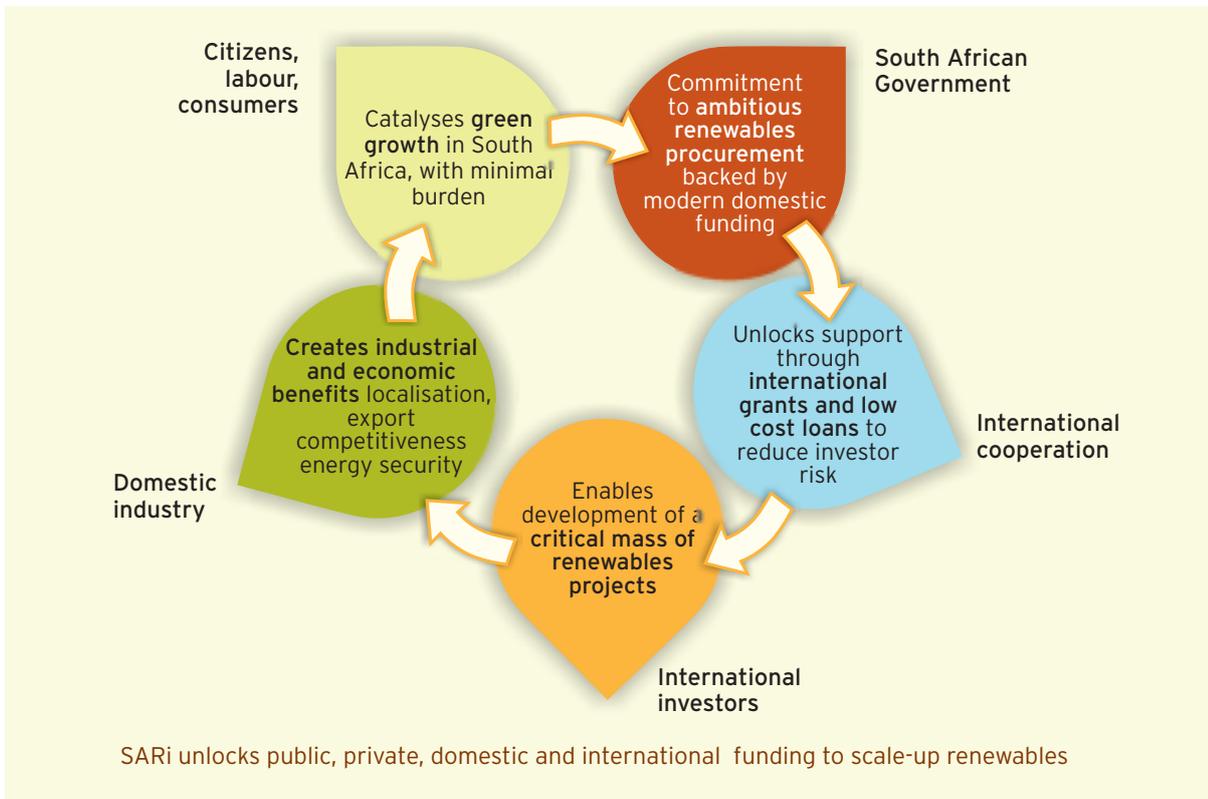
The objective of the South African Renewables Initiative (SARi) is to develop a financing strategy and various mechanisms that will enable the procurement of renewable energy at a critical mass. This will in turn create a business case for the

development of industrial and technological capabilities relating to the manufacture of equipment for renewable energy generation in South Africa. A green economy strategy is the bridge between the procurement of renewable technologies and building an industry around that procurement. It is the imbedding of such industrial capabilities in a country that creates a green economy. The logic, or transmission mechanism, on which SARi is building, is the notion that the government is making a commitment to ambitious renewable procurements backed by modest domestic funding.

Essentially, SARi is creating a structure that will enable strategic mitigation efforts, as required by the climate change negotiations. Such a high level of commitment should unlock international funding support, which will then secure procurements and boost investments in industrial and technological capabilities in order to meet the needs of the procurements. This should lead to increased taxation and a higher gross domestic product (GDP), thus creating a virtuous circle.

SARi cannot be seen in isolation from the broader context, such as the power purchase policy, climate change policy, energy planning policy and industrial policy. The domestic policy environment (e.g. ensuring that producers will be paid even if the grid does not use their energy), and the nature and robustness of power purchasing agreements will determine whether a feasible funding mechanism can be designed to achieve the ambitious target set for renewables.

SARi's sophisticated financial model gives a holistic picture by incorporating the costs of energy-safe carbon emissions, investment requirements and GDP outputs in the manufacturing supply chain. A scenario exceeding the Integrated Resource Plan 2 (IRP2) was modelled to determine the likely costs



and funding requirements if targets are set at 7% electricity generation in 2020, and 13% in 2025. The modelling found an annual funding gap between USD6.7 and 9.5 billion to reach the ambitious scenario of 23 GW of renewables by 2025. The solution to the problem of funding this gap lies in a two-pronged approach:

- Decrease the cost of capital for renewables through international concessional debt and guarantees.
- Increase the funding available for renewable energy through a planned increase in South Africa's general electricity tariff; domestic contributions to the renewable energy feed-in tariff (REFIT); and possible international grants.

High carbon is relatively capital cheap and very fuel intensive, whereas South Africa has cheap coal and very expensive capital. The international

community's help to lower the average cost of capital for these developments would be sought, as well as increasing the amount of funding available for REFIT from domestic and international sources.

The modelling suggests that, using the baseline commercial funding scenario, low-cost loans could decrease the gap from USD9.5 to 7.4 billion. If political insurance and low-cost loans are combined, the gap shrinks to about USD6.1 billion, based on the worst commercial case. Three potential sources of funding to increase the price paid for renewables are as follows:

- A domestic contribution from the fiscus should be made, recognising the benefits derived from achieving scale with international support. The enhanced quantity of renewables and development of the manufacturing industry should lead to increased GDP and taxes.



The South African Renewables Initiative : a green energy infrastructure finance case study - continued

- A green purchase obligation would make energy-intensive exporters compliant with trade partners' carbon requirements, as a range of exports with a high carbon composition would be subject to export taxes. If exporters pay a premium for green energy, they will become compliant with global targets and the money will be kept internally.
- A number of countries may want to make straightforward grant payments to contribute to strategic mitigation activities by developing countries. They could offer pay-for-performance, climate-related grant funding to cover incremental costs based on a cost-effective mechanism for carbon emission mitigation.

A potential formula for domestic contribution is based on the principle of achieving fiscal neutrality over the medium term. A projection for 2012-25 shows that South Africa would be able to raise about USD3 billion in fiscal contribution on the back of project-related tax, supply industry tax, etc. One solution would be to combine domestic grant contribution with international grants. For instance, if domestic funding of USD2.4 billion, international grants of USD3.5 billion and low-cost loan funding are combined, the gap can be narrowed from USD9.5 to 6.1 billion. It is important to see such funding as feeding into a process:

- *During Phase 1 (Pioneering)*, the costs of capital and renewables are high. There will be high levels of policy and institutional uncertainty and risks; as well as learning curves in construction, operations and grid deployment.
- *In Phase 2 (Early independence)*, policy and institutional alignment will have been achieved. Residual technology risks must be dealt with (e.g. for concentrated

solar power) and it will take some time to reduce technology costs.

- *Phase 3 (Fully commercial)*, is characterised by commercially viable markets and mature institutions and technologies. Institutional and policy risks have been normalised to the levels of mature, active markets.

Wind energy would be a good place to start. There is likely to be a premium paid in the early years by virtue of institutional and technological uncertainty. After the initial support, the production of wind energy will move rapidly to grid parity and commercial viability, and then soon become a standalone, competitive technology.

The renewables initiative consists of a series of technology-specific deals. Depending on the maturity, cost premium and risk profile of the technology, funding is raised to enable critical mass procurement that takes the system to the next level. Meeting a target of 22.5 GW will involve a number of deals that could bring about a significant decrease in business-as-usual emissions and contribute 10-14% to the Copenhagen Accord targets. Because SARI drives environmental benefits at low costs, the costs of GHG mitigation will be far cheaper than at carbon market prices.

Local job creation during the building programme is expected to be significant, with 40 000-54 000 mainly skilled or semi-skilled jobs being created per year by 2020/25. This would cover both the direct supply chain and indirect industries. The maintenance programme would create fewer jobs. There is also significant potential for localising renewable supply chains. A very high level of local content can be reached, provided these supply chains are procured at a critical mass.

In summary, there are a range of benefits associated with SARI, including industrial development opportunities; competitiveness of exports; enhanced

energy security; achievement of the Copenhagen commitments; and minimal domestic cost.



Source: 123rf

Renewable energy - wind turbine



The Infrastructure Inputs Monitoring Project

Dr Zavareh Rustomjee, Independent Consultant (DBSA)

The Infrastructure Inputs Monitoring Project (IIMP) began in 2006 at a time when the infrastructure programme in South Africa was accelerating and there was a concern that the supply industry would be unable to meet the demand. There were, in fact, shortages in cement and some other commodities. The project was repeated in 2008 and again more recently.

The current round of the IIMP, undertaken in 2011 was carried out by the DBSA. The IIMP's terms of reference were to consolidate previous 2007/08 data into a single, updatable database and to prepare a detailed research manual that would allow the process to be updated more frequently and a deeper analysis to be undertaken. Private and public sector projects were captured and interviews were held to strengthen the data and identify key issues related to strategic outcomes, localisation, procurement and integrated infrastructure planning.

Whereas previous studies tracked expenditure on public sector infrastructure mainly by following the conditional grants that increasingly make up the funds for infrastructure, the IIMP tracked actual national, provincial and municipal budgets and expenditure. It was heavily dependent on the various budgeting and accounting systems of the National Treasury. The budgets of provinces and municipalities were also unpacked, and relevant unpublished data sought and verified.

The various amounts allocated to expenditure on public sector infrastructure for 2011/12 were as follows: buildings and construction (R47 287 million); housing (R14 941 million); water and sanitation (R29 330 million); roads (R43 250 million); telecommunications (R2 324 million); electricity and energy (R137 238 million); and transport

(R23 923 million). An important point to note is the heavy weighting of the bricks-and-mortar type of investment, which was almost a quarter of the total estimated investment of R298 293 million.

The study concluded that - unlike previously with the excessive demand and shortages of supply - there is now considerable latent demand and budget rollovers, where infrastructure funding is not expended. This is due to blockages in executing infrastructure projects, particularly at provincial and municipal levels, for which considerable supply capacity exists. There has also been a drop in private sector expenditure on infrastructure capital, which has been caused by the global economic downturn.

The significant weight of labour-intensive building and construction in both the public and the private sector is another key issue that emerged from the study. There is also potential to apply the infrastructure demand database to more detailed spatial planning. Currently, there are few supply constraints, but this could change if the global economy turns around. Future supply constraints can be anticipated and addressed by domestic supply and/or imports. With the current downturn and excess supply, input prices are not a major constraint at present, but they could become a constraint to future infrastructure plans.

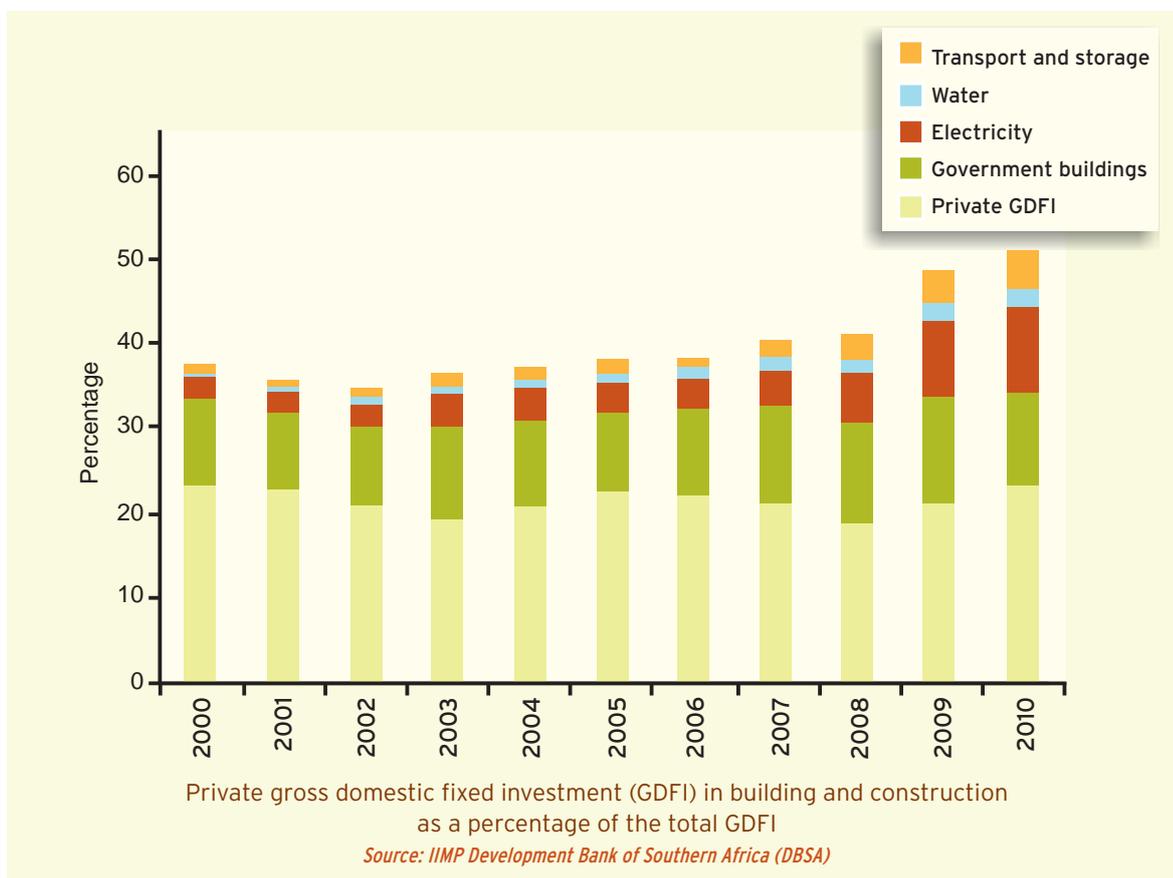
Generic factors that impact on infrastructure demand include the capacity, especially at municipal and provincial levels, for project preparation, tendering and execution; demand forecasting accuracy; and the difference between what has been budgeted for and what is actually spent on infrastructure. Factors in specific infrastructure sectors also impact on infrastructure demand, as discussed below.

Some R47 billion of the R290+ billion budget for 2011/12 will be spent on buildings by national departments, municipalities, provinces and other public entities. Factors impacting on demand include municipalities' capacity to improve their municipal infrastructure forecasting; the capability to carry out building projects at provincial and local government levels; the extent to which public-private partnerships (PPPs) absorb an increasing amount of the national budget for infrastructure; the extent to which these PPPs develop traction and are executed; and accelerated housing delivery reforms.

Some R18 billion is earmarked for expenditure on roads by provinces, which is nearly half the total budget for roads, while the South African National Roads Agency Limited (SANRAL) toll roads and non-toll roads make up the balance. The factors impacting on demand include whether what has

been budgeted for, particularly at provincial level, is actually spent. The extent to which the estimated R70/R80 billion of backlogs in road maintenance draw programmes and obtain financing will add to the demand for road infrastructure supply. Toll road processes appear to be stalled, which means that there will be a commensurate reduction in demand for inputs into roads. Regional road projects could also have an impact on demand.

Of the R26 billion allocated to water, about R8-9 billion is under the control of municipalities, with the water boards making up the balance. The factors impacting on demand include the accuracy of municipal-level expenditure data; the rate at which backlogs in regional bulk water and municipal sanitation infrastructure are addressed; and delays in the water boards' expenditure plans due to delays in municipal payments.





The Infrastructure Inputs Monitoring Project - continued

The R138 billion allocated to the energy sector includes, among other components, generation, transmission, distribution, municipal reticulation, refining, and the Transnet fuel pipeline. Energy regulation changes impact on independent power producer (IPP) processes and renewables - for example, building regulation changes will affect solar geysers. There is a R27 billion backlog in investment in the electricity distribution industry. The technology options associated with the National Integrated Resource Plan (NIRP) will also have an impact (e.g. pursuing nuclear versus coal energy). In the liquid fuels sector, investment and demand will be driven by decisions on clean fuel specifications.

There is a strong building and construction component in the private sector, including the services sector. Private gross domestic fixed investment (GDFI) spend is twice that of the public sector, with a commensurate impact on infrastructure input supply industries. Unblocking impediments to private sector investment is, therefore, possibly doubly as important as unblocking impediments to public sector investment. The main categories of infrastructure expenditure in the private sector are building and construction; machinery and equipment; and transport equipment.

The IIMP has gone into some detail in each of these supply-side sectors: steel, aluminium, cement, concrete products, bricks, timber, glass, plastic pipes, aggregates and sand, bitumen, capital equipment, skills, transport and logistics costs, energy requirements, and water requirements. The study tried to pinpoint which factors impede supply.

As regards steel, for instance, the dominance of a single supplier in primary steel production has led to an overdependence on, and periodic shortages in,

key steel products. It has also impeded a range of downstream industries because of import parity pricing. Electricity price increases have affected supply from suppliers that base their steel production on scrap metal in electrical arc furnaces. They are now competing for scrap, which is increasingly being exported because of the high international prices. Further issues are domestic demand recovery and growth; pricing and competition; capacity utilisation; steel pricing; and new investment in primary steel production.

Greening infrastructure issues will, therefore, involve costs, efficiency and regulation. Rising costs of energy will impact on energy-intensive supply sectors, such as steel, aluminium, cement, glass and bricks. There are energy efficiency and climate change issues at a macro level; for instance, whether South Africa should opt for coal or nuclear energy; which renewable generation technologies will be the most feasible and sustainable; and what the nature of tighter fuel specifications and building regulations will be.

The IIMP database, which belongs to the DBSA, covers sectors, infrastructure types, infrastructure inputs, projects, and a time dimension. It tracks the supply of and demand for infrastructure and is also cut along a spatial basis, allowing the user to pick out building projects and water projects on a geographic information system (GIS) basis. Various permutations are possible, for example: sector, infrastructure type and projects; specific infrastructure inputs; or capital expenditure per local authority.



Source : I23rf

The use of technology in the greening of infrastructure

Lessons from integrated infrastructure planning

Prof William Gumede, Senior Analyst, Policy Unit: Development Planning Division (DBSA)

Looking at countries where infrastructure has worked over the past 100 years, what are the kind of lessons that can be learnt? Most countries make the mistake of carrying out isolated projects and then thinking that they can be called “infrastructure”. One thing that all great economic transformation projects based on infrastructure have in common is that the infrastructure is at the heart of a long-term development strategy.

The second key factor involves how all of these projects are implemented and then integrated. The different policies need to be integrated, and all the initiatives joined in a single national plan. In South Africa, although the infrastructure side of the projects is receiving much attention, a long-term development plan has not yet been put together. In all other examples of this kind, this type of approach has failed.

A third key aspect is that in the examples of successful economic transformation over the past 100 years, the focus was on infrastructure development after the economic development plan had been drawn up, and jobs were created from these integrated development plans (IDPs). Instead of focusing on job creation, economic growth and which economic route to take, successful examples of macroeconomic transformation had infrastructure at the forefront. South Africa too should start there first, and economic growth will follow.

Obviously, a high level of coordination and planning is required, as well as a sophisticated skills set and technical capacity. Infrastructure delivery is capital intensive, has long lead and payback times, and is, therefore, financially risky. Infrastructure integration is necessary in order to benefit from economies of scale; to advance the overall security of infrastructure products and services; and to increase competitiveness.

A holistically integrated approach is required, bringing together policy, institutions, financial and social expectations, multiple and diverse stakeholders, and public-private partnerships (PPPs). During the 2010 Soccer World Cup, different municipalities, state departments and the private sector worked together successfully but the infrastructure project of the World Cup was not based on a long-term development strategy. Infrastructure should be delivered as a complete functioning “system”.

Integrated infrastructure delivery in South Africa faces many challenges, chief of which are the complicated institutional arrangements; the silo approaches of national departments; and inadequate planning, coordination and integration among the different levels of government. Infrastructure planning is not integrated into long-term economic development plans. There are severe policy and regulatory misalignments, as well as competition between hard and soft infrastructure development, instead of integration. Hard infrastructure rollouts are not sequenced with other system improvements.

Huge backlogs in infrastructure exist, but as there is limited public funding to overcome these backlogs, in the focus on overcoming them, players fail to plan for future needs and maintain existing stock. Pressure for delivery leads to hasty decisions on policy and implementation thereof, which in turn undermines the development impact. There is also a systemic lack of capacity across the public sectors.

The private sector is strong, but sector skills and finance are not optimally leveraged. Crowding-in and coordination of public-private players are inadequate. There is also insufficient stakeholder consultation and participation. Infrastructure projects are open to capture by opportunistic elements and



Lessons from integrated infrastructure planning - continued

to rent seeking. Often there is a lack of balance between infrastructure and its environmental impact.

Clearly, since 1994, South Africa's architecture, institutions and systems of integrated infrastructure delivery have been flawed. Plans are generally restricted to specific departmental mandates rather than fitting into a much broader national agenda and integrated long-term plan. A project may meet the development aims of one department, but does not get regulatory approval from another. Provincial growth and development strategies often do not have the technical capacity for actual implementation. In addition, the bulk of the infrastructure budget lies with national departments and state-owned enterprises (SOEs), yet there is little alignment between SOEs and national, provincial and local governments. IDPs at local level are focused on individual projects, rather than on pursuing joint objectives.

A number of countries have successful models of integrated infrastructure delivery systems, for example:

- Brazil has a permanent inter-ministerial working group overseeing the integration of activities, and the Brazilian Association of Infrastructure and Basic Industry oversees infrastructure development.
- Australia's National Infrastructure Council integrates infrastructure development between the three tiers of government. The statutory body, Infrastructure Australia, is the overarching governance and implementation entity. Infrastructure Partnerships Australia is that country's main infrastructure forum, and brings together the public and private sectors and communities.
- India has integrated infrastructure development centres across the country, serving as hubs that coordinate integration in areas where infrastructure will be rolled out. They are managed by state-owned development institutions.

It is clear that South Africa needs to link all its infrastructure projects into a single national grid, as local examples have shown that the approach taken thus far has not worked well. Key points concerning integrated infrastructure development can be made from our own lessons. We should:

- Integrate infrastructure development according to broader economic development measures. Synergistic effects between infrastructure development and broader economic development should be maximised to ensure the optimal impact of both.
- Integrate infrastructure development into a national development strategy, with infrastructure at the core of the strategy. Infrastructure development and broader national development across sectors should be integrated and coordinated, as well as the institutions overseeing these.
- Integrate and coordinate flexible PPPs for joint infrastructure and broader national development - development finance institutions (DFIs) are key in this respect. DFIs should be set at the centre of integrated infrastructure planning as integrators.
- Focus on a "one-stop shop for infrastructure", bringing together SOEs, DFIs, national and provincial departments, municipalities and the private sector in PPPs, with

variations such as public-SOE-private partnerships.

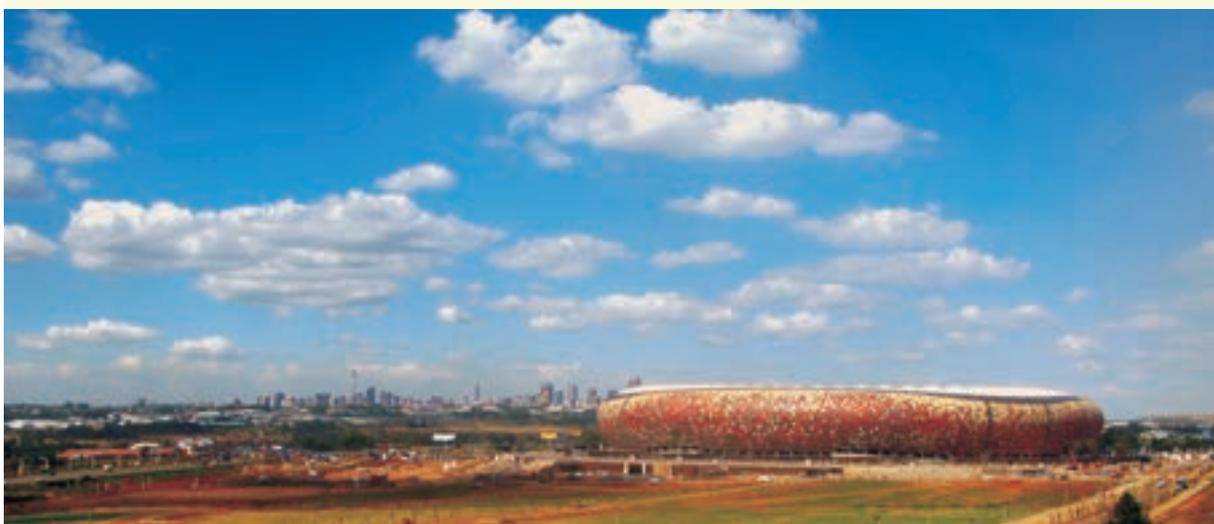
- Share risks between the public and private sectors, while leveraging private sector skills, finance, capacity and systems. The private sector is a pocket of excellence which many other developing countries do not have. Adequate state capacity is also essential.
- Ensure that the Infrastructure Commission set up by the President will be a key entity, and clarify and streamline relationships and roles in the infrastructure delivery system.
- Manage rent-seeking and corruption; align budgets; and synchronise planning.
- Manage stakeholders in the infrastructure chain better. For instance, local communities should participate more in infrastructure planning and delivery.

In most East Asian developmental states that set infrastructure at the core of their transformation projects, the Central Planning Unit is also a core part

of coordinating their long-term infrastructure plans. South Africa, however, does not have a central coordinating institution that oversees a national long-term development and infrastructure plan.

Ideally, we should start by bringing the public service up to scratch, making it an effective service to deliver. Then the private sector should be leveraged in, in a partnership, from a skills, financial and risk-sharing point of view. The infrastructure plans should be made the pillars of a long-term development plan that will drive job creation and growth. For each specific long-term infrastructure project, a special entity or vehicle should be set up that draws on national, provincial and local departments, municipalities and business. Once the project has been completed successfully, that entity will be closed and a new project started, for which a new vehicle will be created.

It is essential that the financing of infrastructure should be planned well, for example, by using DFIs, given the limited extent of public funding and the reduced likelihood of acquiring international funding due to the global economic crisis.



Source: MediaClubSA

FNB Stadium - Soweto



Greening infrastructure: At what cost?

Mr Andrew Donaldson, Deputy Director-General, National Treasury

In 2006, the National Treasury published the Draft Environmental Fiscal Reform Policy Paper, titled "A framework for considering market-based instruments to support environmental fiscal reform in South Africa", and in 2011, a discussion paper titled "Reducing greenhouse gas emissions: The carbon tax option". Both papers are very much focused on revenue issues

- The first paper deals with a range of environmental taxes or fiscal measures that are intended to affect the price associated with pollution or particular environmental externalities; to introduce these into a cost structure of an economy; and so to influence behaviour.
- The second paper deals with the very specific and large costs that the world has come to recognise as associated with greenhouse gas (GHG) emissions. It is clear that a serious carbon tax that fully tries to internalise the cost associated with GHG emissions is a very large tax.

The problem with intervening in costs when the infrastructure has already been built is that it does not change the infrastructure; it simply changes the cost structure. When the infrastructure has already been built and the economy is dependent on particular kinds of resource utilisation (e.g. a highly coal-based energy system, an industrial base and a mining base that is dependent on energy as a resource), behaviour can only be changed very gradually, and in some respects, not at all.

The planning and investment decisions that precede the tax structure of the economy are, in fact, much more important. There is a question mark to place around the reliance of tax-based interventions over a fairly longish medium term when an infrastructure base is already in place that

is not going to change soon. Long-term measures that focus on changing the structure of the economy will likely have to be much more broad based than simply taking the revenue side of public finances into account.

A range of measures, incentives or spending programmes have been developed and expanded over the last decade. The employment-focused environmental spending programmes constitute a large part of the Expanded Public Works Programme (EPWP). There are also interesting, smaller research and development, or scientific knowledge-focused programmes.

One such intervention is an incentive of the Department of Trade and Industry (DTI), administered through the Council for Scientific and Industrial Research (CSIR), which pays for the research and evaluation work of environmental engineers on behalf of factories. It does not finance the actual technology changes needed, the replacement of plants, or the modernisation of equipment. However, the fiscus pays for the analytical studies, as businesspeople are generally hesitant to spend money on this kind of investigative work. However, once they are advised about the implications and benefits of making certain engineering, production or technology changes, in many cases they go ahead and do so. It is, therefore, a specific targeted spending programme that affects industrial technology choice over time in a desirable way.

The support going to municipalities for their Electricity Demand Management (EDM) programmes is also important and Treasury intends to continue with such spending programmes over time. Indeed, the spending side of the fiscus interventions needs more attention and in many respects is more complex and intervenes in a wider range of ways than the revenue measures can.

A long-term focus is important. For example, a three-year budget programme is not enough where infrastructure change is involved. Planning coordination and coherency are critical. As an infrastructure financing institution, the DBSA can explore the possibility of financing arrangements that take the long term into account more effectively than an interest rate usually does. The problem with a market-related interest rate is that it is precisely the price that discounts the future. When taking the long-term implications into serious consideration, the discount rate has to be reduced.

There may be financing mechanisms that can be introduced into the financing of long-term infrastructure, which will increase the benefit or reduce the cost of spending, but which will also ensure that the infrastructure is sustainable and long-term environmental costs are taken into account. How to bring the cost of the future into the financing of infrastructure investments needs focused attention.

The very large backlogs in infrastructure demand that we face up to the financing side of the structure of an economy in which the savings rate is too low. With a savings rate of 15% people will not invest seriously in infrastructure and will rather make short-term investments. They will build housing estates and housing interventions that are as cheap as possible in order to accommodate as many people as they can. This, however, is not in the interest of the long-term development of an economy. It is critical to improve the performance of our savings and find the kinds of infrastructure investment that will contribute to this.

South Africa has had to respond, rather belatedly, to lags in energy investment. The Eskom and Transnet backlog requirements have dominated investment

choices in the last few years. The R60 to R70 billion being spent on Eskom's power station programmes is a very large share of public sector investment. There is concern that we do not believe enough in our demand management initiatives, also with regard to electricity usage. The longer-term electricity investment capacity being planned for in, for example, the Integrated Resource Plan (IRP), may exceed requirements.

It is vital to examine demand assumptions in such modelling, and to consider how the economy can become more energy efficient over time and how that involves energy investment requirements. If we continue for another 15 years to spend so much of our scarce savings resources on electricity investment alone, we will not succeed in making the improvements in quality and in achieving the long-term sustainability of investments in housing and construction that need to be made.

We also need to think through path dependence-sector by sector, context by context, and industry by industry. For example, cities that are already



Mr Andrew Donaldson
Deputy Director-General, National Treasury



Greening infrastructure: At what cost? - continued

established are much more constrained in what they can do in shaping the structure of investments and in making these more efficient than cities that are new, or still have considerable growth potential.

We should think through the design of fast-growing cities, particularly coastal cities, which have long-term trade potential and still have to make infrastructure investment in transport and housing. These cities have the potential to become more efficient than those cities that are already largely shaped.

We should, therefore, take advantage of lessons learnt from international experience and utilise more efficient planning opportunities in the faster-growing parts of the economy. Such cities, in particular, could be made more efficient in terms of energy, transport and housing. There are greater opportunities for taking advantage of these aspects in the faster-growing areas of the economy - in particular, those parts of the economy that have long-term trade opportunities.



Source: DBSA

Preserving wetlands is crucial for sustainability

Case study: Payment for ecosystem services - "Working for" programmes

Ms Duduzile Soginga, Acting Director: Natural Resource Management "Working for" Programmes (DEA)

Species generally produce sufficient offspring to ensure survival of the species, given the prevailing threats and competition in their natural habitats. They are usually replaced by their offspring. However, when moved to new habitats, they may both escape their predators and out-compete the indigenous species. This leads to an invasion where each species may produce massive numbers of offspring, which themselves reproduce.

South Africa itself has fallen victim to invasive alien plants from various countries. Currently, 246 species in South Africa are listed as invasive alien plants. These plants are known to overtake the indigenous landscape when they acclimatise and then produce offspring. Because they do not participate in that habitat's ecosystem, they may soon overtake whatever is growing indigenously and naturally in that habitat. In the process the natural resources, such as land, water and ecosystems, are degraded.

The late Professor Kader Asmal, the then Minister of Water Affairs and Forestry, took note of the problem of invasive alien plants in the riparian zones that he was managing, which were extracting the water that should have gone to the reserves. He launched the Working for Water (WfW) programme, of which Dr Nelson Mandela was the chief patron. The support of more political leaders was obtained, and more "Working for" programmes followed - for wetlands, energy, land care, fire prevention, and value-added industries.

These programmes and their implementation subscribe to the legislation of the country. Section 24 of the Bill of Rights in the Constitution states: "Everyone has the right to an environment that is not harmful to their health or wellbeing; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that (i) prevent

pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and the use of natural resources while promoting both justifiable economic and social development."

The legislative framework also includes the National Environmental Management Biodiversity Act (No. 10 of 2004), of which sections 68-77 are relevant. Section 74, for instance, allows competent authorities to issue directives to non-cooperative landowners; sections 75 and 76 deal with the control and eradication of listed invasive species; and section 77 requires status reports on listed invasive species in an area. Sections 15 and 16 of the Conservation of Agricultural Resources Act (No. 43 of 1983, as amended in March 2001) categorise the methods of controlling the existence of invasive alien species.

The percentage coverage of invasive alien plants in the Southern African region is as follows: Gauteng 51%, Swaziland 39%, Lesotho 22%, KwaZulu-Natal 20%, Mpumalanga 20%, Eastern Cape 16%, Western Cape 9%, Limpopo 8%, Free State 8%, North-West 5% and Northern Cape 1%. The time period taken to control these infestations is projected at between 18 years (Western Cape) and 123 years (Free State).

Although it is possible to calculate the amount of biomass (in cubic metres) that will be available from eradicating invasive alien plants, the massive impacts of these plants on soil erosion, siltation and mudslides have yet to be quantified. The carrying capacity of large stock units could decrease by 71% if such plants are allowed to spread to their full potential.

The objective of the "Working for" programmes is to improve the integrity of South Africa's natural resources. The decision was made to link this



Case study : Payment for ecosystem services - "Working for" programmes - continued



Source: I23rf

Greening the environment

objective to job creation in order to improve the livelihoods of beneficiaries. Invasive alien plants are to be managed in order to enhance the sustainable use and conservation of the country's natural resources, and to promote socioeconomic development as part of the government's Expanded Public Works Programme (EPWP). The envisaged result is a long-term, widespread improvement in society - a country in which invasive alien plants are managed effectively, and labour-intensive and socioeconomic empowerment opportunities are optimised.

Invasive alien plants are cleared in terrestrial areas, riparian zones, water bodies, and conservation and protected areas. Some alien plants actually exacerbate wildfires, which have such a devastating impact, especially on livestock and wildlife. Encroaching plant species also degrade the land. Improved integrity of natural resources will help

to eliminate threats to food security and socioeconomic development, and services will be delivered more easily. For example, a road built over non-rehabilitated land costs five times more. The Land Care Programme therefore aims at clearing bush-encroaching plant species; reclaiming dongas; replanting grasses for land restoration; and fencing degraded grazing land.

The Natural Resource Management (NRM) programmes are a part of the EPWP, which addresses developmental needs in labour-intensive ways. Unemployed people are identified, trained on the ground, and taught skills that will be sustainable. They are also shown that the environment can be a source of livelihood for them.

The NRM programmes, including the Invasive Alien Species programme in KwaZulu-Natal, are a source of work for almost 40 000 previously unemployed people. The programmes focus on providing

opportunities for the most marginalised people, including women, the youth (aged 18-35 years) and the disabled. They are shown the tricks of the trade and easier methods of doing the job, and are supplied with the equipment and materials needed to do the work properly. Peer educators who are trained to share information assist with the workers' social development, focusing on wellness issues; HIV and Aids; sexual and reproductive health; childcare for their children; substance abuse; financial management; and other efforts to empower them.

In 2010/11, the total budget for WfW was just under R734 million and 28 772 people were employed. Of these, 99% were previously disadvantaged individuals (women 54%, youth 53% and disabled persons 3%). The planned budget for 2011/12 is approximately R966 million.

WfW has formed partnerships with various institutions, such as the South African Nursery Association (SANA). We approached SANA to find out how we should teach people that invasive alien plants are not to be sold or allowed to live.

The brochures of the Plant Me Instead campaign show people what indigenous species they should plant to replace invasive species in their yards. The annual Weedbuster Week sends out a similar message in the media. Our Education Unit has embarked on a partnership with the Department of Education to include the identification of invasive alien plants in the primary education curricula, so that children can be taught to save the environment in a sustainable way.

We are also endeavouring to include the "Working for" programmes in the municipal integrated development plans, so that even though municipalities may not have the finance to budget for the removal of alien species, they should be aware of such problems within their areas and then in future they may request funding. There are also policies that aim to partner with private land owners.

Our aim is to remind people that their livelihood matters in the ecosystem services market. Their livelihood should not only depend on social grants. People should go back to the environment and make a living from it.



Source: "Working for" Programmes (DEA)

A team of Working for Water workers



The DBSA and greening infrastructure finance

Ms Chantal Naidoo, Divisional Executive: Environmental Finance Unit (DBSA)

As a development bank, the role of the DBSA, in addition to its financing function, is to build capacity and to serve as a change agent, based on the evidence gained from its projects – information which it shares freely with both its private and public stakeholders. Its investment mandate is largely derived from the current infrastructure targets of almost R870 billion.

A constraint the DBSA is experiencing, however, is that the operational lifetimes of the infrastructure to be rolled out in fact match the period when climate scientists predict rather severe impacts in terms of temperature increases and higher incidences of floods and land degradation. It is, therefore, also important to remember that the cost of greening or climate proofing the infrastructure is likely to be quite substantial. Often it may require an additional cost of 5-25% of the total spend in order to green the infrastructure. Nevertheless, the costs of inaction are possibly higher in terms of value for money, infrastructure losses, higher transaction replacement costs, and an overall diminishing quality of life.

From the perspective of a development finance institution (DFI), certain technology choices need to be made before a particular investment is funded. Institutional, technical and implementation capacities also have to be taken into consideration. Under less chaotic and urgent circumstances, there would have been ample time to conduct research and development, and analyse what needs to be done. At present, however, it is important to identify those technology transfer agreements that can be secured now, and find a way of localising them immediately in order to deliver the industrialisation and job creation benefits.

As a middle-income country, South Africa's key driver is obviously job creation. Investment decisions

would be much simpler if the diffusion of technologies related to the mitigation of greenhouse gas emissions could be linked directly to the country's economic and social realities. Stakeholders are approaching this from different angles. For instance, the government would expect that, when procurement programmes and policies are considered, the following questions will be asked:

- Is the infrastructure being built to last?
- Does it take into account the climate risk projections?
- How will this pan out?

The private sector, again, will be inspired in terms of a healthy commercialisation drive and economic growth drive, which will be created by the evidence of sustainable transaction volumes and other advantages. For example, the DBSA is deliberating with Eskom about the benefits of industrialising solar water heating. What has transpired from many such engagements is that there needs to be a line of sight for demand of at least four or five years. It should also be clear whether targets are regional or national, and whether, for instance, all households will eventually be retrofitted.

The DBSA is currently getting its own house in order. The Bank's environmental appraisal processes are being updated, and climate risk is being built into them as a key factor. The DBSA is also looking at a carbon footprint tool for measuring the impact of its projects and investigating what can be done up front in terms of their design in order to reduce that impact, even in the absence of legislation.

Greening guidelines for some of the sectors will be a further focus. The Renewable Energy Independent Power Producer (IPP) Procurement Programme is an interesting example of how the DBSA has worked with the Department of Energy and the National Treasury

in attempting to unblock some of the policy, regulatory and legal frameworks. In certain cases, there were no frameworks, and the DBSA assisted in drafting some.

Another engagement has been with the Department of Environmental Affairs (DEA). Typically, investments are made on a project-by-project basis. However, such an approach gives neither scale nor lessons for replication. So, using experts and a wide stakeholder group, the DBSA worked with the DEA on nine green economy programmes with a view to identifying key priority issues and projects for a more programmatic approach. Institutional and regulatory issues were considered, as well as project development and commercial funding. Even in the event of commercial funding, there is a need to increase lending capacity; to extend the loan profiles in some instances; and generally to give a better sense of relief to those projects.

Although there is fiscal support and commitment, there are limitations in terms of how to optimise fiscal funding to catalyse and drive investment. The roles of both a DFI and the private sector should be clear. There are different stages of risk across

the lifecycle of a project and different levels of absorption. Similarly, different people are best placed to play along that continuum. The DBSA is looking for such smart financing partnerships, both internationally and locally with the private sector, so that these projects can be co-financed in a way that makes them sustainable and provides relief to the project developer. Of course, the approach needs to be financially sustainable, as well as deliver the environmental benefits that will set it apart from business as usual.

The proliferation of activity in the country is positive, yet it requires coordination for things to fit together. A global Green Climate Fund, to be proposed at COP-17, may also provide the extra support needed. As a middle-income country, South Africa cannot rely exclusively on international support to drive its green agenda and climate interventions. However, such a fund certainly is a very important element of the financing mix, and we should prepare ourselves to receive such funding, possibly in four or five years' time. It is important to start now and identify opportunities to do so.



Source: Guy Stubbs

Rail infrastructure



Sectoral perspective on transport and logistics

Chairperson: Ms Laverne Dimitrov, Transport Specialist (DBSA)

Sustainable transport and logistics: Considerations and opportunities for infrastructure investment programmes

Ms Sue Lund, General Manager: Public Policy and Sustainability, Transnet Ltd

Transnet is developing a sustainability framework around the economic, social and environmental value added to projects. Investment into rail systems, ports and pipelines has increased significantly, which presents a great opportunity but also many challenges. South Africa's port, rail and pipeline infrastructure is vital to the country's imports and exports, of which 97% pass through its commercial ports. Without infrastructure investment, this sector would be a serious constraint to growth.

In 1988, the De Villiers Report on the South African Transport Services recommended that the transport market be regulated as far as possible, and that the government should no longer use taxpayers' money to invest in such infrastructure. Transnet Ltd was created out of the relevant state departments in 1990, as a standalone company wholly owned by the government but run along private company principles. There was also a huge drop in investment during that time.

The annual average capital investment in Transnet's infrastructure from 1995/96 to 2004/05 was R2.7 billion, which represents a very low level of infrastructure investment. The turnaround strategy commenced in 2004/05, at a stage when commodities were taking off; the demand for commodity exports was enormous; and economic growth was picking up. However, by then the average age of the locomotive fleet was 30+ years, whereas the international average is 15 years. Transnet also had a reduced rolling stock fleet; a suboptimal maintenance regime; old or outdated equipment; and inadequate capacity at ports and terminals to handle the growing volumes.

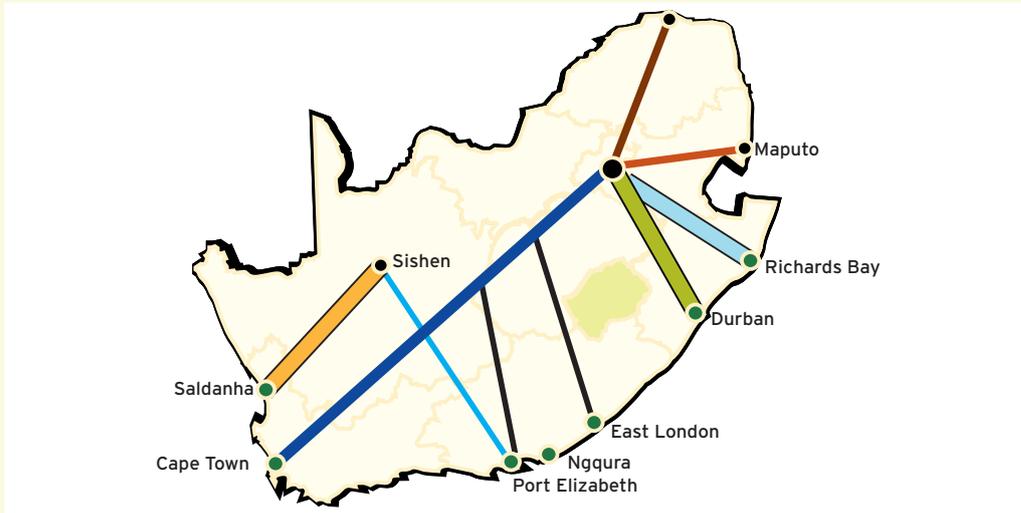
Between 2007 and 2011, the total capital investment was R86.8 billion, funded without government guarantees on the strength of Transnet's financial

position. Of this amount, pipelines received 28.2%, ports 13.5%, and rail and other 58.3%. The current five-year capital investment programme for 2011/12 to 2015/16 has been increased to R110.6 billion, of which around R20 billion per annum will go towards freight infrastructure. An important split has also been made between maintenance investment, also called sustaining capital (about 63%), and expansion investment, or expansion capital (about 37%).

Transnet's major capital investment projects include expanding the iron ore line to move 60 million tons per annum; acquiring state-of-the-art locomotives; building a new multiproduct pipeline to move liquid fuels from the coast to Gauteng; extending the coal line; deepening the Durban container terminal and widening the Durban entrance channel; completing the Ngjura container terminal in the Eastern Cape; expanding the Cape Town container terminal; acquiring the old Durban Airport site to build a new container port; reconstructing the quay walls at the Maydon Wharf terminal in the Port of Durban; and increasing the capacity at Salisbury Island.

All South Africa's commodities have been categorised into 65 commodity groups across the country, and Transnet is able to forecast to where these commodities will need to be moved. This demand forecasting has highlighted the need to invest in a complementary network of rails, ports and pipelines that can support the flow of cargo through these corridors. The Durban/Gauteng corridor has the heaviest traffic flows for general freight.

The motto, "targeting sustainability in all we do", underlines Transnet's commitment to delivering lasting economic, social and environmental value for the present and future generations. A major



Transnet's infrastructure plan for building freight system density along corridors

Source : Transnet Ltd

priority is to get more (rail-friendly) cargo off the road and onto rail, and progress is being made in this regard. Other key concerns are energy efficiency; the protection of biodiversity; safety; and stakeholder engagement. In July 2011, Transnet published its first integrated Annual Report and Sustainable Development Report, in line with the King III Report and the Global Reporting Initiative.

Another important focus of Transnet's capital investments is the development of the local supplier industry. For instance, when new locomotives are purchased, the contracts entered into aim at supporting the local industry and local skills development and job creation. Transnet has

currently contracted just over R11 billion in purchases for its locomotive acquisition programme and has managed to secure 41% of that value as local content. The overseas suppliers will largely supply knockdown parts, which will be assembled locally.

Transnet is also considering opportunities for using the electrical power that is gained from (newer) locomotives' regenerative braking. Regenerative power is fed back into the overhead track equipment and can be used by other trains in the section. The potential savings in electricity are currently being investigated.



Source: DBSA

A Class 19E (25 kV) locomotive and a Class 15E (50 kV) locomotive



Sectoral perspective on transport and logistics

Sustainable transport and logistics: Considerations and opportunities for infrastructure investment programmes - continued

All Transnet's capital projects go through the typical life cycles of project planning; early preliminary feasibility development; feasibility engineering; implementation; and then operations and closure. The same is done with the environmental side of each project, using environmental planning tools and management tools. During each phase leading up to construction, the risks and costs involved become all the more clearer. There is also detailed ongoing stakeholder engagement at a local level, particularly on the impact of the project.

The development of ports and port expansions present huge challenges, as ecosystems will obviously be disrupted. Using Environmental Resource Economics studies on ecosystem services, Transnet tries to assess the environmental cost of the impact, or loss, of the ecosystem service due to the planned development. Local communities which use the ecology of the area are interviewed, and the biodiversity in the area is studied. The value of the discounted net benefits of each development option is determined. Transnet then attempts to offset the loss through implementing mitigation measures or biodiversity initiatives, or by reproducing ecosystems at alternative sites.

The new multi-products pipeline of R23 billion is a case in point. One of the terminal areas involved constructing the pipeline through a wetland. The environmental authorisation required that Transnet implement a biodiversity offset programme. The different challenges included the fate of an endangered giant bullfrog species that migrates across the wetlands. As the wetlands dry up, the frogs actually make channels for the tadpoles to get through to wetter areas.

The proposed pipeline would cross through the frogs' activity for their migratory cycles. The solution was a rather complex arrangement whereby an offset area

was set up in a conservation area of the Lesedi Spatial Development Framework. Channels were built across the construction site for the frogs to use, as well as a kilometre-long screen preventing them from entering the actual construction site. The fence was closely monitored daily to relocate those frogs that overcame the obstacle. The frogs literally had to be carried and helped through the channels to ensure that their migratory patterns could continue unharmed. Once the pipe was under the ground the area was refilled. From the start, bog mats had been placed over the wetland to protect it and measures had been taken to protect the topsoil for reuse. The wetland could therefore be restored successfully.

Innovative solutions for sustainability were also applied at Berth 208 in the Port of Richards Bay, situated next to the eChwebeni Natural Heritage site, one of few areas in the country where white, black and red mangroves coexist. The wave motion created by the tugs bringing large vessels into the port for berthing added to the problem of shoreline erosion, and also damaged the mangrove farms. Transnet built a breakwater system of 46 floating pontoons, each weighing about 63 tons, to calm the sea so that the waves do not wash up onto the mangrove farms. The project cost R50 million. Yet another success story is the Urban Raptor Project's solution to the rodent problem at the Port of Ngqura. The following lessons can be learnt from challenges such as these:

- Upfront environmental risk assessment is essential.
- The project must budget for environmentally friendly solutions.
- The best solution is not always the cheapest, and must go beyond compliance.
- Best practice is integral to project management and each phase of the project life cycle.

Case Study 1: Transport greening - non-motorised transport

Mr Kobus Labuschagne, Research Group Leader: Intelligent Systems and Traffic Management, Built Environment Unit (CSIR)

Sustainable or green transport can be defined as any means of transport that has a low impact on the environment, such as walking, cycling, transit-oriented development, green vehicles, car sharing, as well as urban transport systems that are fuel efficient, save space and promote healthy lifestyles. Non-motorised transport (NMT), especially walking and cycling, is supportive of green mobility. In South Africa, however, pedestrian facilities were historically neither explicitly budgeted nor planned for in road construction projects. There are, therefore, very limited facilities for pedestrians or cyclists at present.

The road infrastructure in South Africa focuses mainly on car travel, with roads and freeways being built for vehicles only. This has contributed to inhibiting people from taking up cycling as a transport mode. The country's urban spaces have also been designed for cars rather than NMT. Retrofitting will constitute a huge challenge, and a paradigm shift is required in designing urban spaces and land use. NMT has several perceived benefits. It:

- reduces congestion;
- reduces gas emissions and pollution;
- promotes a healthy lifestyle;
- promotes alternative modes of transport, such as electric bikes;
- serves as a feeder system to public transport - we have missed a huge opportunity with the Gautrain and Bus Rapid Transit systems, where NMT could have provided the mode feeding the mainline transport systems.

Both rural and urban deprived communities struggle with access to facilities and economic mainstreaming. NMT, however, is very cost effective and green mobilisation is suitable for all walks of life.

Animal-drawn transport and cycling can support entrepreneurship in communities, for instance, when used to transport and sell commodities. The lack of NMT infrastructure leads to a number of social costs, such as high levels of road injury and death among pedestrians and cyclists, with very negative consequences for the dependants of victims; and pressure on the resources associated with policing and treating victims.

There are a number of NMT initiatives in the country, for example in Cape Town, Durban, Polokwane and Johannesburg, but at a very low scale. The Department of Environmental Affairs is evaluating the pre-feasibility study of a German-funded programme to finance NMT projects in South Africa. The Department of Transport's Shova Kalula project has been providing bicycles to scholars, and schools are generally encouraged to take custodianship of these sponsorship programmes.

According to the 2003 National Household Travel Survey (NHTS) of the Department of Transport, 2 259 million people (23% of the workforce) indicated that they walked to their places of work, and some 90.6% of the 7.5 million learners in rural schools walked to their schools and educational centres. However, the major increase in vehicular traffic over the last decade has made it more difficult for NMT users to share road space with regular traffic.

Between 2005 and 2009, 26 984 pedestrians were killed on South African roads. However, this is believed to be a gross underestimation due to underreporting. These fatalities occur on all levels of the transport network, from major freeways to rural roads. The contributing factors are poor human behaviour (e.g. carelessness or alcohol abuse); inefficient law enforcement (e.g. of those pedestrians



Case Study 1: Transport greening - non-motorised transport - continued



Source: CSIR

An assortment of e-bikes with rechargeable batteries¹

who cross freeways); a lack of infrastructure generally; a lack of integrated transport and land-use planning; and a lack of planning for NMT.

There are pedestrians and cyclists in cities, on town fringes and along rural roads. One aspect of NMT is the mobility of people in wheelchairs, ageing people and even sight-impaired people. It is debatable whether an electric wheelchair or electric bicycle still fits the definition of NMT; nevertheless, a serious paradigm shift in thinking in this regard is required.

An electric bicycle, or e-bike, is powered by an electric motor that aids the pedallist, especially in hot or humid environments. Pedalling is not necessary on flat, downhill or gentle uphill slopes. E-bikes can be used effectively for errands and

trips here not much storage space is required, and are ideal for trips to work. After about 20 km the battery runs low and has to be recharged. There are also pedi-cabs (a cab for two drawn by a pedallist) and custom-built bicycles, such as pedi-bikes. Goods and passengers may also be conveyed by means of animal-drawn transport, push carts, trolleys, wheelbarrows and prams.

Pedestrians and cyclists are very vulnerable in road traffic. The most effective measures to protect pedestrians include providing:

- walkways and cycle tracks;
- grade separation, such as footbridges and subways, to separate pedestrians and vehicular traffic;
- specialised infrastructure for people

¹ Source: Free downloadable image from Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported licence.

with disabilities and other specialised NMT users, such as electric wheelchairs, e-bikes and Segway personal transporters (a two-wheeled, self-balancing transportation machine);

- public transport facilities, such as bus and taxi bays, combined with walkways to keep pedestrians off the roadways;
- pedestrian barriers on high-speed roads, as well as median refuges on wide roads to allow pedestrians to negotiate one carriageway at a time;
- traffic calming measures, such as raised platform-type pedestrian crossings, speed humps and mini traffic circles aimed at reducing speed;
- speed law enforcement cameras in areas with high pedestrian activities;
- street lighting to make pedestrians more visible.

The main reason for providing NMT infrastructure is that it is an opportunity to reduce the accident rate. The road safety targets for 2014, set by the Accelerated and Shared Growth Initiative for South Africa (AsgiSA) and the Millennium Goals for the transport sector in South Africa, will not be met otherwise. Some 40-50% of road fatalities involve pedestrians.

There is also a major need for NMT infrastructure in previously disadvantaged townships and areas. Construction programmes in communities to provide this in terms of the Expanded Public Works Programme (EPWP) should be initiated, using labour-based methods to create sidewalks and cycle lanes, and to do maintenance. Such a programme would up-skill unskilled labour, create jobs, generate income, and reduce dependence on government subsidies.

To summarise, NMT provides various opportunities for the greening of transport by promoting walking and cycling instead of relying on vehicular transport, thus reducing pollution and noise. Whole areas would need to be redeveloped completely to enable the use of NMT, which will also serve as a feeder system to public transport. A major need exists to provide adequate and appropriate NMT infrastructure from both a road safety and a traffic operations perspective. In Europe, for instance, commuters are able to put their bicycles on the equivalent of the Gautrain or a Gautrain bus. We need to provide at least storage facilities for NMT at such terminals. NMT facilities are ideal for labour-based construction, and thus offer a huge opportunity to work towards poverty alleviation.



Source: CSIR

A pedi-cab, a pedi-bike, and a Segway PT



Case Study 2: The City of Johannesburg

Mr Norman Qobolo, Deputy-Director: Transportation Department (CoJ)

The City of Johannesburg (CoJ) consists of seven regions, with a population of more than four million people. Transport is responsible for 31.1% of the city's carbon emissions, just after industry and commerce at 36.1%, and followed by households at 30.6%. The city's transport vision is to have a safe, efficient transportation system with a focus on public transport, which supports a world-class city by connecting businesses, people and places in a sustainable, cost-effective manner and, through this, to improve the standard of living and quality of life of the city's inhabitants, as well as the overall competitiveness and growth of its economy.

The CoJ's public transport system consists of public passenger transport, minibuses, taxis, maxi taxis, buses, the Gautrain, Metrorail trains, and non-motorised transport (NMT) in the form of cyclists and pedestrians. Commercial goods and freight are transported by rail and truck for bulk transfers (heavy commercial) and for small parcels and mail (light commercial). For all of these, the CoJ has specialists in its transport department, including a specialist focusing on NMT.

The CoJ's Integrated Transport Plan has in view affordability, convenience, safety, comfort and choice. All these principles are included in, for instance, the Bus Rapid Transit (BRT) system. Before drafting the CoJ's recent Growth and Development Strategy (GDS), each department met with various stakeholders within the communities for a week to pinpoint what people believe the city's vision should be for 2014. The outputs were as follows:

- *Output 1:* Sustainable and integrated delivery of water, sanitation, energy and waste
- *Output 2:* Eco-mobility

- *Output 3:* Sustainable human settlements
- *Output 4:* Climate change, resilience and environmental protection.

The second output, eco-mobility, formed the core of the GDS during the deliberations. Outcome 2 of this output makes it clear that the CoJ has to provide "a resilient, liveable, sustainable urban environment underpinned by infrastructure supportive of a low carbon economy". The goal of a low carbon economy is, therefore, imbedded in whichever means and initiatives the CoJ chooses to pursue in future.

In Programme 1 of Outcome 2 the priorities are to roll out the Rea Vaya BRT; to encourage NMT (walking and cycling); to manage travel demand; and to look at the implications of integrated and transformed mass transit systems. Programme 2 focuses on freight and logistics management; the implementation of "complete streets" that allow for sidewalks, NMT and stormwater harvesting; congestion management; the construction, upgrading and maintenance of transport infrastructure; intelligent transport systems; and road safety. Some of the lessons from the transport GDS are that the CoJ should:

- Not just choose one form of green transport initiative, but consider a "green fleet programme" across the city that can relate to industry players in an organised way.
- Take an integrated approach to green transport initiatives to enable coordination with the Department of Minerals and Energy's regulatory framework; the Department of Trade and Industry's industrialisation programme; coordination of grants and debt funding; the National Climate Change Committee of the

Department of Environmental Affairs; economic, enterprise and skills development; business and professional associations; labour; the bicycle promotion programme; and people with disabilities.

- Focus on a multipronged approach to green fuels, which should seek to balance different sources of green fuels and transport optimally, for example bio-ethanol and biodiesel for freight and heavy vehicles; biogas for minibuses and the CoJ's fleet; electricity for maxi taxis; and solar power for traffic and street lighting. Other fuels include liquefied petroleum gas, compressed natural gas and liquefied natural gas.

The CoJ has several such initiatives in view, for example, the establishment of local bus manufacture, starting with a fleet of about 134 BRT buses and 25 metro buses; the KfW Banking Group project to establish cycle lanes in Orlando; sidewalks in Ivory park and Diepsloot to encourage walking; solar-powered traffic lights and street lights; the possibility of erecting 1 400 solar-operated bus shelters; the

use of city waste to generate biogas for the city fleet; minibus taxi conversions from petrol to biogas; and the manufacture of 25 bio-ethanol buses. There are a number of important considerations for using green fuels:

- Security of fuel supply, with multiple supply points and the possibility of an additional back-up of pipeline gas supply;
- Reliability, efficiency and performance;
- Excellent economics for vehicle owners;
- Lower-cost fuel for public transport, which has a positive impact on subsidies and ticket prices and improves service levels;
- Excellent economics for the fuel producer with limited government subsidies;
- Significant reduction in congested traffic pollution, with a dramatic reduction in the more toxic pollutants, such as nitrogen oxides, and the associated illnesses;
- Greenhouse gas emissions - compressed natural gas from renewable sources reduces these emissions by about 85%.

The Rea Vaya BRT system is a safe, efficient transport system and is the largest public transport project



Source: City of Johannesburg (CoJ)

Rea Vaya buses



Case Study 2: The City of Johannesburg - continued

undertaken by the CoJ. The plan is to roll out 122 km of mainline BRT corridors served by 805 buses (there are currently 143 buses in Phase 1A), 434 000 passengers a day (70 000 at present), 150 stations (27 at present) and 250 km formal feeder routes, thus enabling access to 80% of the city's residents. Rea Vaya has the following key interrelated components:

- Dedicated lanes (trunk routes) on significant sections of the network
- Clean, high-quality buses with high floors
- Automatic fare collection
- Private ownership of buses by public transport operators affected by introduction of the BRT system
- A fee paid by the CoJ for a determined number of kilometres.

Phase 1A established the main trunk route, plus complementary routes that go deep into Soweto, as well as an inner circle or city route that increases

mobility between the Johannesburg central business district (CBD), Braamfontein and Parktown. The current route for Phase 1A starts at Thokoza Park in Soweto and ends at Ellis Park. The feeder system extends into the deeper end of the corridor to collect people and bring them into the trunk route. This is called the CBD distribution service.

The system is a 100% taxi-owned service through the bus operating company, Pio Trans. The 322 shareholders were previously taxi owners, and acquired 585 issued shares at R54 000 per share. The 200+ drivers were all previously taxi drivers. Ticket prices vary between R9.50 and R3.50, and more than 900 trips are made per day.

Phase 1B is expected to be completed by the third quarter of 2011 and will extend the current trunk route from Thokoza Park, along the Auckland Park corridor, up to Parktown and then into the CBD. Phase 1C will extend the services along Louis Botha to Alexandria, and then on to Sandton.



Source: MediaclubSouthAfrica

The city centre's financial district



Source: Chris Kirchhoff - MediaclubsSouthAfrica

Integral part of Johannesburg's infrastructure - public transport



Sectoral perspective on buildings

Chairperson: Dr Rodney Milford, Programme Manager (CIDB)

Green buildings: Key considerations and opportunities for the government's infrastructure programmes

Dr Jeremy Gibberd, Architect: Built Environment (CSIR)

When looking at greening infrastructure, South Africans need to be responsive, while taking local opportunities, needs and existing situations into consideration. As the country's resources are limited, we need to understand and build on experiences with existing and past projects. The context within which we work is important.

Most of Africa lies below 0.5 on the Human Development Index (HDI), and very few other countries in the world have similar low ratings in terms of their socioeconomic aspects, such as education, health, and quality of life. A useful definition is found in the Worldwide Fund for Nature's 2006 Living Planet Report, where sustainability is set above 0.8 on the HDI and below 1.9 in terms of ecological footprint. According to this definition, many African countries have a very low HDI, but also a low ecological footprint. Canada, for instance, has both a high HDI and a high ecological footprint. Cuba would be defined as a sustainable country, with South and Central America also coming close.

The development trajectory is, therefore, very clear - South Africa needs to aim for improved human development, but also a reduced ecological footprint. The country's Medium-Term Strategic Framework (MTSF) is also comprehensive. Its strategic priorities set clear goals that tie in well with the definition of sustainability and sustainable development and address the Millennium Development Goals (MDGs). These goals have been translated into building performance indicators, with well-defined systems for measuring buildings' performance in terms of environmental criteria, such as:

- Energy- greenhouse gas (GHG) emissions and lighting power densities
- Water - potable water consumption
- Indoor environmental quality - ventilation rates, electric lighting levels, individual

comfort control, and percentage daylight factor

- Land - percentage topsoil retained and reused
- Materials - percentage recycled content
- Transport - distance and frequency of public transport.

The conventional definition of sustainable development, therefore, needs to be broadened to include a set of indicators for determining the ecological footprint. The HDI criteria can be linked to building criteria, so that even the design and operations of buildings can support human development, for example:

- *Food*: production; percentage sourced locally; distance to consumption
- *Shelter*: utilisation; materials; energy consumption
- *Mobility*: distance to public transport facilities; pedestrian facilities for walking and cycling; train travel; air travel
- *Goods*: amount of waste produced; percentage of waste recycled; amount and energy content of consumables
- *Services*: local provision and diversity of entertainment and leisure; insurance
- *Long, healthy life*: health facilities; shared access; type, availability and affordability of healthy food
- *Knowledge*: educational facilities; shared access; training facilities; percentage of working hours available for education; availability of building user manuals

-
- *Decent standard of living:* construction labour intensity; operational labour intensity; number of small enterprises supported; gender parity; environmental access.

Many of these aspects have been captured in the Sustainable Building Assessment Tool (SBAT), which has been used on a range of projects, such as the 2010 Soccer World Cup stadia and a number of fairly large industrial projects. A much broader set of sustainable development criteria was developed from this tool for the Gauteng Department of Agriculture and Rural Development, to be used for any built environment projects requiring environmental impact assessments (EIAs). These sustainable development criteria required a holistic approach in terms of existing policies, but also translated these into very quantified, defined tools where the graphical display and analysis tool (GDAT) can be used to assess proposed developments at a very detailed level.

The sustainable development criteria are set out under the following headings: land use and integrated development; biodiversity; agriculture and landscaping; water, sewage and stormwater runoff; materials and construction; energy, mechanical and electrical systems; waste and pollution; local economic development; transport and routes; health and wellbeing; education and ongoing learning; housing; inclusion and social cohesion; management and monitoring.

These criteria allow clear sustainable development objectives to be set. Pertinent questions can be posed to open up the debate around development and hopefully broaden the way in which development is done in order to make it more innovative. Data has to be provided specifically in terms of the set measures, and the proposed development is then

modelled or predicted on that basis. For instance, what quantified improvement will occur from the proposed development? Will the development achieve specific targets for a better social impact, environmental impact and economic impact?

Green building development policy, bylaws and incentive schemes will have a number of mandatory standards to be achieved in any new or retrofitted building. There will also be a set of promoted standards which, if met, will make the development eligible for incentives, such as fast-track applications. As the market becomes used to stricter requirements, many promoted standards can be made mandatory, and new promoted standards be introduced. The criteria are usually simple cost-effective measures, such as water-efficient fittings and maximum lighting power density, which are straightforward, easy to achieve, and easy to assess and approve.

The design guidelines for energy efficiency developed for the City of Johannesburg move away from the idea that all buildings have to be heated and cooled, and provide a broad rule of thumb for passive buildings - how buildings can be designed that require very little energy to heat and cool, or very little artificial lighting. The guidelines were developed around simple buildings and strategies to make them more energy efficient.

The Council for Scientific and Industrial Research (CSIR) is currently running a programme that designs and assesses clinics in Lesotho by means of very sophisticated tools. For instance, buildings can be modelled in terms of their ventilation, using a computation of fluid dynamics. Natural systems can be understood much better with these very complex tools, but they are extremely expensive to use. It is, therefore, beneficial to model a range of scenarios that would apply to a specific type of building, and then to translate the process for use



Sectoral perspective on buildings

Green buildings: Key considerations and opportunities for the government's infrastructure programmes

- continued

in other kinds of buildings. A fairly prescriptive set of measures can then be defined, which the buildings need to achieve.

Another project of the CSIR was the construction of nine Thuba Makote pilot schools, which would also be used as centres for community development. Several green aspects were included, such as water tanks, food gardens and earth construction. Some of the capacity built with the project has been sustained. For example, the contractors who built the schools with earth blocks have used their skills to transform the village by constructing very low cost, good quality buildings. These kinds of buildings do not have to cost more, although they may take somewhat longer to build.

These projects revealed two key elements for success. First, a great deal of thinking is involved in the interaction with different stakeholders, and then in planning. Second, a parallel process is needed. On the one hand, a great deal of effort goes into designing the buildings and sourcing local materials and local contractors. On the other hand, much effort goes into the management and maintenance of those buildings, so that they eventually are used in the way they were designed. For instance, the gardens, learning resource centres, workshops, etc. should be sustainable structures related to school-governing bodies that maintain the buildings after completion.

Building regulations also have to be simplified. A case in point is the new SANS 10400 Q2011, which deals with new building regulations for non-water-borne means of sanitary disposal. Such regulations are most welcome, but have to be shorter, based on local research and needs, and able to support technologies using alternative materials, such as grey water.

Yet another CSIR project is that of the Fraunhofer Institute in collaboration with the University of

Johannesburg as part of the Enerkey project. The Enerkey Performance Certificate shows the exact energy consumption within a building over a period of a year, which can then be compared with a benchmark. The concept has been very successful in driving energy efficiency in Europe. Certificates such as these could be expanded to include water and recycling performance, small business support, labour intensity, training, etc. The following recommendations can be made in view of green infrastructure:

- As South Africa has very limited capacity, care must be taken not to concentrate on one aspect only. We need to think through a more integrated set of measurements so that integrated environmental, social and economic performance is achieved.
- We need to align with good practice and government policy, and apply this to each individual building, seeking to achieve a better social, environmental and economic impact.
- Minimum standards for buildings should again be made mandatory, with the key considerations being cost effectiveness, high impact, and quality of life.
- Prescriptive standards and measures (e.g. SANS 204) are easier and cheaper to implement than, for example, paying an engineer a large sum of money to model the energy in the building.
- There should be enough capacity; systems should be simple; and there should be clear allocations of responsibility, clear sets of indicators, simple checklists, and effective guidance and training.
- Improvement should be ongoing, with support and reporting back.

Case study 1: Education infrastructure

Prof. Iain Low, School of Architecture, Planning and Geomatics, University of Cape Town

The building industry, and architecture in particular, is generally driven by the Leadership in Energy and Environmental Design (LEED) star rating. Unfortunately, this tends to marginalise the need to be responsible for, and sensitive to, local conditions, such as the spatial practices of traditional people. Rather than just following a checklist from outside, we need to be proactive instead of reactive, and also consider human performance in relation to the buildings that are being constructed within a specific social context.

Another important factor is the tension between economic development, growth and sustainability, on the one hand, and social justice, decent jobs and socioeconomic opportunities, on the other hand. Architects should consider in whose interest they are designing buildings; whose values are informing the translation of policy into physical buildings; and how their designs can integrate people in space. Many impressive buildings have been awarded a four or five-star Green Star rating. However, they are made of glass and the values underlying their design are driven by imagery rather than by indigenous knowledge systems or more traditional ways of utilising materials and spatial conditions.

The present case study concerns the Training for Self-Reliance Project (TSRP), which began in 1979 and had evolved from a soft loan from the World

Bank to the Kingdom of Lesotho. It is a large, integrated and ongoing project to upgrade schools and education throughout the country and provide civil works, furniture, books and in-service training. Part of the World Bank's conditions for loaning the money was that a Project Implementation Unit (PIU) be set up. The PIU is an autonomous body that functions in long-term cycles with large objectives and is accountable to the Cabinet only. The Ministries of Education, Finance and Works are also involved in the project and the PIU assists them with the kinds of standards needed.

The civil works component of the TSRP consists of providing classrooms, offices, stores, laboratories, libraries, latrines, kitchens, trees, gardens, fences, site work and maintenance. Desks and equipment are supplied, as well as books in a revolving fund. The R1.00 rental charged per book is used to repair damaged books annually. Every year, unqualified teachers are also brought in for their education to be upgraded.

Lesotho is a mountainous, predominantly rural country. Due to its colonial history, there are often three schools - usually Catholic, Anglican and Evangelical - in one area. Part of the TSRP, therefore, was also to rationalise schooling and get a single school to be the leading school in an area. Because the facilitation process ensured buy-in from the start, communities felt they had



Source: University of Cape Town

Early experimentation with materials and construction



Sectoral perspective on buildings

Case study 1: Education infrastructure - continued

ownership of the programme. The notions of a “vernacular style” and ownership are important, as people are capable of building for themselves.

At first, much of the work was experimental, and concrete blocks were used to build schools. Some classrooms had openings where the children could line up, because there were no halls. There was also a series of experiments around a certain modular hut-type, adapting the design in several different ways.

By 1985, the typology had been resolved. The resulting system was easy to read and build, and could be adapted into different kinds of buildings. As this was a World Bank project, any member country could tender for it. The Americans, for instance, proposed using prefabs, while the Italians suggested plastic, blow-up classrooms. The final specification, however, was to use stone. The stone usually came from the villages and the contractors would employ the village masons. Technical students received in-service training in drawing basic plans by hand, which could then be used by people with rudimentary skills. There were also detailed sheets for building with stone or brick.

By drawing up careful specifications, therefore, positive socioeconomic consequences for both the project and the local development economy could be planned.

Any money left over at the end of a project was used to build an extra classroom for schools if they were willing to fill in the shell. These rooms could be used as outdoor classrooms or dining or gathering areas. The office store for keeping books, etc. was also an important feature. Specialised rooms included libraries, rodent-proofed food aid kitchens for cooking meals, and ablution blocks with ventilated improved pit (VIP) and ventilated improved double pit (VIDP) toilets.

The building system was open, adaptable and multifunctional, and allowed both indoor and outdoor space to be interpreted according to need. Old buildings were either demolished or adapted, and the site works generally offered sufficient small-scale work for local skills development. Good foremen were nurtured and enabled to secure small contracts for building two classrooms. The consistent labour-intensive emphasis meant that components were largely handmade rather than purpose built.



Stonework reflecting the handiwork and identity of different craftsmen



Source: CSIR

Urban sites utilising passive solar heating with Trombe walls

The TSRP thus dealt with both social and economic development, with a strong focus on environmental sustainability during its implementation. Because people worked with limited means, common sense and responsibility prevailed. The PIU, as an autonomous unit, was able to respond positively to post-occupancy evaluations over a five-year cycle. Such an approach is more directed at actual development conditions on the ground.

RDP housing - the ubiquitous type of building in this country - is possibly the worst example of design.

It has resulted from a modernist focus on quantitative delivery at speed with minimal cost, rather than qualitative consideration of new ways of being in the world. There is a need for teaching, research and service to be integrated, for instance through community service for architects, in order to develop design-built research. A resonance should be found between policy and new institutional arrangements, and the way in which people engage with realities in specific development contexts.



Source: 123rf

Architectural detail of an entryway to an elementary school energy efficiently designed



Sectoral perspective on buildings

Case study 2: Healthcare infrastructure

Mr Geoff Abbott, Architect and Principal Researcher: Health Facilities, Built Environment Unit (CSIR)

The objectives of any health system are to achieve health and wellbeing in the population at large in a way that is responsive to their needs, and ensures fair and equitable access to the healthcare service. In order to achieve this, the correct, balanced service platform has to be in place, together with service delivery at an appropriate level; adequate resources (staff, buildings, equipment, medication and supplies); stewardship to oversee the service and manage resources; and sufficient financing.

In the public sector in South Africa, there are approximately 4 000 primary healthcare facilities and 500 hospitals, with a current (conservative) replacement value of about R200 billion. The existing facilities include top-of-the-range buildings, such as the Inkosi Albert Luthuli Central Hospital in Durban. This modern state hospital is about one kilometre away from the large King Edward VIII Hospital, which is situated on a crowded site that has developed haphazardly over a long period of time. There are also smaller hospitals in towns, as well as rural facilities and many small rural healthcare clinics.

When we talk about greening healthcare infrastructure, therefore, we are dealing with a range of facilities - some of which are good, and others that are either in a poor condition, or in the wrong place, or have poor functionality. Replacing these facilities would require a long, incremental process involving a great deal of refurbishment. It is not simply a matter of wiping the slate clean and starting from scratch. The main drivers for change are the:

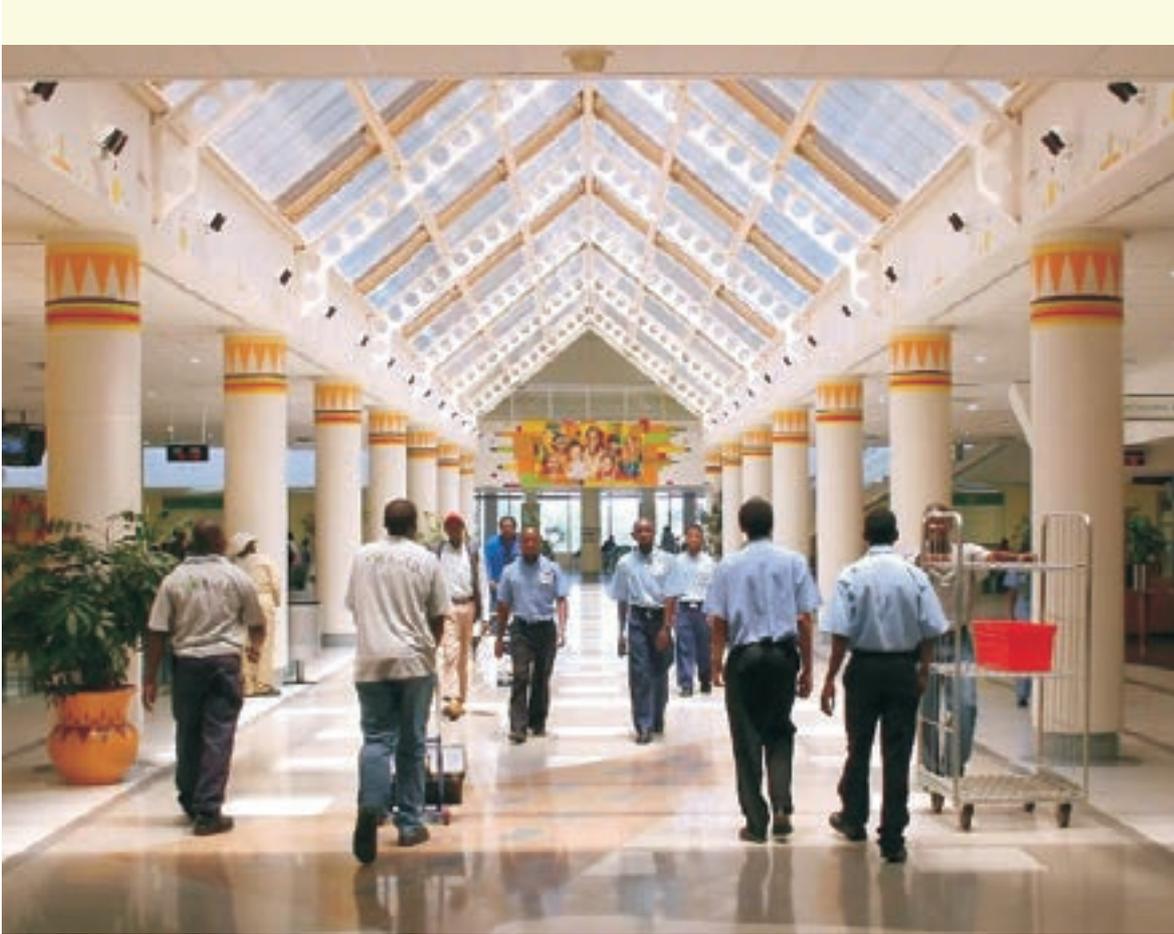
- health service transformation policy;
- National Health Insurance Scheme;
- primary healthcare re-engineering;
- population growth, distribution and migration;
- disease profile of HIV and Aids, and tuberculosis (TB);

- technological advances (medical; information technology; communications; engineering);
- environmental concerns regarding climate change and sustainability;
- efficiency issues around people and funding.

Although the health sector is a very complex one, with many interacting and interrelating variables, the matter of functionality remains paramount. The sector needs to provide the right sort of framework environment in which services can be provided effectively and safely. Safety is a major issue and in order to manage it, the right information is needed.

The Council for Scientific and Industrial Research (CSIR) is currently involved in the Infrastructure Unit Support Systems (IUSS) programme for the Infrastructure Unit of the National Department of Health, in collaboration with the DBSA and other stakeholders. The objective is to optimise the acquisition and management of South Africa's public healthcare infrastructure. The CSIR is responsible for developing norms, standards and guidelines, as well as for area modelling and cost modelling. The DBSA handles the rapid appraisal of project contracts, and monitors and oversees projects.

In developing such norms and standards, certain themes have been identified that cut through the broader themes of whole hospitals, primary healthcare, area norms, cost norms, strategic planning, maintenance and upgrading, etc. The cross-cutting themes include the environment and sustainability; infection prevention and control; engineering services; and fire and other regulations. These themes would have different nuances, depending on which department in a hospital and which levels of care are involved.



Source: CSIR

Inkosi Albert Luthuli Central Hospital, Durban, KwaZulu-Natal

The IUSS task group includes public, private, health and technical specialists who seek to identify South African and international best practice for, and case studies of, sustainable healthcare facilities. Performance measurement and benchmarking need to be done, and “lifecycle guidelines” drawn up in order to steer strategic planning, project planning, design, construction, operational management, retrofitting and refurbishment, as well as disposal.

A document published by the National Health Service (NHS) of the United Kingdom in June 2011, titled “Tomorrow’s healthcare environments: Towards a sustainable future”, highlights the environmental impact of the NHS health estate. The 893 000

tonnes of carbon emissions from British hospitals per year make up just under one third of the total emissions of that country’s public buildings. It has been suggested that 25% of the £563 million spent annually on energy supply in hospitals could be saved through better building design.

The question is what the equivalent figures are for the South African health estate. Assuming 80% occupancy of the approximately 126 000 public and private beds, the annual energy consumption of about 95 kilowatt hours per occupied bed comes to a total of 3.5 million megawatt hours (MWh) at an estimated cost of R2.4 billion. If this amount could be reduced by 25% through environmentally conscious



Case study 2: Healthcare infrastructure - continued

design, South Africa could save R600 million in the health sector every year.

The Khoo Teck Puat Hospital in Singapore is an example of such a design. Opened in June 2010, this large, 550-bed facility for general and acute care consists of different blocks. For instance, the red block in the diagram is a private ward facility, while the green block houses subsidised wards. Both the private and the public sectors are accommodated on the same site, and they share the same diagnostic and treatment clinical services and specialised outpatient clinics.

The layout of this hospital ensures natural ventilation, especially for the subsidised block, with windows that can open and many green plants. Good airflow is important to combat airborne infections, such as TB. The other blocks have air conditioning. The different orientations and façades of the buildings were planned in response to the prevailing winds, exposure to the path of the sun, heat gain, natural airflow, and daylight access.

The internal courtyard of the hospital is shaded; the multiple landscaped decks contribute to a reduced heat island effect; and the overall geometry of the design ensures self-shading. Specially designed sunshades have been used on certain façades, along with high performance glazing, and optimal thermal insulation. All these measures have brought about 23.6% less heat gain through the façades than is allowed by the current building standard. In addition, courtyards have been landscaped, and landscaped terraces and community gardens are kept on the roofs of some buildings. On every floor of the subsidised wards planter boxes filled with plants have been placed outside a window of each ward, thus creating an instant garden outside.

The Khoo Teck Puat Hospital has reduced its expected energy consumption from 3.26 to 1.63 MWh

per bed per month, with a global saving of 52% in energy efficiency (lighting, air conditioning, hot water, etc.). This has been achieved through careful engineering and by spending much time on planning, perfecting the design, and setting initial targets. The result is a high-comfort, high-performance, aesthetic hospital building, with enhanced daylight design, thermal comfort, aural comfort, air quality and spatial quality.

Another example is the Deventer Ziekenhuis in the Netherlands, a 380-bed teaching hospital completed in 2007. Through careful design, its emissions are 69% below that of the average Dutch hospital; and its heating, cooling and electricity use is 73%, 50% and 16% below average, respectively. The large roof area has been landscaped and the wards are situated away from high traffic areas, while making the most of natural daylight, airflow and views.

Safer hospitals are a vital concern, especially if airborne infections are to be controlled. South Africa has the highest incidence of TB in the world, with almost 1 000 new cases per year for every 100 000 of the population. The HIV/TB co-infection rate is over 70%. One of the CSIR's projects involves designing long-term accommodation for drug-resistant TB patients that is safer for patients and staff in a sustainable way. A major component of the design is the use of natural ventilation, which does not cost much in the long term, is reliable, and is not dependent on electricity.

One such project is at the Modimolle Multi-Drug Resistance (MDR) TB Hospital, where a number of small buildings have been clustered around open courtyards. The roof of each building has been carefully designed to promote natural ventilation. A baffle system in the interior ensures that no matter where air movement is coming from, there will still be suction and air changes in the room.

It is possible to carry out these kinds of sustainable, energy-saving projects within the existing regulations, such as SANS 10400-XA. Thus everyone involved in healthcare infrastructure should strive

to achieve the right balance between optimising functional performance and environmental performance. The IUSS is developing a benchmarking website, and input into the process is most welcome.



Source: CSIR

Construction of a unit at the Modimolle MDR-TB Hospital



Sectoral perspective on ecosystem infrastructure (including water)

Chairperson: Ms Saphira Patel, Environmental Specialist: Advisory Unit, Development Planning Division (DBSA)

Ecosystem infrastructure: Key considerations for planning

Mr Jeffrey Manuel, Acting Director: Biodiversity Planning and Mainstreaming (SANBI)

A typical integrated development plan (IDP) or strategic planning document of a municipality has three top priorities, namely: the need to deliver housing; the need to allow access to basic and social services; and the need to improve infrastructure. However, although municipalities may invest heavily in infrastructure, this is often not done specifically to address the planning and development challenges reflected in their IDPs.

Municipalities currently spend large sums of money on enabling construction that is linked to economic growth, such as shopping malls. Their argument is that this will stimulate economic growth and create jobs. Municipalities believe that this will eventually increase municipal revenue to a point where they can then start to address the challenges outlined in the IDP.

This creates somewhat of a paradox. In South Africa, there is no shortage of good, integrated planning frameworks, sound environmental management policies, and excellent ecological information. Yet, the environment is often positioned as an obstacle to development. In fact, as the country chases the mythical 6% growth that developing countries should aspire to through construction and extraction-based development, the environment will inevitably be presented as being an obstacle.

The development and planning frameworks, therefore, need to be changed. South Africa is on a fundamentally unsustainable path and alternatives must be pursued. The Constitution has already addressed the planning and development challenge. It holds that legislation and other means should prevent ecological degradation; promote biodiversity conservation; and secure ecologically sustainable development while promoting justifiable economic and social development.

The main issue is what is meant by ecologically sustainable development, and by justifiable social and economic development. There are two levels at which development can be considered justifiable – first, strategic planning and the kind of development models used, and second, the realities at local level. Therefore, the question is what kind of development is justifiable in the context of, for instance, a municipality with limited resources? For example, a “justifiable” golf course development will not uplift a nearby community that does not even have access to electricity.

When it comes to ecologically sustainable development, many municipalities still shy away from their environmental responsibilities. Most ecosystem goods and services have a direct bearing on the functioning of municipalities, and have direct implications for issues such as disaster risk reduction; erosion control; water provision; flow regulation; soil fertility; and recreation. These are aspects from which a municipality could benefit, but which could also incur high costs if nothing were done about them. Ignorance is not an excuse, as South Africa's ecological infrastructure and biodiversity assets have largely been identified and mapped. Municipalities should sit up and take stock of the various implications for them.

Planning in the past was driven by zoning schemes and, unfortunately, the trend persists today. Planners largely kept themselves occupied with urban centres, with little proactive planning being done for rural domains and scant consideration being given to landscapes. In Cederberg in the Western Cape, for example, 60% of the municipal jobs concern ecotourism and agriculture, yet the municipality does absolutely no planning for that part of its jurisdiction.

Although the government has had a rural development focus for the past few years, the capacity at municipal level is still poor; jurisdictions overlap and objectives differ. For example, the Department of Rural Development is drawing up spatial development frameworks (SDFs) for many municipalities, while the Land Reform component is preparing area-based plans to inform land reform in that same space. The Department of Environmental Affairs is preparing environmental management frameworks, whereas the Department of Agriculture is drawing up area-wide plans. In addition, there are different agencies, such as catchment agencies, which also have different objectives.

South Africa still has some way to go towards landscape-level planning, which is the new paradigm for municipal land-use planning. Land-use planning is not just a process to decide on development applications. Currently, a developer may put in an application for building a shopping mall or a housing complex, and if the application meets the broad criteria, then it is approved.

At its heart, however, land-use planning is a social policy meant to inform the spatial layout and, therefore, the impact of human activity. Land should be used efficiently and for the benefit of the wider society. The old Group Areas Act is a prime example of the negative, far-reaching



Source: DBSA

Good municipal planning should prevent land-use conflicts.



Ecosystem infrastructure: Key considerations for planning - continued

consequences of land-use planning that is used incorrectly or for the wrong reasons. Due to the past spatial planning policy, the country is still struggling to reintegrate settlements and people have to travel long distances to access services.

Mpumalanga, for example, has a great mining potential, with the main resources being coal, gold and minerals. Up to 2009, 49 companies had applied to the Department of Mineral Resources to mine or prospect in 53% of the protected area of the province. Practically the whole province has been covered by mining or prospecting applications, apart from the Kruger National Park, although a few applications have been aimed at activities inside the Park as well. When looking at the water yield on a map of the province's ecological infrastructure, it is clear that most of the high water yield catchments are the subject of mining-related applications. Most of these catchments supply water to large cities.

Cities are not self-contained units. They have massive service areas on which they rely for the provision of food, water and services. Failure to do landscape-level planning may mean that investments will soon be needed in infrastructure for extractive industries, transport, etc., which will ultimately hamstring societies in terms of their water supply.

It is not a matter of preventing mining from taking place at all. The ideal mix of land uses must be found in order to secure productive, extractive and non-extractive economic activities in each landscape over the long term. There should also be a level of realignment of the infrastructure investment required in support of such a scenario. Infrastructure cannot simply be greened in a business-as-usual model - a fundamental shift is required so that investments in ecological infrastructure will not

only create labour-intensive, long-term job and re-skilling opportunities, but also result in cost savings.

Disaster relief is one area in which savings can be achieved. Why simply pay out farmers year by year if the alternative is to invest in that ecological infrastructure in order to limit the damaging impacts of floods; improve disaster risk management pre-emptively; reduce overall infrastructure spending; and reduce economic downtime? For instance, when a bridge washes away in a national park, the park's ability to generate income is limited. Investments should be made into ecological infrastructure on a sustainable basis, and not just per project. Interestingly, the highest supply of ecosystem services is mainly in financially poor rural areas.

Champions are needed, as well as strategic enablers and a shift in investments. Over the short term, priorities, policies and plans will have to change. A medium-term goal is a shift in office practice and standards; a longer-term goal is a change of hearts, minds and values. The services rendered by nature underpin a better return on state investment; improved rural and urban services; job creation through proper management of the ecological infrastructure; better disaster risk management; and mitigation of the effects of climate change.



Source: 123rf

Open limestone mining



Case Study 1: Water

Dr Christo Marais, Head of Operations: Natural Resource Management Programmes (DEA)

The current number of full-time equivalent employment opportunities created by the government is approximately 240 000, which costs around R1.9 billion annually. However, the restoration of natural capital and the sustaining of ecosystem services set the future demand in the order of 231 000 jobs, which would require an annual turnover of about R57 billion. The question is how to get from R1.9 billion to R57 billion in order to develop the market for ecosystem services and restructure natural capital.

An “anchor tenant” in the market for ecosystem services is the water market. Whatever happens to the land has an impact on the so-called watershed services as well. Land degradation, for instance, includes desertification, where vegetation is lost. The Drylands Fund, which became operational in April 2011, aims to scale up efforts to address such environmental degradation.

The spectrum of land degradation includes bush encroachments and invasive alien plants, where not only natural vegetation is lost, but also water. Hydrological monitoring before and after clearing invasive plants shows that these plants have a significant impact on runoff and stream flow. They tend to use more water than natural vegetation, and when they are removed, natural water resources increase and the loss of registered water yield is reduced.

“Watershed services” involve those things in which water resource managers are interested and for which they are prepared to pay, such as water flow; yield from water infrastructure; ecological reserves; and water quality. The insurance industry also takes an interest in these services, as risk management is one of their greatest concerns. Climate change may be expected to cause longer and more severe droughts, as well as more intense and severe floods.

Whereas floods and high flows are serious incidents, low flows are another. Nearly 50% of South Africa's water is still being extracted from its rivers, either by means of a pipe system or manual collection by people. This run-of-river extraction is a cause for concern, because if the country loses its water flows, these would have to be replaced with infrastructure.

Land management practice also affects the operation of dams. A dam may be fed by a few heavy downpours or a measure of flooding, followed by a long, dry summer without base flows to sustain the dam levels. The dam may then accumulate sediments if the natural infrastructure that could prevent siltation was not taken into account in the planning.

All the water infrastructure in this country has to release water in order to maintain the rivers on which it was built. South Africa's estuaries are all “fish nurseries” and the marine fishing industry is dependent on estuaries for fish. The ecological reserves are, therefore, very important and water resource users are prepared to pay for that.

Water quality is another aspect of watershed services. The poorer the quality of the water that enters a dam, the more the municipality or metro will have to spend on purifying the water for use. If clean, clear water enters the dam, there will be a decided economic benefit in reduced purification costs. Water weed management is also a major issue, especially in terms of water reticulation and distribution. Health risks of disrupted watershed services may include cholera outbreaks. The poorer the water quality, the more water weeds and micro-organisms will flourish. Weeds also pose a threat to turbines.

Siltation is caused by erosion and land management practices. There is a linear correlation between soil

movement (erosion) and soil cover (vegetation). One of South Africa's largest dams, the Gariep Dam, is nearly 12% silted; Pongolapoort 3.2% and Vanderkloof 0.3%; while the Sterkfontein and Vaal Dams have none. Taken together, this group of "Big 5" dams suffers from 4% loss in storage space due to siltation. Although this may not seem much, it translates into a total loss of 718 million cubic metres in storage space. Worse examples are Welbedacht - an almost totally silted dam by now - with its 96% sedimentation; Gilbert Eyles 76.5%; Elandsdrift 76.9%; Bethulie 69.8%; and Seshego 62.6%. It costs around R20 per cubic metre to build storage space for water; whereas dredging costs R8 per cubic metre. In effect then, a further 40% is added to the cost of the water if a dam has to be dredged.

Efforts are currently being made to mainstream watershed services into the economy via the National Water Resources Strategy and the Water Pricing Strategy. The Water Resources Strategy, for instance, calls for:

- Managing and using water optimally in support of the social and economic development of South Africa; this applies to all major water-use sectors. There should be an awareness of hydrological variability and climate change, with timely responses to minimise the impact of extreme events, plus adequate funding for water resources management;
- Protecting South Africa's water resources, which includes halting and reversing the deterioration in water quality;
- Achieving effective water governance;
- Ensuring that everyone values water. Apart from implementing public awareness campaigns, water resource

management activities should be financially sustainable, and water should be priced appropriately and subsidies well targeted;

- Placing water at the centre of integrated development and planning.

South Africa's high yield catchments are its "water orchard", whereas the wetlands are its "kidneys". Some catchments are highly overstressed and some are subject to loss due to sedimentation. There are about 20 million hectares of invasive plants in the country and if these are condensed to 100%, the figure is 1.9 million hectares, which is an area larger than the Kruger National Park. Large areas of the country are degraded, which increases the risk of fire. Many of the places from which the watershed services or ecosystem services come are where the poor live; therefore, it makes sense to invest in the restoration of the country's natural capital.

The main proposition of this case study is that real, natural capital or natural infrastructure can contribute to the efficient use of manmade infrastructure. The following needs to be done to unlock investment:

- Improve primary assumptions of ecological science.
- Translate these ecological assumptions into the economic consequences of changes in the delivery of watershed services.
- Improve institutional arrangements and governance, which includes the need to regulate land-use practices in order to protect ecosystem services, and to regulate the market for watershed services.
- Raise awareness among both the buyers and sellers of the watershed services.



Case Study 2: Soil and biodiversity

Mr Ruan Kruger, Environmental Analyst: Northern Cape Business Unit, Operations (DBSA)

This case study is about the Nuwejaars Wetlands which is an excellent example of using conservation as an instrument for rural development. The area concerned is immediately to the north of the Agulhas National Park in the Western Cape.

Early in 2002, the Global Environment Facility (GEF) and the United Nations Environment Programme (UNEP) provided finance for starting a planning process on how to conserve and utilise the Cape Floral Kingdom in order to promote economic development in South Africa. One of the projects that flowed from the funding support was Cape Action for People and the Environment (CAPE).

From the CAPE programme, the Agulhas Biodiversity Initiative was selected as one of the key initiatives at which planning and efforts would be directed. The objectives were to conserve the “living landscape” (meaning that farmers were still actively farming next door to the Agulhas National Park); and to develop a model for land stewardship.

The model demanded very good cooperation between landowners and the government, as the former would be required to take on some of the government's conservation responsibilities.

When the Park was proclaimed, about 22 000 hectares of ground were expropriated and the buffer zone spanned a further 24 000 hectares. The local farmers foresaw a problem in that their traditional farming practices would no longer be as profitable and they would need new ways to improve their income but still remain farmers.

The Park hosts a variety of habitat types and vegetation. Of the approximately 2 000 species of indigenous plants, 100 are endemic to the area. Among the wetlands there is good agricultural soil, where the farmers are active.

The DBSA became involved in the project to conserve the wetlands, as the GEF funding specified that all work done in the Cape Floral Kingdom had to focus on conservation as well as development.



Source: DBSA

Game on the Nuwejaars Wetlands

The DBSA has a similar approach of wanting to aid conservation, but also expecting development to follow its investments. The Bank has signed the CAPE memorandum of understanding and is committed to using its capacity-building arm, the Development Fund, to work with the farmers and convince them of the need for new ideas that require capacity building.

The 32 farmers were ready to accept the Bank's support, as they were already trying to plan how to conserve the wetlands. An important consideration for the DBSA was that the private sector would begin to undertake the conservation functions that the government normally would. There was the potential for both economic development and the conservation of unique ecosystems, as the wetlands drain towards the De Mond Nature Reserve on the south-western Cape coast. This provincial nature reserve is also an important Ramsar Site, and it is, therefore, crucial to conserve the wetlands that filter the water for the reserve. The project planning centred on the following focus areas:

- Restoring the wetlands so that they can perform all their ecological functions;
- Ensuring the sustainable use of natural products, so that the farmers can still harvest and sell them to augment their income;
- Identifying alternative land uses, such as tourism, for farmers to generate additional income;
- Promoting sustainable agriculture, what the farmers do next door to the national park has a direct impact on it;
- Promoting the wellbeing of all the people in the area.

The principles guiding the planning were that the farmers wanted to retain long-term ownership of

the land despite taking the conservation route, and wished to improve their current levels of income. They were also determined to add value to the area in order to create a greater self-sustaining system, both from an ecological and an economic point of view.

The farmers looked at what limited development they could do in the buffer zone surrounding the core conservation area. With the assistance of consultants appointed by the DBSA, they produced a zoning plan whereby biodiversity is conserved on their farms while their farming practices can continue. These areas were actually delineated as conservation areas in the title deeds of the farms. This formal commitment to conservation has doubled the protected land on the Agulhas Plain.

In response, the German government made €2 million available to the farmers in order to assist them with environmentally friendly farming practices and conservation initiatives, such as eradicating invasive alien plants and rehabilitating the wetlands. Many jobs were created in this way. The farmers also reintroduced wildlife as a basis for future tourism development. They purchased game, including buffalo, and erected game fencing. The first buffalo calf was born in September 2011, the first one to be born in the area in 200 years.

The Nuwejaars Wetlands project has had a very positive development impact:

- UNEP has declared the project to be a model worthy to be replicated worldwide.
- South African National Parks (SANParks) has gained conservation land without having to spend more money.
- The Western Cape Department of Agriculture was part of the planning team and plans to replicate this model in other areas in the province.



Case Study 2: Soil and biodiversity - continued

- Through cooperation between farmers and other partners, such as Working for Water, the Department has established a charcoal factory utilising the invasive alien vegetation that has been chopped down. For the first time, landowners have been given a financial initiative to clear such vegetation. Job creation in this regard has also been substantial.
- The original R480 000 grant by the DBSA to pay consultants for the planning leveraged €2 million in grant money and has also generated a great deal of international goodwill.
- At present, 60% of the Agulhas Plain wetlands are protected. This area provides clean water not only to nature, but also to the farmers; it enhances aquatic life; wetland vegetation is growing again; and the Zoetendals Vlei, one of the largest freshwater lakes in South Africa, is able to release fresh water to the De Mond estuary.
- The Lowlands fynbos is being conserved as a large ecosystem.
- Ecological functions and the movement of species are being enhanced through the corridors of conservation. Species are also better able to mitigate

climate change, as they are able to find new microhabitats where they can survive.

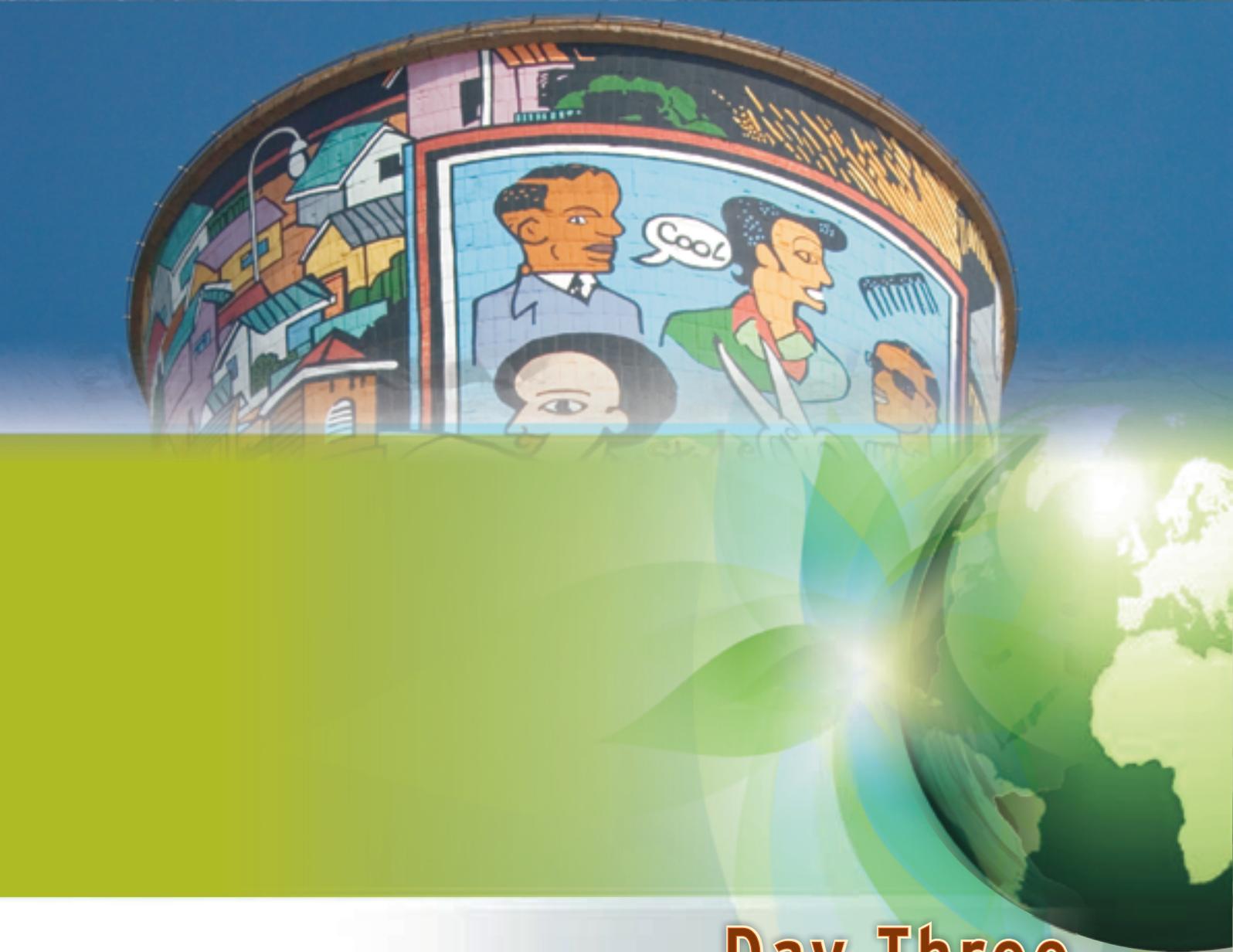
To replicate a project of this kind, it is necessary to identify an existing nature reserve and investigate which land adjacent to the reserve contains areas with a high biodiversity value. The owners of that land need to be visionary. They must really understand the concept; want to do things differently; and be willing to cooperate with the government and other partners. It is then possible to look for support from conservation agencies, such as SANParks or provincial nature conservation agencies. The concept of payment for ecosystem services will be an important means of funding conservation initiatives on private land in order for farmers such as these to sustain all the conservation activities.

The DBSA has formally committed to using nature conservation, and not only agriculture, as an instrument for rural development through the Bank's rural development division. SANParks has formally endorsed an approach whereby the DBSA can replicate this model at four other national parks in South Africa, including the West Coast National Park. There is also a potential partnership with the Western Cape Department of Agriculture.

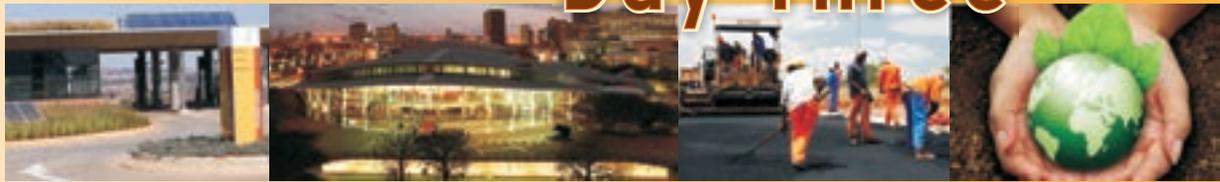


Source: 123rf

Erosion control



Day Three



Green buildings and greening infrastructure: A shared framework?
Greening of infrastructure from an engineering perspective
Summing it all up: The next critical steps



Key choices for greening infrastructure in South Africa

Chairperson: Ms Sinazo Sibisi, Divisional Executive DPD, (DBSA)

Green buildings and greening infrastructure: A shared framework?

Dr Rodney Milford, Programme Manager (CIDB)

The Sustainable Buildings and Climate Initiative (SBCI) of the United Nations Environment Programme (UNEP) undertook an investigation across several countries to identify the key drivers behind the establishment of green buildings. The study concluded that green buildings are largely driven forward through regulatory and control instruments - the so-called "stick" approach. Policy instruments in this regard include appliance standards, building codes, energy-efficiency certificate schemes, and labelling and certification programmes. Both their effectiveness in reducing emissions and their cost-effectiveness range from medium to high.

Greening issues have been discussed in South Africa for many years and several measures are currently being implemented. The key concern will be how to quantify or measure how green the country's infrastructure, in fact, is. If such issues are driven through the regulatory environment, a standard or a code can be regulated; otherwise they will remain voluntary. SANS 10400 XA on energy efficiency has just been regulated and a similar code for water efficiency is being developed. The International Green Construction Code could also be made mandatory locally through regulation. The United States of America (USA) has a standard for the design of high-performance buildings, and clients may mandate it if they want to, while China has mandatory green building codes.

Worldwide, several green rating, labelling and certification systems exist for benchmarking buildings against a given norm. These systems include, among others, the National Australian Built Environment Rating System (Nabers); the Residential Energy Services Network (Resnet) benchmarking system for residential housing in the USA; and Energy Star, which allows the energy or water performance of a structure in the USA to be benchmarked against an extensive national database. There is also the Leadership in Energy and Environmental Design (LEED) suite of rating systems of the United States Green Building Council. The Green Star system in Australia has been adapted for use in South Africa. The European Union Directive 2002/91/EC for energy performance certificates for buildings is useful and provides for reference values, such as current legal standards and other benchmarks.

The same approach could be applied to rating the energy performance of buildings in South Africa. It would have to be referenced either to a legal standard, such as the SANS 10400 XA, or to a benchmark, such as Nabers. For green infrastructure, the metrics and benchmarks would be rather complex, as we are dealing with a range of infrastructure, not just buildings. The Australian Green Infrastructure Council, for instance, is developing a rating system for other forms of infrastructure. The Greenroads rating system



assesses sustainable roads, whether new, reconstructed or rehabilitated. The mandatory requirements involve the environment, water, access, equity, construction activities, materials, resources, pavement technologies, and custom credits awarded for sustainable roadway projects.

Some rating systems, like the Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan, evaluate whole neighbourhoods. The LEED for Neighbourhood Development (LEED-ND) rating system in the USA looks at green infrastructure and buildings in various contexts, such as pollution prevention during construction; the extent of site disturbance; reduction of contaminants; stormwater and wastewater management; heat island reduction; on-site energy generation; renewable energy resources; district heating and cooling; infrastructure energy efficiency; and recycled content.

There is no shortage of guidelines for developing green buildings or infrastructure, such as the City of Cape Town's Green Building Guidelines, or the Project Sustainability Management Guidelines of the International Federation of Consulting Engineers (FIDIC). The question is how to translate intent into action - how to get people to use the guidelines. Different policy instruments for the public and private sectors are likely to be required, as it is easier to regulate the public sector. Different policy instruments are also needed for the non-residential and residential sectors, and possibly for the commercial, educational and health sectors, as well as for new versus existing stock. It is not a matter of one size fits all.

The emerging strategy for new and existing commercial buildings in the public and private sectors serves as an example. Minimum standards for the energy efficiency of new buildings in the private

sector are regulated by SANS 10400 XA, and can be expected to be ramped up over time. Clearly, these standards apply to buildings in the public sector as well. The CIDB has produced a Government Gazette notice setting the best practice for all government buildings at a four-star Green Star rating. Internationally, the trend is for the public sector to lead by example and so to influence the private sector. All the government buildings in the USA, for instance, have to be LEED certified. In New South Wales, Australia, all public works buildings have to be both Green Star and Nabers rated.

Existing buildings in the public sector in Europe have to display their energy and water performance certificates permanently. If their performance is at a certain threshold level, they may be forced to retrofit. In the private sector, such certificates only need to be displayed upon change of ownership or tenants. The matter becomes even more complex when distinguishing between the non-subsidy housing sector and the subsidy sector. Locally, if the SANS 10400 XA energy efficiency regulations are made to apply to RDP housing, the cost per house will increase by 15%.

The monitoring of green buildings is a further issue. The CIDB and UNEP's "South African report on greenhouse gas (GHG) emission reduction potentials from buildings" investigated different long-term mitigation scenarios. It was a very complex task to gauge the volume of GHGs emitted by the built environment sector, and many assumptions had to be made. The CIDB and UNEP are also working on defining mechanisms for monitoring the greenness of buildings over time. The objective is to encourage governments worldwide to monitor the performance of their building and housing stock.

Such a sustainability building index should be a globally consistent framework that is used to



Key choices for greening infrastructure in South Africa

Green buildings and greening infrastructure: A shared framework? - continued

understand, measure and report on the influence of the building stock's performance concerning core sustainability issues. It should be a tool to support the generation of annual reports on jurisdictions' progress in improving the sustainability of their building stock. The policy instruments need to be mandatory, covering issues such as the impacts of GHG emissions arising from building operations and the impacts of water use during building operations.

A policy framework for green infrastructure would probably have to deal with the public and private sectors separately. Certainly, the different classes of infrastructure, such as water, transport, energy, waste, manufacturing, mining and telecommunications, would need to be approached

in a different way. Defining the metrics in such a very complex environment would require legislation to deal differently with public and private stakeholders, public and private sectors, and new and existing stock. Nonetheless, the minimum requirements and standards would largely be the same.

Corporations could introduce best practices and the government could then legislate best practices for their infrastructure. Clearly, as the move towards greening South Africa's infrastructure gains momentum, an incremental approach is needed that takes into account the huge differences and complexities between the various classes of infrastructure and stakeholders.



Source: DBSA

The Development Bank of Southern Africa Welcome Centre

Greening of infrastructure from an engineering perspective

Mr Jonah Ptak, Specialist Bridge Engineer, SSI Engineers and Environmental Consultants

Consulting engineers take an idea and turn it from a vague concept into a set of drawings and tangibles within the parameters set forth by the client, to build a product to the quality the client wants. There are two main challenges that may block the implementation of greening infrastructure, and regrettably both lie with consulting engineers.

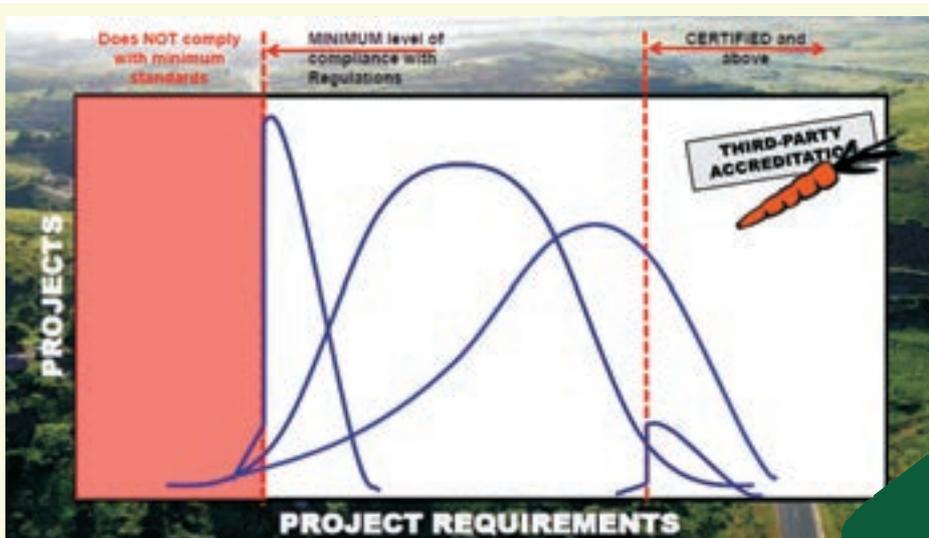
The first challenge is that when consulting engineers turn a concept into a product their services are not free. As more and more of engineers' work is being allocated through the bidding process, their fees have to be competitive. Unfortunately, there is a perception that adding additional value to a project, such as greening the infrastructure and buildings, may not bring direct added benefit to the consulting engineers.

The second challenge involves standards and regulations. The red vertical line to the left of the graph above represents the minimum level of compliance with regulations. Everything falling into the red panel is not allowed. For example, when building a set of steps, treads that are too small or uneven would not comply with the minimum

standards. However, if accessibility for wheelchairs or bicycles were added to normal steps, that would shift the project above the minimum level of compliance.

In reality, although consulting engineers work within the parameters of the client's brief, they actually tend to pursue the minimum requirements as far as possible. This is to avoid adding costs to the project that could price them out of the bidding process. The solution to the situation lies in the form of a real "game changer" - the pursuit of best practices and third-party accreditation, as put forward by the Green Building Council of South Africa (GBCSA) and the Leadership in Energy and Environmental Design (LEED) accreditation system of the United States Green Building Council (USGBC).

Lack of direction is a problem. A client may, for example, want to build a bridge with certain aspects of green infrastructure. However, without a clearly specified code or parameters, no consulting engineer will design such a bridge. It must be possible to track, calculate and report the standards involved.



The three levels of project requirements
Source: Green Building Council of South Africa (GBCSA)



Greening of infrastructure from an engineering perspective - continued

In this regard, the GBCSA's technical design manual lays out the requirements for a Green Star rating. Although it is not mandatory, the possibility of having projects accredited or certified is an incentive. The Greenroads manual of the non-profit Greenroads Foundation is another game changer with regard to road construction.

Manuals such as these offer a means for defining, tracking, calculating and reporting on standards. The project requirements, construction activities, access and equity issues, etc. contribute to achieving points and credits in order to earn a total score and Green Star rating. There is, nevertheless, an emphasis on certain American values and assumptions that are perhaps not in line with the challenges faced in South Africa. Even issues such as access and equity are defined differently in other countries. The GBCSA, therefore, adapts the requirements and credits of the Australian Green Star system to realities in this country.

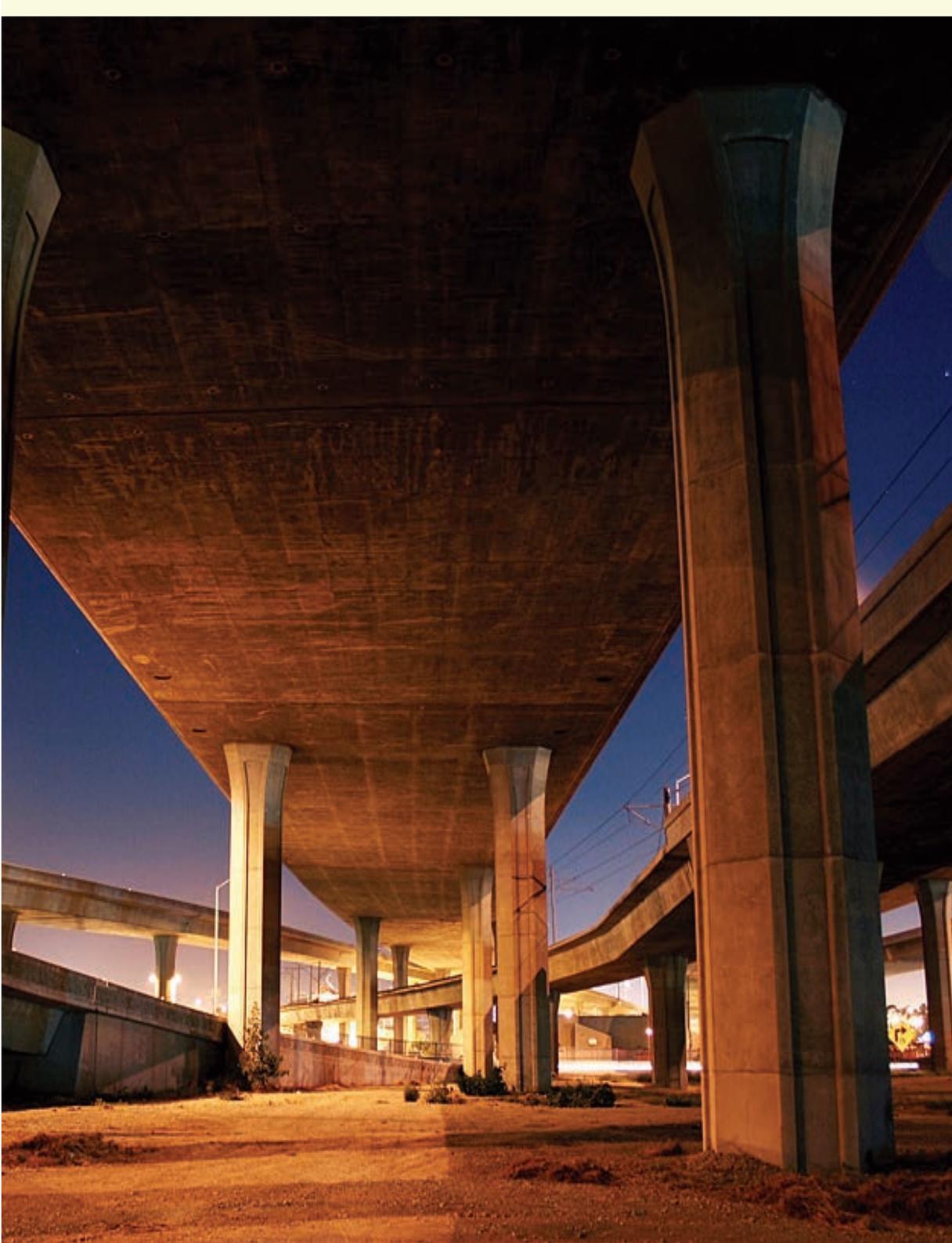
People do need bicycle paths and scenic walks through the city centres; however, these are not exactly the type of credits that South Africa needs most. Credits for job creation, community involvement, and greater socioeconomic equality are more specific to the local context. Custom credits would include labour-intensive methods, maintenance plans, road safety education, skills development, etc. The Greenroads manual defines credits for various types of sustainable practices, which clarifies the options open to consulting engineers.

In terms of return on investment, meeting South African credits would result in job creation from the first day of the project, as well as skills development, pedestrian-friendly roads, and other benefits. Money, skills and education would be put back into the community. By focusing on the human

capital aspects of infrastructure, projects have the potential to make a strong impact, in addition to reaching green goals, such as a reduced carbon footprint and preserved natural resources. This could be a major contributor to the sustainability and stability of the long-term view of South Africa and the continent.

Progress has, therefore, been made in some respects. The next step would be to produce manuals that are not only discipline specific (e.g. buildings, transportation, spatial planning, energy, water), but also specific to different parts of that discipline. When guidelines, metrics, etc. become specific, many more people become directly rather than peripherally involved. Perhaps a green infrastructure council is also needed. Moreover, rather than encompassing the entire green city concept, with buildings, bridges, roads and green sites, one could start by looking at a city and getting parts of it to work together, so that certain areas become green and other areas move towards it.

A current issue is the envisaged Greenroads Council of South Africa. A memorandum of understanding has been signed with the Greenroads Foundation in the United States, which is happy to see guidelines developed in South Africa specifically for local needs. Different stakeholders must put their efforts behind this tool to develop it and ensure its implementation. These would include discipline-specific stakeholders, such as the labour, roads and environmental authorities, as well as national, regional, provincial, municipal and technical authorities. Other parties which should get involved are manufacturers, professional organisations, Consulting Engineers South Africa (CESA), the South African Institute for Civil Engineers (SAICI), research institutions, designers and builders. This tool is not something that a number of consulting engineers can attempt on their own, as it needs to reflect government policy.



Source: 123rf

Roads, bridges and transport are important areas of opportunity for the greening of infrastructure



Key choices for greening infrastructure in South Africa

Summing it up: the next critical steps

Mr David Jarvis, Divisional Executive: Strategic Operations, Development Planning Division, DBSA

In summarising the outcomes of the DBSA Knowledge Week 2011 the following key focus areas for the greening of infrastructure programmes were proposed and adopted by participants:

- Promote a just transition to a green economy through socio-economic development that focuses on job creation and localisation opportunities.
- Incorporate the goals of green infrastructure into long-term (20+ year) development strategies.
- Balance the need to address immediate needs with an approach that avoids being locked into unsustainable long term solutions.
- Set goals and targets for the transition to greener infrastructure in priority or sequential order.
- Promote approaches that consider long-term, sustainable objectives rather than short-term gains.
- Support the mainstreaming of greening of infrastructure through the redesign of legislation, standards, regulations and capability.
- Enable adaptable planning that supports planning institutions.
- Support measurable impact of the transfer and use of existing tools, technology and systems on a domestic, regional and international basis.
- Encourage and support in the private and public sector, civil society, development finance institutions and state-owned corporations to coordinate efforts towards greener infrastructure.
- Encourage public participation and consultation in initiatives.
- Establish agreed monitoring, evaluation and data collection systems.
- Facilitate an approach to infrastructure financing that promotes greener infrastructure, through full lifecycle costing and sustainable asset management policies.
- Finance climate-resilient infrastructure to sustain the economic, social and ecological base of South Africa and the region.
- Develop frameworks for the priority and cross-cutting sectors that address norms and standards, benchmarking, lifecycle planning, costing, management and assessment, measurement, and monitoring and evaluation.

List of acronyms and abbreviations

Aids	Acquired immune deficiency syndrome	GBCSA	Green Building Council of South Africa
AsgiSA	Accelerated and Shared Growth Initiative for South Africa	GDAT	Graphical Display and Analysis Tool
BCA	Building and Construction Authority	GDFI	Gross domestic fixed investment
BRT	Bus Rapid Transit	GDP	Gross domestic product
CAPE	Cape Action for People and the Environment	GDS	Growth and Development Strategy
CASBEE	Comprehensive Assessment System for Built Environment Efficiency	GEF	Global Environment Facility
CBD	Central business district	GHG	Greenhouse gas
CEO	Chief Executive Officer	GIS	Geographic information system
CESA	Consulting Engineers South Africa	GW	Gigawatt
CIDB	Construction Industry Development Board	HDI	Human Development Index
CO₂	Carbon dioxide	HIV	Human immunodeficiency virus
CoJ	City of Johannesburg	ICLEI	Local Governments for Sustainability (formerly International Council for Local Environmental Initiatives)
COP	Conference of the Parties	IDC	Industrial Development Corporation
Cosatu	Congress of South African Trade Unions	IDP	Integrated development plan
CSIR	Council for Scientific and Industrial Research	IEA	International Energy Agency
DBSA	Development Bank of Southern Africa	IIMP	Infrastructure Inputs Monitoring Project
DEA	Department of Environmental Affairs	IPCC	Intergovernmental Panel on Climate Change
DFI	Development finance institution	IPDM	Integrated Planning and Development Modelling
DPE	Department of Public Enterprises	IPP	Independent power producer
DPME	Department of Performance Monitoring and Evaluation	IRP	Integrated Resource Plan
DTI	Department of Trade and Industry	ISO	International Organization for Standardization
DWA	Department of Water Affairs	IUSS	Infrastructure Unit Support Systems
EDM	Electricity Demand Management	LAB	Local Action for Biodiversity
EIA	Environmental impact assessment	LED	Local economic development
EPWP	Expanded Public Works Programme	LEED	Leadership in Energy and Environmental Design
ETEF	Empowerment Through Energy Fund	MATSim	Multi-Agent Transport Simulation
EXCO	Executive Committee	MDG	Millennium Development Goal
FIDIC	Fédération Internationale Des Ingénieurs-Conseils (International Federation of Consulting Engineers)	MDR	Multi-drug resistance
		MOA	Memorandum of agreement

List of acronyms and abbreviations - continued

MTEF	Medium-Term Expenditure Framework	SANS	South African National Standard
MTSF	Medium-Term Strategic Framework	SARi	South African Renewables Initiative
MWh	Megawatt hours	SBAT	Sustainable Building Assessment Tool
Nabers	National Australian Built Environment Rating System	SBCI	Sustainable Buildings and Climate Initiative
Naledi	National Labour and Economic Development Institute	SDF	Spatial development framework
NBR	National Building Regulations	SOC	State-owned company
ND	Neighbourhood Development	SOE	State-owned enterprise
NBR	National Building Regulations	TB	Tuberculosis
ND	Neighbourhood Development	TEEB	The Economics of Ecosystems and Biodiversity
NHS	National Health Service	UNDP	United Nations Development Programme
NHTS	National Household Travel Survey		
NIRP	National Integrated Resource Plan	UNEP	United Nations Environment Programme
NMT	Non-motorised transport		
NPC	National Planning Commission	UNFCCC	United Nations Framework Convention on Climate Change
NREGA	National Rural Employment Guarantee Act	USA	United States of America
NRM	Natural resources management	USD	United States dollar
PICC	Presidential Infrastructure Coordinating Commission	USGBC	United States Green Building Council
PPP	Public-private partnership	VIDP	Ventilated improved double pit
R&D	Research and development	VIP	Ventilated improved pit
RDP	Reconstruction and Development Programme	WCMC	World Conservation Monitoring Centre
REFIT	Renewable energy feed-in tariff	WfW	Working for Water
Resnet	Residential Energy Services Network	WWF	World Wide Fund for Nature (formerly the World Wildlife Fund)
SAA	South African Airways		
SABS	South African Bureau of Standards		
Safcol	South African Forestry Company Limited		
SAICI	South African Institute for Civil Engineers		
SANA	South African Nursery Association		
SANBI	South African National Biodiversity Institute		
SANParks	South African National Parks		
SANRAL	South African National Roads Agency Limited		



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