environment in the GCR

introduction

In 2009, GCRO investigated how cities and city-regions around the world were responding to the global financial crisis. Research indicated that initiatives to create green jobs and invest in a low carbon future have been key to counter-cyclical spending worldwide. As a result, Gauteng's Department of Economic Development asked GCRO to draft a green economy strategy to feed into the evolving Gauteng Growth Employment and Development Strategy. GCRO co-ordinated the project, and the result was a green sustainability strategy for the province.

Gauteng's main green challenge is to move away from environmentally unsustainable ways of working and create jobs while doing so.

Gauteng contributes significantly to the country's carbon footprint through its manufacturing and mining sectors, as well as the provision of coal-based electricity to a constantly growing population.

In this section we review the main challenges the Gauteng city-region faces in moving towards a low-carbon economy, the main drivers of such a shift, and what we can do - in the short and longer-term - to wean ourselves off fossil-fuel-based energies and implement alternative energy strategies, to promote sustainable development, enhance our global competitiveness and fulfill our international obligations.

background

'We have an opportunity over the decade ahead to shift the structure of our economy towards greater energy efficiency, and more responsible use of our natural resources and relevant resource-based knowledge and expertise. Our economic growth over the next decade and beyond cannot be built on the same principles and technologies, the same energy systems and the same transport modes, that we are familiar with today.'

South Africa's then-Finance Minister Trevor Manual (2008) 'Budget speech', Parliament

can we have economic growth by consuming less rather than more resources?

Global economic thinking is currently experiencing a paradigm shift from capital-focussed, resource-intensive development towards what is being called the green economy. This shift has been intensified by the global economic crisis.

a green economy is one where business processes and infrastructures are reconfigured to:

- deliver better returns on natural, human and economic capital investments, while at the same time
  - reducing green house gas (GHG) emissions
  - and extracting using fewer natural resources
  - creating less waste
  - reducing social disparities

UNEP 'Global Green New Deal: An Update for the G20 Pittsburgh Summit', ii

Thus green economies – also called low-carbon economies – grow by reducing rather than increasing resource consumption.

Swilling, 'Growth, Resource Use and Decoupling: Towards a Green New Deal for South Africa', 5

'There can be little doubt that the economy of the 21st century will be low-carbon. What has become clear is that the push toward decarbonisation will be one of the major drivers of global and national economic growth over the next decade. And the economies that embrace the green revolution earliest will reap the greatest economic rewards.'

Former British Prime Minister Gordon Brown (September 2009) 'Newsweek'

what compels us to follow this path?

There are major new challenges arising from ecological constraints to the 'business-as-usual' approach to growing economies.

The dominant economic growth and development paradigm fails to address a wide range of underlying resource constraints that can rapidly undermine the preconditions for the kind of developmental growth that is required to reduce inequalities and poverty over time.

UNEP, 'Global Green New Deal: An Update for the G20 Pittsburgh Summit', ii

'While recently we have heard much about how problems on Wall Street are affecting innocent people on Main Street, we need to think about those people around the world with no streets. Wall Street, Main Street, no street: the solutions devised must be for all.'

Ban Ki-Moon, UN Secretary-General


and how do we walk it to achieve economic realignment?

To realign economies to focus not only on GDP, but also on long-term sustainability, job creation and 'happiness' requires:

shifting from capital investment to strategic investments in

- knowledge and innovation systems

developing new skills in

- renewable energy, e.g. solar water heating
- local food production
- urban agriculture
- energy audits

making new investments in infrastructure/planning around

- water
- transportation
- alternative energy systems and production

creating new green jobs

introducing new regulations to

- encourage development near planned public transport nodes
- curb urban sprawl

What are green jobs?

work in agricultural, manufacturing, R&D, administrative and service activities that contribute substantially to preserving or restoring environment quality.

UNEP, 'Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World', 3

what is the role of cities in promoting a green economy?

Cities now house more than 50% of the world's population, and consume a significant portion of the world's resources.

For example, the construction industry – a key driver of growth – is responsible for:

- *10% of global GDP*
- *employs over 100 million people globally*
- *uses up to around 50% of global resources*
- *uses 45% of global energy*
- *uses 40% of water globally*
- *uses 70% of all timber products.*

In addition, city-regions and countries are starting to come up against ecological resource constraints that prevent 'business-as-usual'.

For example, water supplies in the Gauteng region are increasingly becoming constrained, as is the ability to absorb waste and supply food.

In the medium to long-term, climate change is likely to have a devastating effect on food and job security unless this issue is addressed in the short-term.

So, we have to change our thinking to achieve sustainable goals by

- no longer viewing environmental protection as a constraint to economic growth, but as a driver of growth and essential for long-term economic sustainability.[1]The alternative is that growth falters as South Africa reaches ecological limits and becomes penalised by the international community for its carbon emissions and related energy intensity.
- no longer viewing production and consumption as 'linear' processes, but using holistic life cycle/ circular concepts to think about and design these processes.
- shifting from capital-focussed investment to strategic investments in knowledge capital and the systems that create innovation.

Dependent on coal for almost 90% of its electricity needs, South Africa is the 12th-biggest emitter of carbon dioxide in the world, producing more than 40% of Africa's fossil fuel-related carbon dioxide emissions.

what benefits do green economics hold for cities and city-regions?

Green economies not only create direct and indirect employment opportunities, they also protect existing jobs by addressing the increasing costs and challenges that undermine traditional economic growth, such as increasing food and energy prices. It will be up to Gauteng as the economic heart of South Africa to drive these goals and create sustainable jobs through the sustainable use of resources and a reduction in carbon intensity.

To achieve these goals, the economic focus needs to be on creating institutions that are able to foster the evolution of new technologies and processes. These institutions are the key to unlocking green potential, by creating skills and programmes that drive a low-carbon agenda.

SA and the GCR

'Growing without carbon constraints may be good for South Africa's economic growth, but it will result in rapidly increasing emissions. A four-fold increase in emissions by 2050 is likely to be unacceptable to the international community. It is also a high-risk approach on other grounds, such as rising oil prices, carbon constraints in trade, and advancing impacts. If all countries, including high emitters in the developing world, adopted a 'Growth without Constraints' approach, climate change impacts in South Africa would be extensive. A massive effort would be needed by South Africa to achieve emissions reduction sufficient to meet the 'Required by Science' target. The gap between where South Africa's emissions are going and where they need to go is large – 1300 Mt CO2-equivalent, more than three times South Africa's annual emissions of 446 Mt in 2003.'

(2008) 'Long Term Mitigation Strategy for Climate Change', 27. This strategy has been approved by the South African Cabinet

[1] UNESCAP, 'Green Growth at a Glance', 13

focussing on South Africa…in the global context

South Africa, like the rest of the developing world, is locked into a deeply unequal global economy that must change fundamentally if development and prosperity are to be genuinely shared across the globe.

In 2008/09, the deepening global financial crisis brought the global inequities into stark relief, at the same time as disputes over global warming and the realities of climate change gave way to a global consensus that 'business-as-usual' was not an option – or not a sustainable option, anyway.

The most logical argument is thus that managing the global crisis has to be located within a broader strategic framework that seeks a sustainable future by creating a more fair, inclusive world than existed prior to the crisis.

where does the Gauteng city-region fit into this picture?

Gauteng is the economic engine of South Africa and sub-Saharan Africa. It is part of the globalised world economy, and has been directly affected by the economic crisis that spread across the globe during 2008 and 2009.

The crisis exacerbated existing fault-lines:

- Cities and regions with existing low skills or structural unemployment problems suffered more than others
- Low-diversified economies were hard-hit, especially those locked into export markets
- Dirty economies' with large carbon footprints faced almost inevitable environmental taxes unless they could go green.

Investing in green technologies – from renewable energy to training unemployed young people to retrofit existing buildings – became a central feature of responses to the crisis worldwide.

The Gauteng city-region faces some key macro-economic challenges from a green perspective.

But these are also key opportunities which, if grasped, could catapault the GCR into being one of the leading green city-regions globally.

can the success of green initiatives be measured?

if we invest in green technologies, can we measure the success of our initiatives?

The success of green initiatives can be assessed through measuring how 'decoupled' the economy becomes from resource use and environmental impacts.

Resource decoupling refers to decoupling the rate of consumption of primary resources from economic activity, which is equivalent to 'dematerialisation'. It implies using less material, energy, water and land resources for the same economic output. If there is resource decoupling, there is an increase in resource productivity, or an increase in the efficiency with which resources are used.

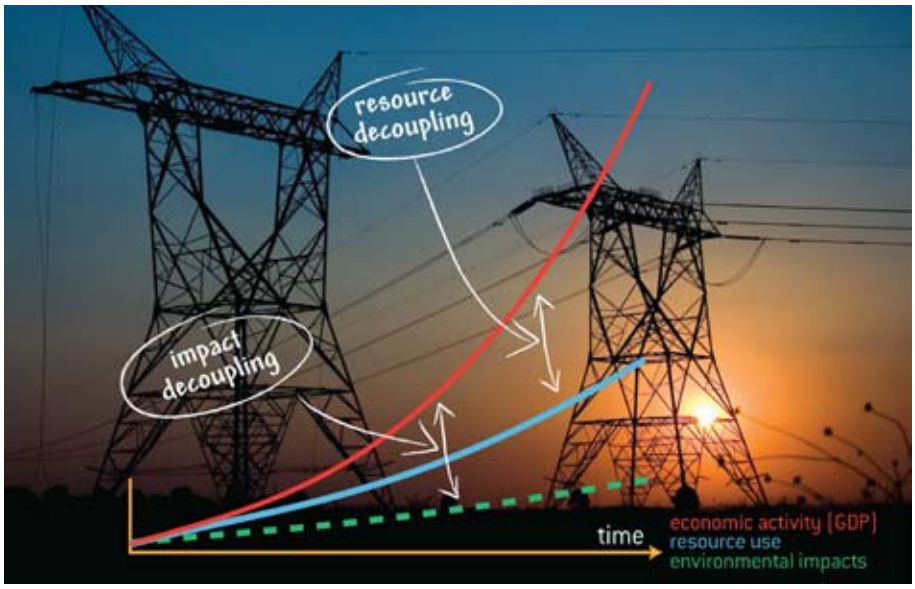
Resource productivity can usually be measured unequivocally.

Expressing resource productivity for a national economy, an economic sector, or even for a certain economic process or production chain looks like this:

$$\frac{\text{added value}}{\text{resource output}} \quad \textit{for example} \quad \frac{\text{gross domestic product}}{\text{domestic material consumption}}$$

If this quotient increases with time, resource productivity is rising

There's another way to demonstrate resource decoupling – comparing the gradient of economic output across time with the gradient of resource input – if the latter is smaller, there is resource decoupling.



Swilling, M. and Fischer-Kowalski, M. (2010) 'Decoupling and Sustainable Resource Management: Towards a Conceptual Framework'. Paris: International Panel for Sustainable Resource Management, United Nations Environment Programme

By contrast:

Impact decoupling refers to the relation between economic output and environmental impacts.

Environmental impacts are associated with:

- the extraction of resources required – such as groundwater pollution due to mining or agriculture
- production – such as land degradation, waste and emissions
- the use phase of commodities – for example mobility resulting in CO2 emissions
- end-of-pipe environmental impacts – such as waste and emissions.

Methodologically, these impacts can be estimated by life cycle analysis in combination with various input-output techniques.

If environmental impacts become dissociated from added value in economic terms, there is impact decoupling.

JUST A NOTE OF CAUTION: On aggregate system levels such as a national economy or an economic sector, it is methodologically very demanding to measure impact decoupling, because there is a whole number of environmental impacts to be considered, their trends may be quite different and system boundaries as well as weighting procedures are contested.

Swilling, M. and Fischer-Kowalski, M. (2010) ' Decoupling and Sustainable Resource Management: Towards a Conceptual Framework'. Paris: International Panel for Sustainable Resource Management, United Nations Environment Programme

what really matters in the short-term, though?

While decoupling provides a measurement tool at a high level, what's important is the implementation of greening activities across a wide range of key areas.

challenges

the GCR faces some key macro-economic challenges from a green perspective

what can we do about food?

The food system – including food production, distribution and consumption – forms a critical but often undervalued component of any economy.

A functional and sustainable food system:

- creates jobs – and benefits large numbers of dependents
- stimulates the economy through foreign exchange earnings and forward and backward linkages with other sectors
- ensures food security
- sustains the environmental resource base.

Without food, the rest of the economy cannot function. But the industrialised and unregulated nature of the modern food system has led to many adverse impacts, including:

- environmental degradation
- climate change
- a high dependency on fossil fuels
- the marginalisation of small farmers
- high levels of food insecurity linked to unfair global trade.

Although agriculture absorbs only 2% of the total South African labour force, its labour multiplier outperforms all other sectors.

The government estimates that more than six-million people depend on agriculture for a livelihood.

The South African Reserve Bank estimates that for every R1-million of agricultural production, additional output of R600 000 is generated in the rest of the South African economy.

Reasonably priced food is a key requirement for economic growth but it is challenged by:

- rising oil prices, and therefore higher fertiliser prices - think the 2008 food crisis
- arable land used for biofuels production competing with food production
- degradation and over-use of soils till they become unproductive or marginal

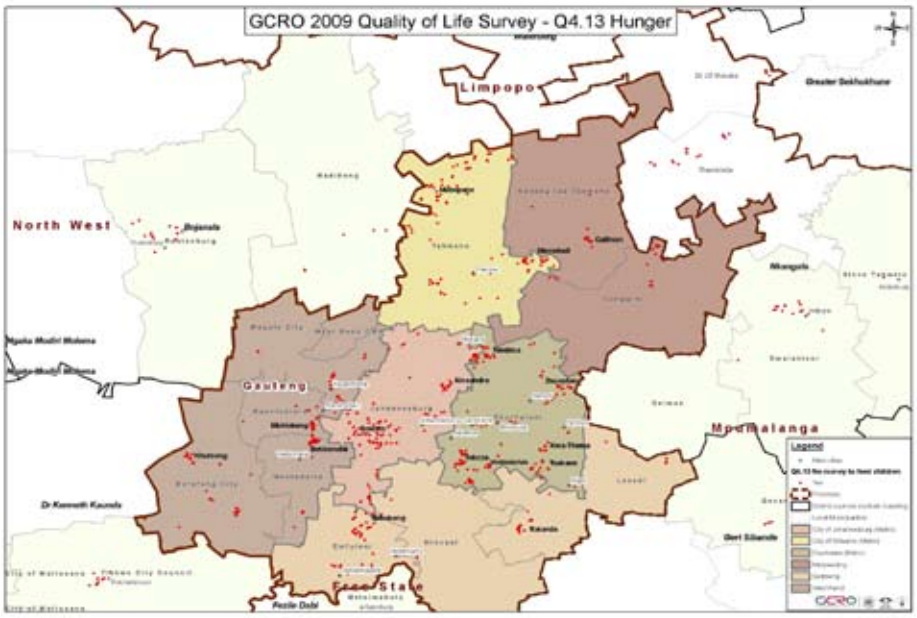
Of course, food security is further undermined, especially in Africa, by:

- rapid urbanisation
- population growth
- growing poverty and inequality

The key sustainability objectives which are promoted through a regional food system include:

- community resilience and food security
- increasing ecosystem services and environmental capital through sustainable production methods
- the potential for reduced greenhouse gas emissions through reducing food miles

who in the GCR is food-insecure? respondents who said that there were times in the previous year that they did not have money to feed their children



GCRO (2009) 'Quality of Life' survey

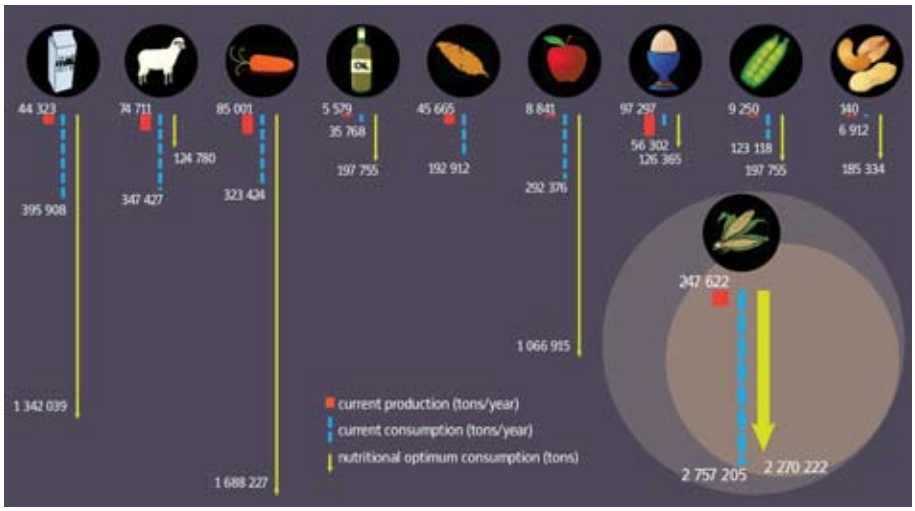
food insecurity is a reality for a large number of people in the Gauteng city-region

- The GCRO's 2009 'Quality of Life' survey revealed that 13% of respondents with children experienced occasions in the year before being interviewed of being unable to feed children because they lacked money to buy food
- 42% of households in the City of Johannesburg have recently been classified as food insecure.

As the map makes clear, food insecurity is highest in the townships and homelands created by apartheid as ghettoes for African citizens, areas which by design could not sustain local economic activity and would force people to migrate and sell their labour in order to survive.

The legacy of apartheid, in this context, remains alive and well. And it is an important reminder that sustainability includes building decent human settlements and sustainable local communities – this is key in the struggle against the scarred landscape left by apartheid.

Gauteng might be an economic powerhouse, but we're importing our food



Compiled from Statistics South Africa (2006); Statistics South Africa (2007); Nel and Steyn (2002); Harvard School of Public Health (2009); University of Michigan Integrative Medicine Clinical Services (2009); USDA (2009)

Gauteng currently consumes far more food than it produces, and is heavily dependent on imported food produce. In Gauteng

618 000 tons of food are produced per annum compared to 5 193 260 tons of total food consumed.

Food insecurity critically undermines the capacity of households to ensure their own livelihood security and is an immediate impediment to poverty alleviation as well as the development and growth of the region.

what should we be doing?

As we can see from the graph, Gauteng residents should increase their intake of fresh vegetables, fruits and milk.

A key area for intervention therefore to promote food security is to increase the availability of fresh food produce to the residents of Gauteng, with a strong focus on urban food security measures.

Gauteng should address food security by increasing the production of food within the province whilst simultaneously generating significant employment and building a stronger regional food economy through diversification and value-adding initiatives.

Opportunities exist for promoting food and livelihood security through:

- food production in cities, focussing on the poorest and most vulnerable households on underutilised land, building on existing initiatives and leveraging government support across departments and through strategic public-private partnerships

Increasing production of key food produce – specifically vegetables, fruit and nuts as well as chicken, fish, milk and eggs – through programmes to assist local communities and emerging farmers with access to land, resources and support is critical for promoting food security but also presents a significant employment opportunity. This has tremendous value and potential in the urban context.

Investment to support an extensive urban agriculture programme would include ensuring adequate access to land and water, basic infrastructure for production and market access, training and capacity building and ongoing support.

- a strategic land reform programme for food production aimed through networks of small and diversified farms and building stronger rural-urban linkages

Land reform has the potential to create jobs, promote rural development and ensure food security for Gauteng, but this will require extensive support to be successful and investment should be considered in the context of hidden subsidies that other forms of large-scale agriculture currently receive.

- the regionalisation and diversification of the food value chain to identify opportunities for increasing efficiencies, promoting sustainability across the sectors and realising new jobs through regional investment.

Land reform to increase regional production in rural and peri-urban areas would also secure food for regional consumption whilst creating employment and stimulating the regional economy further. Key produce that could be focussed on for peri-urban and rural farms include grains, vegetable oils and livestock as well as vegetables, fruit and nuts. Farms producing for regional consumption are typically more diversified and concentrated in the production of food.

if those are the interventions, what policy changes are needed to realise them?

The following key policy recommendations are based on a compilation of several recent studies on the state of agriculture and food security in South Africa in the move towards a renewal in the South African food system:

- Ensuring uptake of social grants by all eligible households
- Implementing measures to improve dietary diversity, food safety and food quality
- Implementing a provincial urban agriculture policy, and incorporating food security into integrated development plans
- Strengthening and supporting the role of the private sector in food security initiatives
- A provincial commitment to a regional procurement programme, supporting regionally produced food products where possible and actively encouraging the building of a strong regional food economy
- Accelerating land reform and affording greater priority to currently successful small farmers as beneficiaries
- Targeting farmer support services at those who need it most, especially farmers in remote rural areas

- Improving the efficiency of the supply chains that bring farm inputs to the farm and that take farm products to the final consumer, whether domestically or internationally
- Developing a thoroughgoing understanding of the food pricing mechanisms, including benefits and costs to farmers, input suppliers, and small and large operators in the supply chain.
- Continuing with application of competition policy along the supply chain
- Developing and implementing a research and action agenda to promote sustainable agriculture development across the range of farming types in South Africa
- In the context of the developmental state approach, broadening the definition of infrastructure to include soil as part of infrastructure that attracts investment.

McLachlan (2009) 40-42

solar energy – integrating environmental and developmental concerns

Solar water heaters (SWHs) can effectively replace conventional electrical geysers, kettles and other water heating methods used to provide hot water for household cleaning and personal hygiene in both high- and low-income homes.

the case

- SWHs reduce the demand for electricity generated in coal-fired power stations
  - thereby lessening emissions of harmful pollutants into the environment
  - and mitigating against South Africa facing further electricity shortage crises by reducing peak demand
- SWHs create far more jobs than conventional power generating means
- lower energy consumption means lower electricity bills
- SWHs provide readily available hot water in low-income households that were previously reliant on time-consuming heating processes.

6700 jobs in Gauteng if the largest portion of systems are sourced locally

the opportunity

- SWHs offer government the means to achieve electrification targets
- much smaller increases in electricity supply required
- in high-income groups SWHs offer long-term savings and environmental benefits
- in low-income communities, similar benefits are provided, as well as drastic improvements in peoples' quality of life.

SWHs supplant 30% - 40% of the electricity required in low-income households

So, although SWHs make more environmental and economic sense for high-income consumers, they offer important developmental service for poor users without harm to the environment.

Therefore, solar energy can act as a powerful agent to reduce inequality in society through a technology that provides significant social upliftment opportunities.

the benefits

importantly, SWHs demonstrate that renewable energy technology does not just offer benefits to the rich

- The energy that could be saved through SWHs is comparable to that produced by a small 300MW power station
- These savings are particularly valuable since
  - a significant part would occur in peak electricity demand periods when national supply is shortest and generation most expensive, at up to R2.50/kWh for gas or diesel power generation
  - during this time, residential electricity use accounts for up to 30% of demand. (Eskom (2009) 'Residential Load Management FAQ')
  - savings would reduce residential electricity demand by roughly 18%.

what SWHs have got going for them

this is more than enough to achieve the targets set by the 2005 Energy Efficiency Strategy

- It is a well-established industry in South Africa
- Scale-up would ensure significant job creation,especially amongst semi-skilled individuals
- It provides a key entry point into 'green economy' development by addressing environmental and developmental needs.

what still needs attention in terms of implementation

- The industry is relatively small in terms of output
- The up-front installation costs are too high for most, but especially for low-income households
- Government policy and subsidy support are required to see the technology rolled out successfully.

although the life-cycle costs of SWHs are less than that of conventional heating means, we have a moral and political imperative to ensure the SWH initiative does not exclude low-income communities and worsen inequality in Gauteng

Gauteng's proposed 2025 SWH targets (from the Department of Local Government and Housing, 'Gauteng Integrated Energy Strategy')

- *95% of mid- to high-income households (0.8% population growth) 1 266 393 systems installed (from City of Johannesburg (2007) 'Spatial Development Framework')*
- *50% of low-income households (0.8% population growth) 666 522 systems installed (58% of the households in the province are classed in LSM 1-6 (Holm 2005) and the assumption is that this figure will fall to around 50% by 2025 if development targets are achieved)*

The GCRO's 2009 'Quality of Life' survey estimates that less than 0.1% of Gauteng residents currently use a solar water heater.

what do we recommend to achieve the targeted roll-out?

- By-laws should be promulgated that make SWH installation compulsory
  - when existing electrical geysers break down
  - on all newly built middle- to high-income market houses
- SWHs should be included in all new government-subsidised housing projects
- Existing housing projects should be gradually retrofitted
  - retrofitting can be undertaken as part of the Community Employment Programme (CEP)
  - with young people with matric or Higher Education being recruited, trained and qualified to install and maintain SWHs by the CEP
  - once qualified in maintenance, graduates can be helped to set up their own SMMEs to provide SWH maintenance and more general, related plumbing and electrical services
- The local SWH industry should be supported to ensure maximum economic development, through
  - a subsidy scheme to local manufacturers to kick-start the sector; or
  - a preferential procurement system supporting locally made systems once the sector is established
- A critical factor in the successful roll-out of SWHs as a green economy initiative is the development of a financing scheme for the retrofitting of homes –
  - this could be included in the rates and taxes; or
  - as separate from local municipalities.

In this regard, the **sale of carbon credits** should form an essential part of the strategy and the **registration of a low-income sector SWH roll-out as a Carbon Offset project** under the Kyoto Protocol's Clean Development Mechanism should be made a priority.

What should also be investigated is **a cross-subsidisation scheme** - a small amount added to high-income households' interest rate to finance SWHs in the low-income sector.

and what about **providing hot water as service**, with local municipalities:

- paying for installation
- retaining ownership
- charging a levy for use of the hot water from they system which is added to municipal rates.

energy efficiency – the 'neglected' frontier

'Energy efficiency may be the farthest-reaching, certainly the least-polluting and clearly the fastest-growing energy success story of the last 40 years. The irony is that it is also the most invisible, the least understood and in serious danger of being overlooked as the most cost-effective and economically viable opportunity for addressing the challenges of climate change and maintaining a strong economy.'

Laitner, 'Understanding the Size of the Energy Efficiency Resource', 351

Between 1973 and 2005, energy efficiency had already saved up to 58% of what was actually consumed. But major improvements are still possible.

DID YOU KNOW

A 20% energy efficiency target could:

- create over 10 400 jobs
- add R640-million to labour income
- reduce energy expenditure by more than R16- billion per year
- the Provincial spend for a programme to enable greater energy efficiency would be around R13-million per year

The Provincial spend for a programme to enable would be around R13-million per year

out with the old

The traditional way of creating energy capacity is to create more supply. However, this can also be achieved by reducing demand – which is a more sustainable achievement.

A South African study has showed that a 5% increase in electricity efficiency in 2010 would lead to:
- a net increase of 39 000 jobs
- labour income of about R624-million

Winkler, Energy Policies for Sustainable Development in South Africa's Residential and Electricity Sectors, 76

Energy efficiency compared to conventional energy:

- costs less per MWh
- creates more jobs at less cost
- stimulates more economic activity.

Laitner, 'Understanding the Size of the Energy Efficiency Resource', 351

but there's more…

The benefits of industrial energy efficiency in South Africa also include:

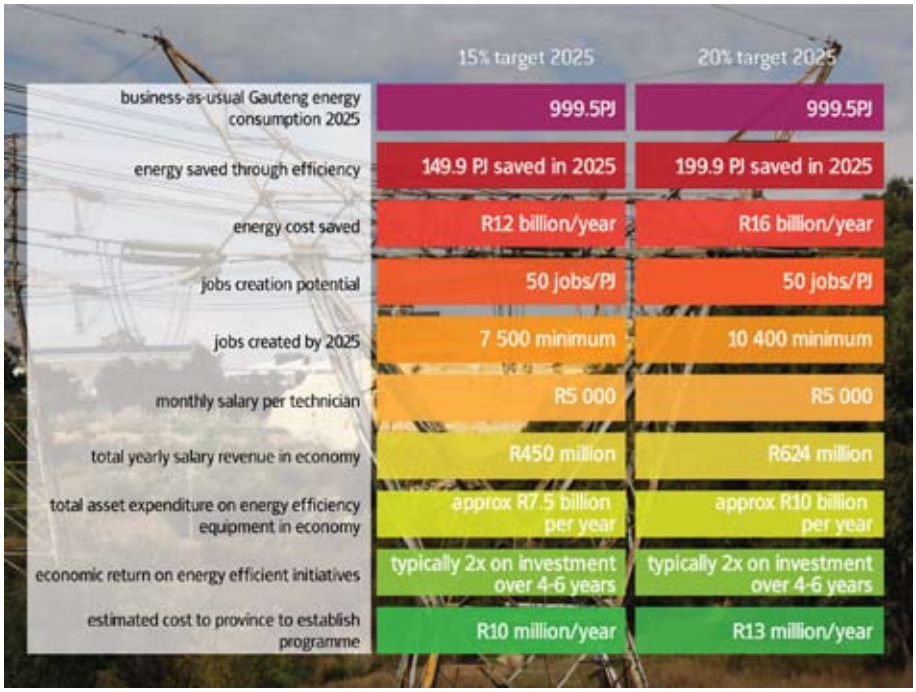
- significant reductions in local air pollutants
- improved environmental health
- reduced electricity demand
- delays in new investments in electricity generation.

The co-benefit of reducing GHG emissions could result in a reduction of as much as 5% of South Africa's total projected energy CO2 emissions by 2020.

Winkler, H. Howells, M. and Baumert, K. 'Sustainable Development Policies and Measures', 212

The proposed Gauteng target is a 15% improvement in energy efficiency by 2025. When considered against what other countries are seeking to achieve – South Australia at 20% and the UK at 30% - as well as our high energy intensity, it can be argued that a more ambitious target should be set, possibly even as high as 30%.

what can be achieved in terms of growth through energy efficiency?



what interventions do we propose?

- enable municipalities to be rewarded for driving energy reduction rather than for electricity sales
- educate energy users on the savings that can be achieved through energy efficiency
- implement compulsory energy efficiency standards
- provide access to finance for energy-efficient equipment.

a similar model has successfully been applied in California

under the magnifying glass – concentrated solar power (CSP)

how does it work?

Concentrated solar power refers to the method of generating electricity by concentrating the sun's power. A typical CSP plant is 50 MW or above in size. Storage of up to 7.5 full load hours has been proven commercially in Europe in the past few years. Most CSP technologies incorporate a certain percentage of backup fuel for overcast periods.

15% allowed under South Africa's renewable energy feed-in tariff (REFIT)

Combining storage with backup fuel results in CSP becoming a dispatchable source of green electricity.

The following figures are based on meeting the proposed 16% renewable target for Gauteng from predominantly concentrated solar power:

the benefits

- The price of electricity with 16% CSP is likely to be less expensive than 100% fossil fuel based electricity in the residential sector by 2025

can this be done in Gauteng?

- Provinces with good potential for the implementation of large-scale CSP plants:
  - Northern Cape
  - Free State
  - Western Cape
  - Eastern Cape to a smaller degree.

R3.88/kwh for 100% coal versus R3.59/kwh for 84% coal + 16% CSP whereas an accelerated CSP programme with a larger portion of renewables could be even cheaper

For Gauteng, the implementation of actual CSP plants is not as viable, due to the relatively low solar irradiation compared to other regions in South Africa.

However, the energy generated with CSP from surrounding areas could be imported through the national grid into Gauteng.

The electrical energy which can be generated with CSP in the southern Free State and the north-eastern Northern Cape is adequate for the Gauteng province's demands. There are independent power producers (IPPs) who are ready to construct CSP plants under the current REFIT – and if of scale, would be prepared to manufacture such technology in South Africa. There is, however, a delay in any project progressing due to no power purchase agreements (PPAs) being issued.

DID YOU KNOW

- The cost of Eskom's new 4 800MW Medupi power station is R124-billion
- This equates to an installed cost of
- R25.8-million/MW
- The cost of Eskom's second new power station, Kusile, will be even higher
- The levelised energy cost (LEC) of new coal is estimated at R 0.48/kWh (Meyer, 2010)

This is likely to be adjusted downward if the LEC cost of CSP power plants drop.

By contrast

- The estimated cost for a new 50MW CSP plant with 6hrs storage is R3.2-billion
- This equates to R64-million/MW installed
- The current REFIT for CSP technology = R2.10/kWh

However, with the escalating prices of fossil fuels and the diminishing LEC for renewables, specifically CSP, grid parity will be reached in the near future.

Grid parity is the point at which renewable electricity is equal to or cheaper than grid power.

The addition of carbon tax will shorten the time to grid parity. From predicted trends grid parity for CSP in South Africa is expected by 2016 (Heun et. al., 2010).

what's the prognosis for CSP in the GCR?

There is huge potential for CSP in South Africa. Although Gauteng does not possess significant viable sites for CSP plants, the province has the manufacturing capabilities to have a major share in the local manufacturing of CSP plant components.

Leveraging its manufacturing facilities and skills to develop a research and develpment centre and manufacturing industry around CSP over the next 15 years could lead to a new industrial sector which will require human capital ranging from basic labour to highly skilled personnel.

Gauteng could also become the hub for CSP in South Africa by stimulating growth. This could be achieved with the development of specialised institutes and collaboration with local and international institutes in both the academic and commercial industries.

water and sanitation

The World Bank says there has been a six-fold increase in water use for only a two-fold increase in population size since 1990.

Moreover, the World Economic Forum has warned that many places in the world are on the edge of 'water bankruptcy'.

In South Africa, water quality has deteriorated, with a lack of resource capacity at many municipal waste water treatment plants, while the efficacy of such treatment has been hampered by unplanned power outages.

With an average annual rainfall of 497mm, South Africa is a dry country. More problematic is that 98% of available water resources in Gauteng have already been allocated. This means that all future growth will be constrained by the lack of this resource.

In addition, the country has no further 'dilution capacity' when it comes to absorbing effluents in its water. The Gauteng region is located on a watershed which means that outflows of waste water pollute the water resources it depends on.

After China, South Africa's national water resources contain some of the highest toxin levels in the world.

In short, the combination of low average rainfall, over-exploitation and re-engineered spatial flows have led South Africa to an imminent water crisis in quantity as well as quality.

what are we saying about water quantities?

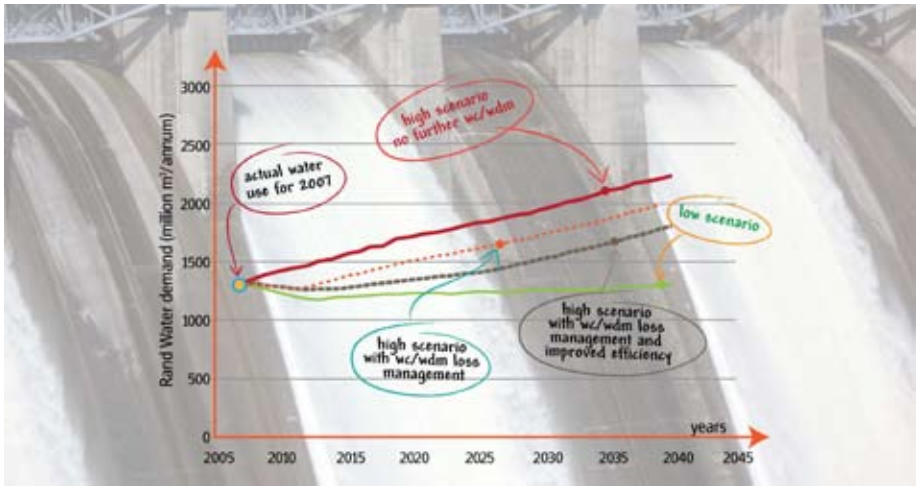
Situated on the watershed between the Orange/Vaal and the Crocodile/Limpopo river systems, Gauteng has limited natural water resources. The Vaal in the south and the Crocodile in the north have historically provided water supplies for the region, but their capacity has long been outstripped by demand which is perhaps ten times more than sustainable and reliable locally available resources. The province's water supply now comes primarily from the Vaal, Orange (Lesotho) and Thukela (a linkage which adds reliability rather than large volumes).

In terms of quantity, sources such as groundwater are of limited local importance and rainfall, while important for agriculture and maintaining the natural landscape, is relatively low and, more important, highly seasonal and variable.

There is sufficient water in the Orange River system to meet the needs of the province until around 2025/2030, depending on the rate of growth of consumption. A similar increment is also available from the Thukela.

Thereafter, further increments will be extremely expensive as well as conflicting with users in other areas and the province should aim to cap water use and live within the available resource. Examples of the detailed projections are shown below.

scenarios for future water demand in the Rand Water supply area



Department of Water Affairs, Vaal River System: Large Bulk Water Supply Reconciliation Strategy, accessed at http://www.dwa.gov.za/Projects/VaalWRMS/documents.aspx

what are we saying about water quality?

The quality of water resources in the province is generally poor in all areas downstream of the Vaal Dam as well as in the Crocodile River catchment. This is a function of the low volumes of water, the high levels of urban, industrial and mining activity and poor management of some urban services.

Key quality challenges are:

- biological pollution (largely sewage from domestic services) which has health impacts but also causes algae growth and 'eutrophication' of rivers and dams
- chemical pollution (from mines and other industries) primarily leading to overall high water salinity that, if it reaches excessive levels, renders water unusable without desalination.

Because of the vulnerability of the Highveld catchments, special standards for wastewater treatment have long been enforced in Gauteng and surrounding areas. To achieve these, South Africa was at one stage an international leader in wastewater treatment technologies, so technology is not a major barrier to achieving standards, although it is an expensive and commercially competitive area. The present challenge is primarily one of management of existing plants and investment in the expansion of treatment capacity.

what do we recommend?

- Water demand management, through
  - leak control programmes, in co-operation with the DBSA managed water conservation and demand management programme
  - household plumbing maintenance and improvement in low-income communities
- Pollution reduction, through
  - improvement of storm water infrastructure and management, including community education
  - improvement of sanitation in low-income communities
  - household plumbing maintenance in low income communities to reduce flows into wastewater works
  - a joint regional strategy, to be developed with the Department of Water Affairs (DWA) and Rand Water, to review options including utility based treatment, export to water-short catchments, more rigorous control of existing mines etc.
- The Department of Economic Development (DED) should consider joining with DWA and other agencies to review the potential costs and benefits of building collective mining water treatment capacity
- DED should participate actively in the process to produce a new National Water Resource Strategy which begins in 2010 and focus, in particular, on mechanisms to encourage greater efficiency in industry
- DED should work with appropriate local, provincial and national housing authorities to identify new housing schemes in which innovative water conservation, water efficiency and sanitation measures can be introduced and evaluated.

the more we waste, the more we'll want

DID YOU KNOW

- Waste-to-landfills can be reduced by 60% (3 885 702 tons/year)
- 19 400 jobs can be created
-
- Gauteng is the largest waste producer in South Africa
  - We produce more than 5.7-million tons of waste/year
  - The average amount of waste generated in Johannesburg is about 1.2 kg/person/day.

in Gauteng…

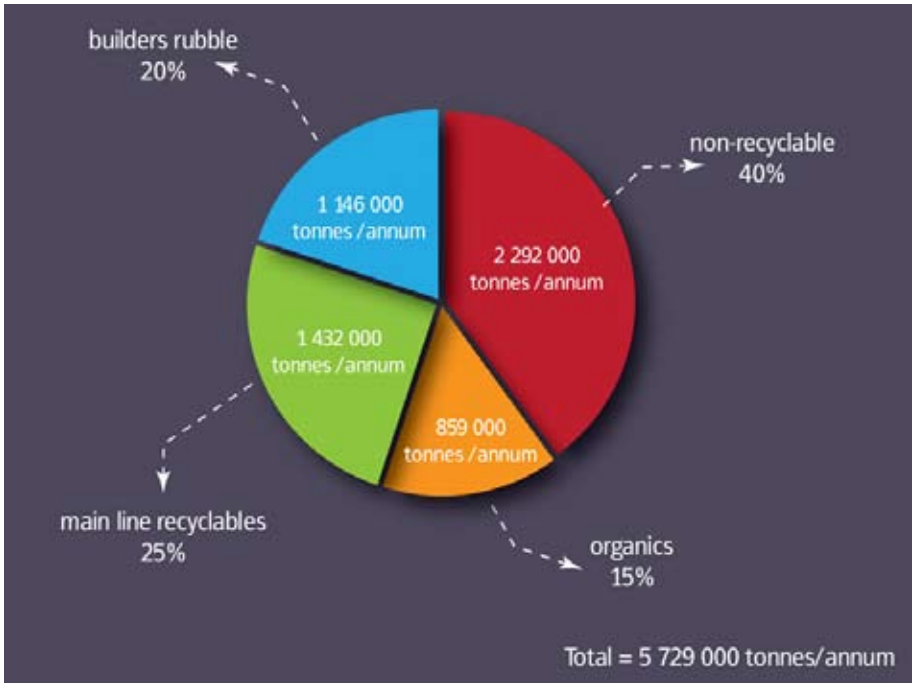
- increasing urbanisation is leading to increasing waste generation
- increasing commercial and industrial development is translating into more waste being generated by the residential, industrial and commercial sectors
- there is limited waste collection in poor areas. Twenty percent of households within the Gauteng province do not have access to weekly refuse removal services
- there is poor enforcement of national, provincial and municipal laws and regulations
- there is a lack of encouragement and awareness of waste avoidance, minimisation and recycling
- the rising oil price is increasing the cost of waste transportation to landfills.

leaving us with…

- pollutants entering the surface or groundwater resources, air and soil
- leachate generation, odours, noxious airborne emissions (volatile organic compounds) from mismanaged landfill and dump sites, as well as incineration and illegal burning
- landfills attract vermin and harbour disease spreading vectors that pose health risks
- littering and illegal dumping can lead to urban decay
- reduced biological diversity in the areas of waste management operation as a result of land disturbance and effects of emissions and discharges from waste facilities
- negative societal impacts of inadequate service provision in the form of illegal dumping, littering and abuse of open spaces
- increased health risks associated with inadequate waste collection and disposal services coupled with informal salvaging on landfill sites
- reduced recreational value of land and water resources and associated reduction in tourism and investment potential.

A waste stream analysis for municipalities in Gauteng reveals that of the total waste composition, only 40% cannot be recycled. This means that 60% can be recycled. This is made up as follows:"

Gauteng waste stream composition



Gauteng Department of Agriculture and Rural Development, General Waste Minimisation Plan for Gauteng, July 2009, p15

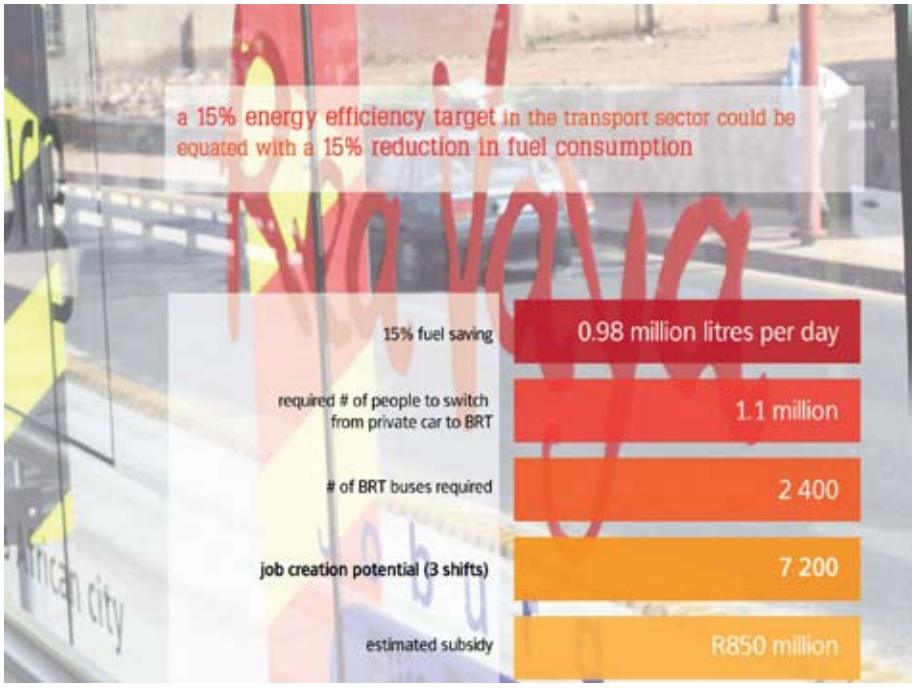
what can we do to improve the situation?

- Mandatory recycling
  - By 2020 it is estimated that 6 520 076 t/annum of waste will be produced and that 3 885 702 t/annum could be recovered through recycling initiatives (GDACE, 2008). This represents 60% of the projected volumes of waste for the long-term planning horizon thus indicating the positive effect that reuse, reduction and recycling can have on waste minimisation.
  - Informal reclamation of recyclable waste under unhealthy and unsafe conditions on landfill sites is the only form of recycling currently undertaken in many areas (Metsweding District Municipality (2005) 'Inerated Waste Management Plan (IWMP)').
  - Currently recycling is done on a voluntary basis, but the province plans to formalise efforts to ensure that separation at source becomes mandatory.
  - By formalising these initiatives, the amount of waste sent to landfills will be reduced which will ultimately save in high disposal costs. In many areas construction and demolition waste is disposed of at landfill sites. These products would serve a greater purpose through recycling initiatives whereby demolition and construction waste is recycled to produce building materials (GDACE, 2008).

- Development of composting initiatives
  - Currently organic waste is disposed of in landfill sites which occupies limited valuable landfill space (Ekurhuleni Metropolitan Municipality (2005) 'Inerated Waste Management Plan (IWMP)'). There is a general lack of collection/composting facilities for organic waste throughout the province. This presents an ideal opportunity to begin initiatives such as composting whereby organic waste can be reused to create a useful product.
  - This can be tied in with local food production.
- Waste minimisation clubs
  - This refers to initiatives where businesses in a particular geographic area group together to negotiate better terms or services from waste contractors (GDACE, 2006a). The club may also share facilities and equipment and exchange waste items that may be of use to another business (GDACE, 2006a). These initiatives can eventually lead to waste minimization efforts being instigated.
- Waste to energy
  - The conversion of municipal solid waste to energy as an alternative energy is considered a viable option to generate clean energy.
  - There are developers already investigating such projects under the proposed Feed-In Tariffs. These developers should be supported in their initiatives.
- Green procurement
  - Green procurement is rooted in the principle of pollution prevention, and generally involves products that are easily recycled, last longer or produce less waste (GDACE, 2006a). If all levels of government follow the principles of green procurement it will have positive repercussions in industry as their suppliers will need to follow the principles of green procurement. Furthermore, municipalities can offer the benefit of green procurement to the general public.
- Multi-faceted landfill sites
  - Landfills take up a large amount of valuable land, thus these sites need to become multi-faceted to ensure efficient use of all land resources. These sites provide an ideal opportunity for Eco-Parks, landscape design features and educational facilities in terms of their end uses.
  - Landfill site selection will need to be optimised such that rail can be used to move the waste to the site and thus reduce transportation costs.

mobilising the region in the right direction

A 15% energy efficiency target in the transport sector could be equated with a 15% reduction in fuel consumption, and thus the following can be calculated:



what are the growth constraints and sustainability challenges in terms of transport?

- Transport is a major contributor to energy and carbon emissions in the region, e.g. Liquid fuels associated with transport contributed some 31% to the total City of Johannesburg carbon footprint, and almost 62% of its overall energy usage. (Mercer, 'City of Johannesburg State of Energy Report')
- There is a growing tendency to move away from train and bus transport in favour of private vehicles. (Mercer, 'City of Johannesburg State of Energy Report')
- The number of peak hour private vehicle trips is increasing.
- The number of vehicle-kilometres travelled is increasing, implying that people are living further away from work and schools.
- A result of the above behaviour is that congestion is increasing.

In addition, the majority of public transport commuters have concerns that:

- public transport is not readily available or is too far
- public transport is too expensive
- vehicles are not safe and drivers drive poorly.

For example, more than half of taxi users are dissatisfied with the taxi service overall, compared to 45% of train and only 23% of bus users.

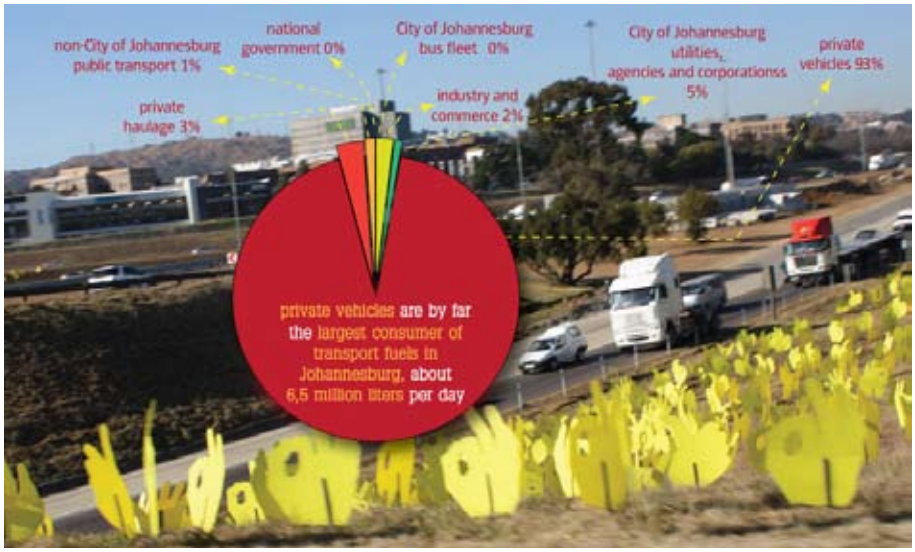
Thus, to re-orientate transportation in a green economy, transportation should be:

- affordable and safe
- job-creating
- promote short distance trips
- low in carbon emissions.

The current proposed target for "Transport Energy Efficiency" is a reduction of 15% by 2025 (Department of Local Government and Housing 'Gauteng Integrated Energy Strategy'). A simplistic view of this would be to argue for a 15% reduction in fuel consumption in the province.

Recent State of Energy Reports by the three metropolitan municipalities in Gauteng collectively estimate that the largest consumer of energy in the three cities was the transport sector, at 60% of total energy consumption in 2007. This is massively up from just 34% in 2000, when industry was the biggest consumer at 58% of total consumption. Within the transport sector, the largest consumers of energy are private vehicles. The graph below shows data from the City of Johannesburg's State of Energy Report 2008, illustrating that private cars buy 93,4% of total fuel sales. This was approximately, 2,3 billion liters of petrol and diesel in 2007, some 6,5 million liters per day

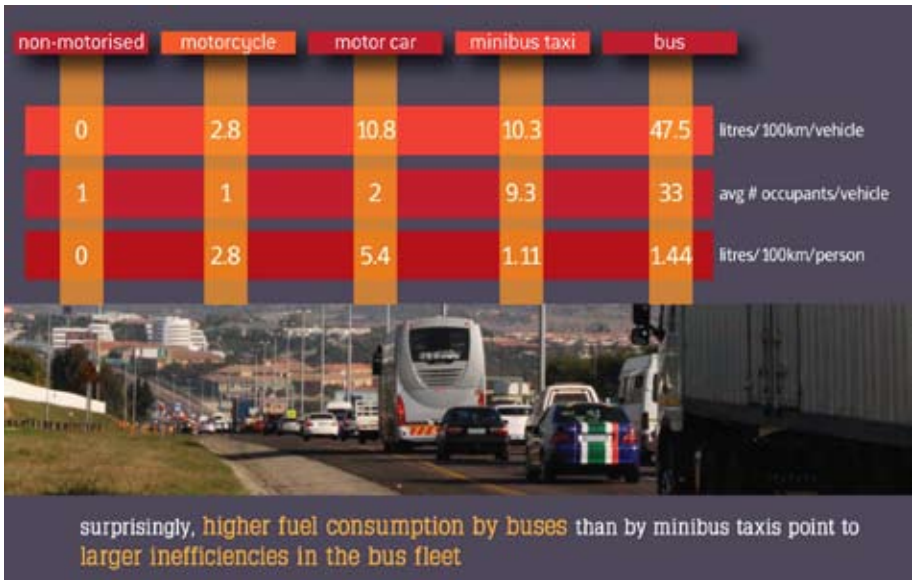
transport fuels sales by end-user sector in Johannesburg, 2007



City of Johannesburg, State of Energy Report, 2008, p59

The table below shows the average fuel consumption per person per 100km travelled (Mohammed and Venter, 'Analysing Passenger Transport Energy Consumption from Travel Survey Data').

consumption of motor fuels by different transport users in Gauteng



Surprisingly, the fuel consumption by bus is higher than by minibus taxi. This points to large inefficiencies in the bus fleet. The new Bus Rapid Transport (BRT) system is likely to improve significantly on this figure. Travelling by taxi will save 4.3 litres per person per 100km travelled.

To shift transportation towards a low-carbon environment, the following strategic changes should be addressed:

- A shift from private to public transport
- Better public transport quality/affordability/availability
- A shift in city planning from
  - road-driven to rail/bicycle/pedestrian-driven infrastructure development
  - work/home/schools to be brought closer together
- Less private kilometres driven.

leading to:

- savings to the economy
- lower carbon emmissions
- greater energy security
- job creation.

recommendations for turning our region green

key drivers that promote the development of a green economy for the Gauteng province

create new skills and jobs
encourage innovation
promote investment
decouple growth from resource consumption
improve energy and resource consumption efficiency
promote energy security
reduce dependency on crucial imports (oil)
minimise dependency on fossil fuels
respect ecological limits
shift energy supply to decentralised renewable energy
create food security
alleviate poverty

our recommendations for getting there

The recommendations were made by the GCRO to the Gauteng Provincial Government for places where policy could be used to re-orientate towards this type of economy.

ENERGY
incentivise low-carbon initiatives
enable various entities to generate own energy
enforce efficiency standards
fast-track energy efficiency skills training

CLIMATE CHANGE
enforce emission reduction targets
implement local emissions trading system
subsidise research on impacts and adaptation techniques

RESOURCES
mandatory consumption measurement for H2O, Co2, electricity and travel
local materials beneficiation for local use
extended producer responsibility
public sector green procurement

TRANSPORT
low carbon transportation systems
mass public transport shift away from private cars
remove subsidies for fossil fuel
penalise inefficiency, e.g. high fuel consumption

SOCIAL
measure 'gross national happiness'
public awareness-raising campaigns
eco-label of products

ECONOMY
growth through innovation in green technologies
government support for adoption of environmentally sound technologies
develop new green skills
focus on small business

FINANCIAL
green taxation
green subsidy reform and incentives
investment in sustainable infrastructure
eco-industrial parks and smart growth zones

so what's the long and the short of it?

moving to a sustainable, developmental green growth model is imperative

The Gauteng city-region has enormous potential for massive savings on

- energy use
- reducing our carbon emissions
- using our natural resources.

Regulatory certainty will unleash green industry potential and allow for manufacturing – instead of importing – as well as the creation of significant numbers of green jobs in installation and maintenance.